

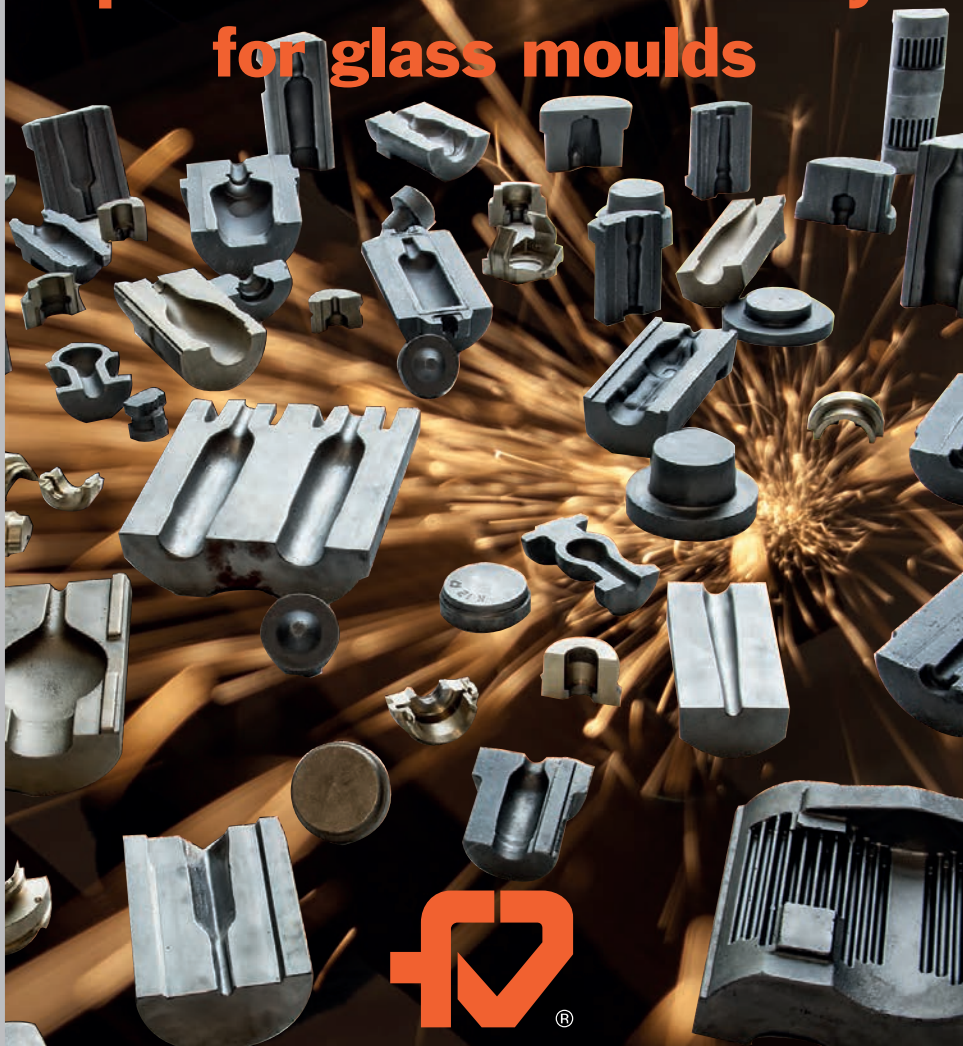
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YEAR 39 • ISSUE NO. 4/2026

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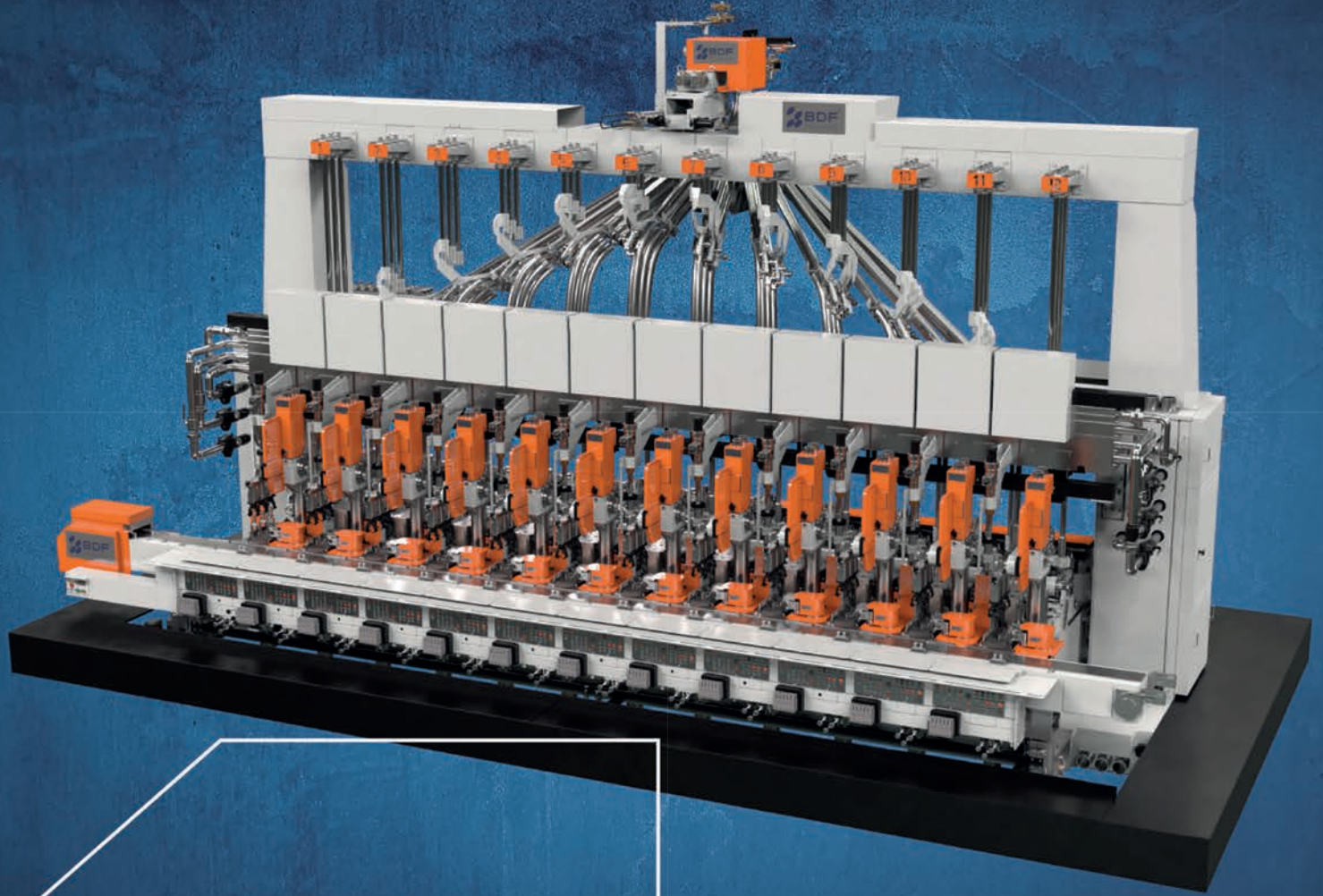
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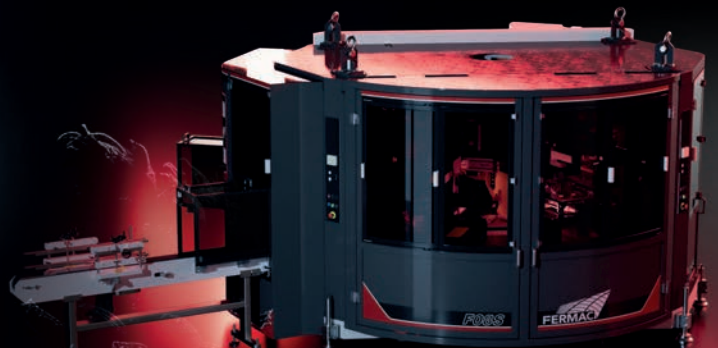
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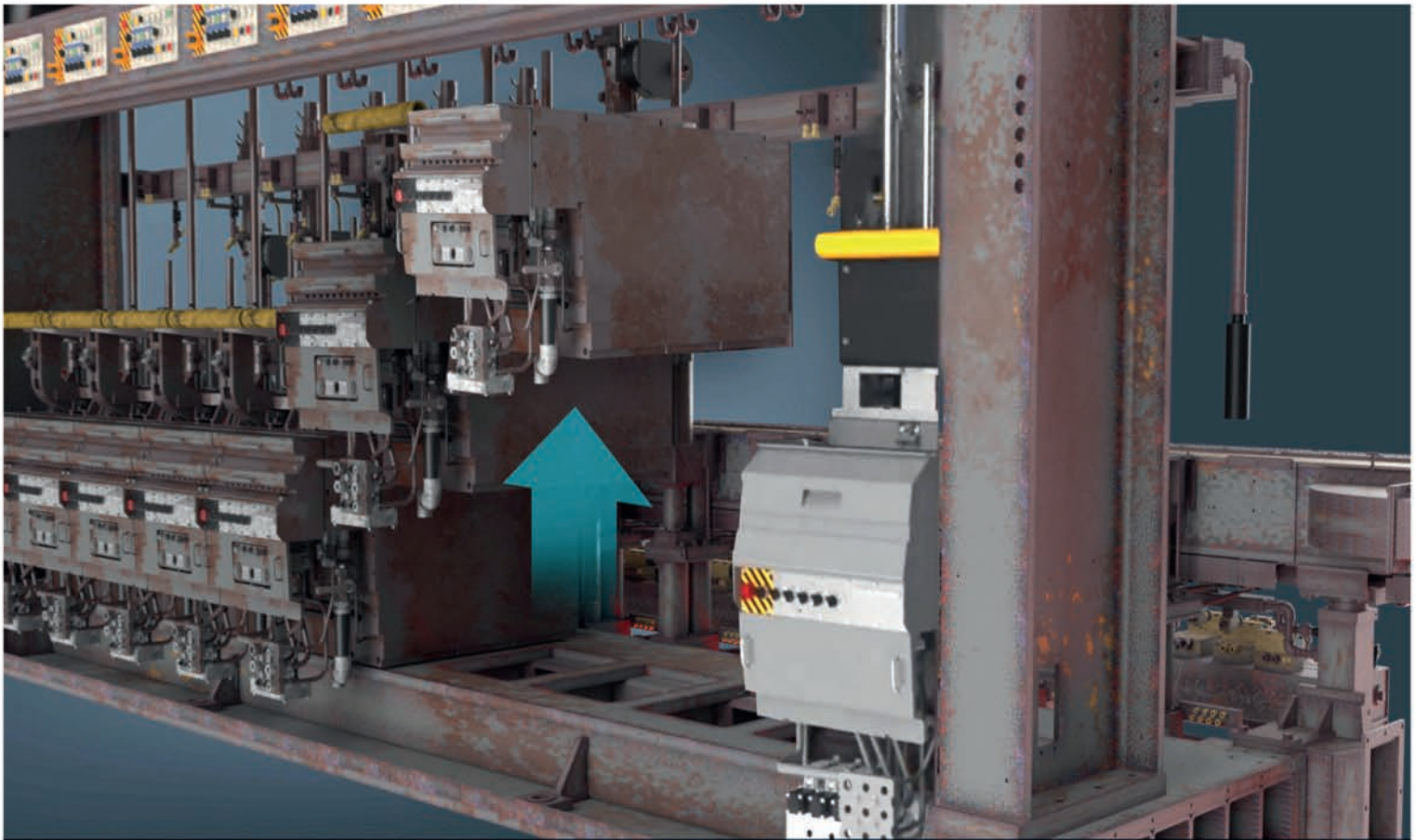
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PUBLISHING DIRECTOR: Arcangelo Altamura

EDITOR-IN-CHIEF: Marco Pinetti

ASSOCIATE EDITOR:

Nicolaas François Fouché | nick.fouche@glassonline.com

CONTRIBUTORS:

Rajeev Jetley, Zoë Elaine Whitten,
Jennifer Pressman, Alexander Roe

ADVERTISING:

ITALY: Maurizio Lozza | maurizio.lozza@glassonline.com

WORLDWIDE: Luciano Molina | luciano.molina@glassonline.com

Alessandro Corboud | alessandro.corboud@glassonline.com

GRAPHIC DESIGN:

Sonia Previato | sonia.previato@glassonline.com

Cristiano Guenzi

PRINTED BY:

BICIDI ARTI GRAFICHE

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GLASSMAN ITALY | 4-5 FEBRUARY | BOLOGNA - ITALY

AMBIENTE | 6-10 FEBRUARY | FRANKFURT - GERMANY

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07-01-2026

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COSMOPACK | 26-28 MARCH | BOLOGNA - ITALY

CHINA GLASS | 7-10 APRIL | SHANGHAI - CHINA

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20-02-2026

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ICG - ANNUAL MEETING | 13-17 APRIL | LYON - FRANCE

INTERPACK | 7-13 MAY | DÜSSELDORF - GERMANY

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ALL4PACK- EMBALLAGE | 24-26 NOVEMBER | PARIS - FRANCE

UZ GLASS | 1-3 DECEMBER | TASHKENT - UZBEKISTAN

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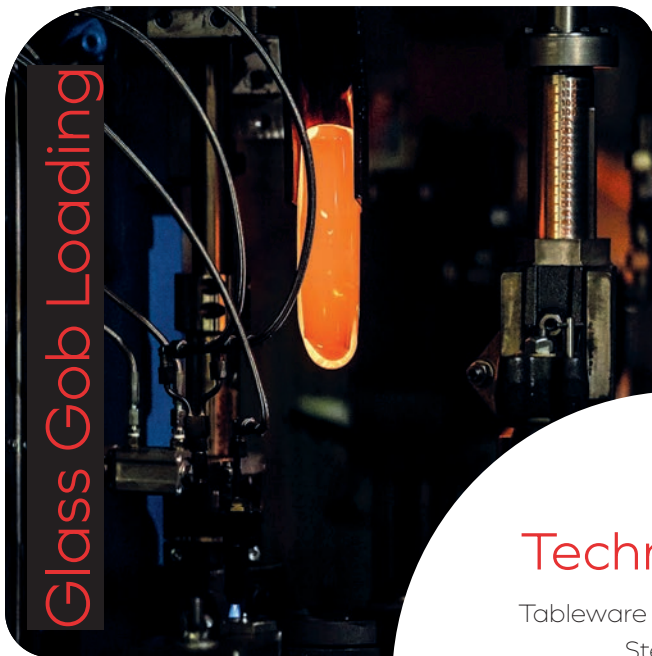
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- Flame Polishing machines
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CINER GLASS

Enthusiastic support for ResponsibleGlass

Ciner Glass has reaffirmed its commitment to sustainable glass production by supporting ResponsibleGlass, the first global sustainability certification programme for the entire glass value chain, at its developing next-generation container glass plant in Lommel.

Ciner Glass is currently building a multimillion pound, state-of-the-art glass manufacturing facility in Lommel, Belgium, which represents a major investment in the future of glass manufacturing.

Against this backdrop, Ciner Glass is proud to support ResponsibleGlass, an independent, multi-stakeholder initiative aimed at creating clear, credible and auditable sustainability standards across the entire glass value chain, from raw material sourcing and production to recycling and end use.

The leadership of ResponsibleGlass recently visited the Lommel site to engage with Ciner Glass as construction progresses, highlighting Belgium's role in shaping the next chapter of sustainable glass production in Europe.

Following the launch of the ResponsibleGlass initiative last year, a multi-stakeholder Council has now been established, bringing together manufacturers, suppliers and major glass users across sectors ranging from automotive to soda ash production. This Council is already progressing the development of the ResponsibleGlass standard, Version 1.0 of which will be published later this year and will provide the industry with a clear, practical blueprint for responsible glass production and a pathway toward a globally recognised and trusted standard.

Despite being an essential material across packaging, construction, automotive and renewable energy applications, glass production remains energy-intensive and is responsible for an estimated 95 million tonnes of CO2 emissions globally each year. Unlike sectors such as steel or forestry, glass has until now lacked a globally recognised sustainability certification framework.

ResponsibleGlass aims to change this by developing an independent and auditable certification system that covers emissions reduction, circularity, worker health and safety, and responsible sourcing of raw materials across flat, container and speciality glass.

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ICG

Appointment of Erik Muijsenberg as President

During the ICG - International Commission on Glass meetings held in Lyon on April 11 and 12, Erik Muijsenberg officially assumed the role of ICG President for the period 2026-2029, taking over from Hiroyuki Inoue. The presidential badge was presented by former ICG President Reinhard Conradt, highlighting a long-standing ICG tradition that symbolises continuity in leadership and shared responsibility. The ICG Council also approved Dr. Edgar Dutra Zanotto as the new ICG Vice President. Erik Muijsenberg is a Mechanical Engineer, he graduated from the University of Eindhoven in 1990. He began his career at TNO Glass in Eindhoven, focusing on furnace modelling and glass melt technology, later be-

coming Head of the Glass Department. In 1998, he became Managing Director of GLASS SERVICE B.V., establishing the company's first subsidiary in the Netherlands. He later moved to the Czech Republic, where he served as Group Vice President. Since 2024, following the integration of Glass Service Group into SEFPRO, Erik has held the position of Group Business Development Director. He has been a strong advocate of Industry 4.0 in the glass industry, promoting model-based furnace control and carbon emission reduction for more than 20 years. Erik is also the recipient of several international awards, including the Otto Schott Award in 1997, the ICG Turner Award in 2023 and the N.L. Varshneya Memorial Award in 2023, and served as Chairman of The Phoenix Glass Person of the Year in 2024. The International Commission on Glass (ICG) is an international association of scientists and technologists, research centres, universities and companies, whose main objective is to promote understanding and stimulate cooperation in the field of glass science and technology, as well as glass history and art.

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ORORA

FY26 trading update & impact of Middle East conflict

Following the March 2026 quarter trading period and management's review of Saverglass 2H26 forecasts, including the impacts of the ongoing Middle East conflict, Orora is now able to update it.

FY26 underlying EBIT (EUR) for Saverglass is now expected to be approximately EUR 63M to EUR 68M (excluding direct impacts of the Middle East conflict), this is compared to the previous guidance broadly in line with FY25 EBIT of EUR 79.2M.

FY26 reported EBIT (EUR) for Saverglass is now expected to be approximately EUR 52M - EUR 59M.

This reduction in reported FY26 forecast EBIT reflects both direct and indirect impacts of the Middle East conflict:

- Direct: operational and financial impacts relating to the Ras al Khaimah facility in the United Arab Emirates: 2H26 EBIT impact of approximately EUR 9M - EUR 11M, this amount will be separately disclosed as a significant item in the FY26 annual financial report; and
- Indirect: a combination of lower volumes than initially forecast and greater than anticipated negative mix shift towards premium wine and champagne compared to a

decline in premium spirits.

There is also a within-category mix impact lowering average selling price and margin. The company believes this recent shift includes the impact of weaker customer confidence after the commencement of the Middle East conflict - leading to a forecast 2H26 EBIT impact of approximately EUR 11M - EUR 16M.

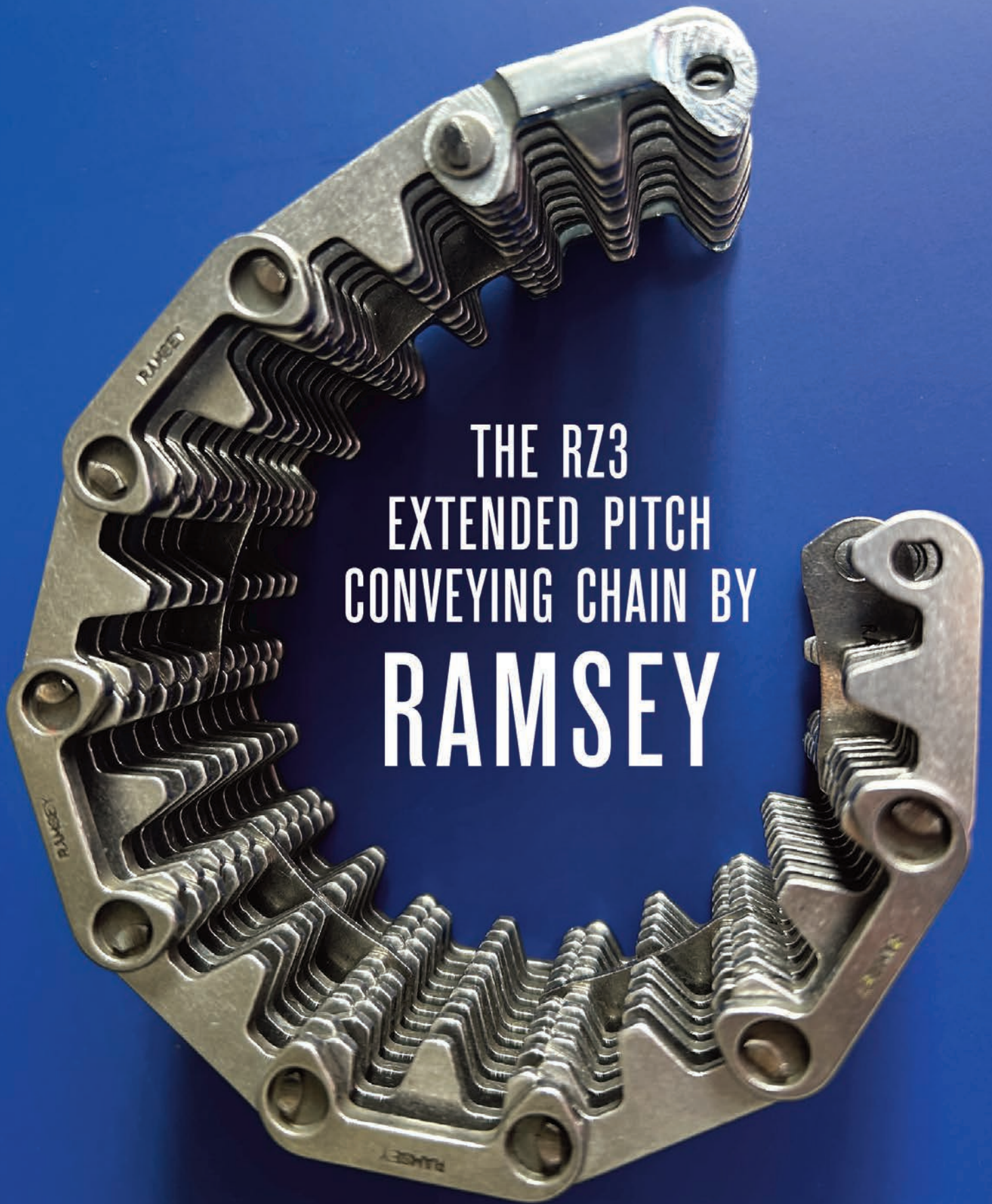
The latest on Ras al Khaimah (RAK) facility

The Ras al Khaimah (RAK) facility in the United Arab Emirates has shifted to closed loop 'hot' operation. Importantly, all team members in the region are accounted for and safe, and the glass production facility at RAK has not sustained any damage. Ensuring the safety and wellbeing of its team members remains Orora's first priority.

Since the commencement of the Middle East conflict on February 28, 2026, shipping routes have been closed, and overland routes are inaccessible. Accordingly, a decision has been made to transition the RAK facility to a closed-loop 'hot' operation, whereby the furnace will be kept warm with no bottle production taking place.

The RAK furnace (4 lines) represents approximately 15 percent of Saverglass production capacity, with most of the recent production geared toward global premium and ultra-premium wines for the North American market. The production of these bottles will now shift to Mexico, with moulds to be transported to the Acatlán facility to facilitate production from late FY26.

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HEINZ-GLAS

New electric glass furnace inaugurated at Kleintettau



The HEINZ-GLAS Group continues to invest in its German production sites. Shortly before Easter, the new electric glass melting furnace was inaugurated at the Kleintettau plant. The total cost of constructing the tank amounted to around EUR 13M.

The construction of the electric furnace, involving numerous stages of work, took around 14 weeks, starting with draining and cooling the old furnace, dismantling and demolishing it, rebuilding the new glass melting furnace and finally tempering it.

The scale of this major project is particularly impressive when illustrated by a few figures regarding the materials moved:

- Within six days, 400 tonnes of refractory material, as well as 250 tonnes of glass, steel and other materials, were demolished and removed.
- Within 30 days, 450 tonnes of refractory material were transported and installed.

During a small inauguration ceremony, the management thanked all the departments and external contractors involved for their professional work on the project.

“Building a furnace is always a major undertaking that can only be achieved through teamwork,” said Carletta Heinz. “I am proud that we have successfully completed this project and that production has already started with the new furnace. My thanks go to everyone who contributed to this.”

Dr. Rolf Schieder then performed the ceremonial blessing of the new electric glass melting furnace, during which a hymn was sung. The new furnace was christened “Josephine”.

Afterwards, everyone gathered at the Kleintettau Volunteer Fire Brigade’s station to celebrate the joyful occasion of the furnace inauguration together. The new electric glass melting furnace melts the glass entirely using CO₂-free electricity. Since 2024, only fully electric glass melting furnaces have been in use at the HEINZ-GLAS Group’s German production sites.

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AIGMF

Gas shortage to negatively impact glass packaging in India

The All India Glass Manufacturers' Federation (AIGMF) has sent a letter to the government expressing heightened concern over the gas shortage due to the war in West Asia. Glassmakers may be losing as much as EUR 9.2M as a result of missing supplies that are forcing them to scale back or even shut off furnaces.

"This is a difficult situation for us because glass manufacturing is energy-intensive requiring uninterrupted fuel supply," said Rajesh Khosla, president of the AIGMF and CEO of Hyderabad-based AGI Greenpac. "In its absence, around a third of container glass units have already shut down. We may see more plant shut-

downs if the gas shortage is not addressed quickly."

With the gas crisis arriving without warning, many furnaces could be shut down without proper conditions, leading to expensive damages, lost income and packaging product shortages. Even if operations are scaled back, the glassmakers clients are facing product shortages and lost profits for the foreseeable future.

In their letter to the government, the AIGMF has requested prioritising container glass manufacturing given its usage in food, beverages and pharmaceutical applications.

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HORN GLASS INDUSTRY

HORN commissions all-electric furnace for Gerresheimer

HORN was entrusted by Gerresheimer to replace its existing all-electric melting furnace with a new state-of-the-art all-electric furnace at its Momignies manufacturing plant in Belgium. To address this need, HORN installed its in-house developed e-Fusion Power Boosting Technology, which offers reduced CO₂ emissions and increased energy efficiency to decarbonise glass production. JSJ, as a premium supplier of all-electric furnaces and subsidiary of HORN, designed the state-of-the-art furnace. The all-electric furnace is used to produce high-quality cosmetic glass containers in flint on multiple production lines. The new furnace F #4 has a rectangular furnace shape, which guarantees a more evenly distributed glass convection to improve glass melting/refining performances.

This furnace, powered by renewable electricity with 50 percent melting capacity flexibility, will allow Gerresheimer to reduce their CO₂ emissions, significantly increase glass quality as well as reduce energy consumption.

The cold top all-electric furnace incorporates HORN's lat-

est design features that offer a specifically engineered furnace structure as well as a steelwork-integrated cooling system to extend the furnace lifetime. In addition, a new and improved swivel mechanism for the top electrodes has made it much easier to swing them in and out, both in terms of effort and time.

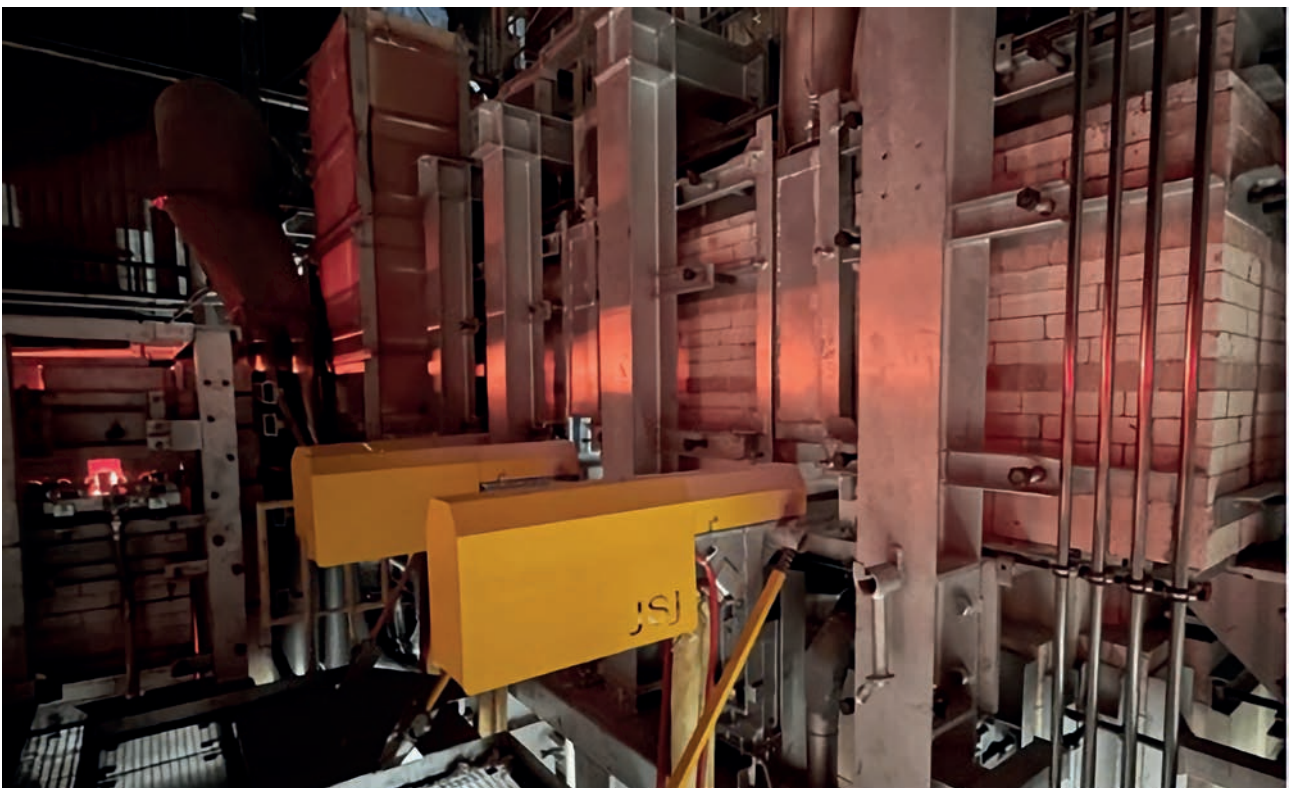
Within this furnace rebuild, HORN supplied a complete package of design, refractory engineering, delivery of the steel structure and equipment as well as the complete construction works. HORN's scope of supply also included the emergency combustion system, e-Fusion power boosting system, measuring and control equipment as well as tank and throat cooling.

The complete construction works and heating-up process were accompanied by the HORN supervisor team to ensure a trouble-free commissioning. In addition, Gerresheimer's operating personnel were prepared to take over the system through specially tailored training.

The new all-electric, energy-efficient glass melting furnace went into operation on October 3, 2025.

HORN is proud to have helped Gerresheimer take a further step toward reducing their CO₂ emissions associated with the glass melting at its Momignies site, and to have successfully delivered this project within the specified timeline.

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TOYO GLASS

Commencement of full-scale operation of new glass melting furnace



A consolidated subsidiary of Toyo Seikan Group Holdings, TOYO GLASS recently commenced operation of one large glass melting furnace for glass bottles that utilises an oxygen combustion method at its Plant in Kashiwa, Chiba Prefecture, Japan.

The oxygen combustion method uses high-concentration oxygen instead of air. By introducing this method, combustion without nitrogen becomes possible, improving heat transfer efficiency to the glass. As a result, greenhouse gas (GHG) emissions per melting furnace will be reduced by approximately 20 percent compared to conventional methods, while maintaining the same production volume.

Furthermore, the adoption of this method eliminates the need for a heat storage chamber that uses a large amount of heat storage bricks. TOYO GLASS will pursue the reduction of environmental impact throughout the entire product lifecycle and deliver valuable containers that contribute to their customers' decarbonisation management.

According to TOYO GLASS, as of March 2026, this is now the first introduction in Japan of an oxygen combustion system in a glass bottle melting furnace with a production capacity exceeding 200 tonnes per day.

The glass bottle industry faces a unique challenge in GHG emissions due to the high energy required for high-temperature combustion in melting furnaces. TOYO GLASS has long strived to balance business activities with global environmental protection, and has been working to promote energy conservation and recycling. The introduction of the oxygen combustion system was launched back in May 2024 as one of the most important measures to contribute to energy conservation and the realisation of a decarbonised society, and has commenced operation after approximately two years of preparation and construction.

This initiative will serve as a model case for driving decarbonisation in the glass bottle industry. Furthermore, starting with the full-scale operation of this oxygen combustion method, TOYO GLASS will continue to promote the introduction of the latest technologies and strive to reduce its environmental impact through a multifaceted approach. In order to contribute to the realisation of a sustainable society, the company will work together with its customers, suppliers and local communities to provide more environmentally friendly glass bottles and innovate its manufacturing processes.



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VERALLIA

Inauguration of first hybrid furnace in Zaragoza, Spain

In response to the climate emergency, Verallia has been committed for several years to decarbonising its operations. Supported by a clear and robust CSR roadmap-now reinforced by the SBTi's1 validation of its Net Zero 2040 trajectory-the Group aims to reduce its CO2 emissions (scopes 1 and 2) by 46.2 percent by 2030 compared with 2019, and by 90percent by 2040. Verallia is the first global producer of glass packaging for beverages and food products to commit to this trajectory for 2040.

In this context, the Group is deploying a diversified portfolio of low-carbon melting technologies across its network of plants. These include 100 percent electric furnaces, Cognac, France), traditional super-boosted furnaces (Chalon-sur-Saône, France), and oxy-fuel furnaces (Campo Bom, Brazil, and Pescia, Italy), as well as the Group's new hybrid furnaces (Zaragoza, Spain, with a second planned for Saint-Romain-le-Puy, France).

Those pilot projects allow Verallia engineering teams to develop their innovative technologies, ensuring their optimisation in terms of costs and efficiency, but also the skills and the knowledge required to operate and maintain those furnaces. As such, those projects prepare the deployment across the Group of decarbonised furnaces in the coming years.

The Zaragoza hybrid furnace project, launched in 2022 and developed with **SORG** for a total investment of EUR 63M, marks a new stage in this transformation.

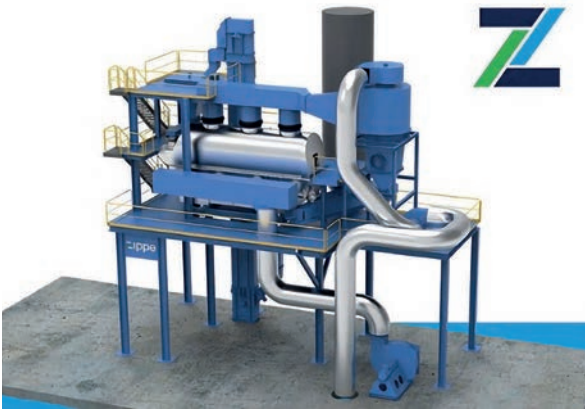
The hybrid furnace combines 70 percent renewable electricity with 30 percent natural gas or biofuel, enabling a significant reduction in environmental impact while ensuring production reliability and industrial flexibility.

With three production lines, the furnace offers a high degree of operational agility and can produce different glass colours. At full capacity, the Zaragoza site-which operates two furnaces-will increase its production to 1.3 million containers per day, reinforcing its role as a reference site on the Iberian Peninsula.

Patrice Lucas, Chief Executive Officer of the Verallia Group, said, "The commissioning of our first hybrid furnace in Zaragoza represents a significant step in the decarbonisation of our processes, notably through the progressive electrification of glass melting. This milestone forms part of Verallia's broader commitment to the decarbonisation of the glass packaging industry, through investments in technologies that prepare our entire value chain for more sustainable production models."

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- Higher furnace capacity due to faster melting

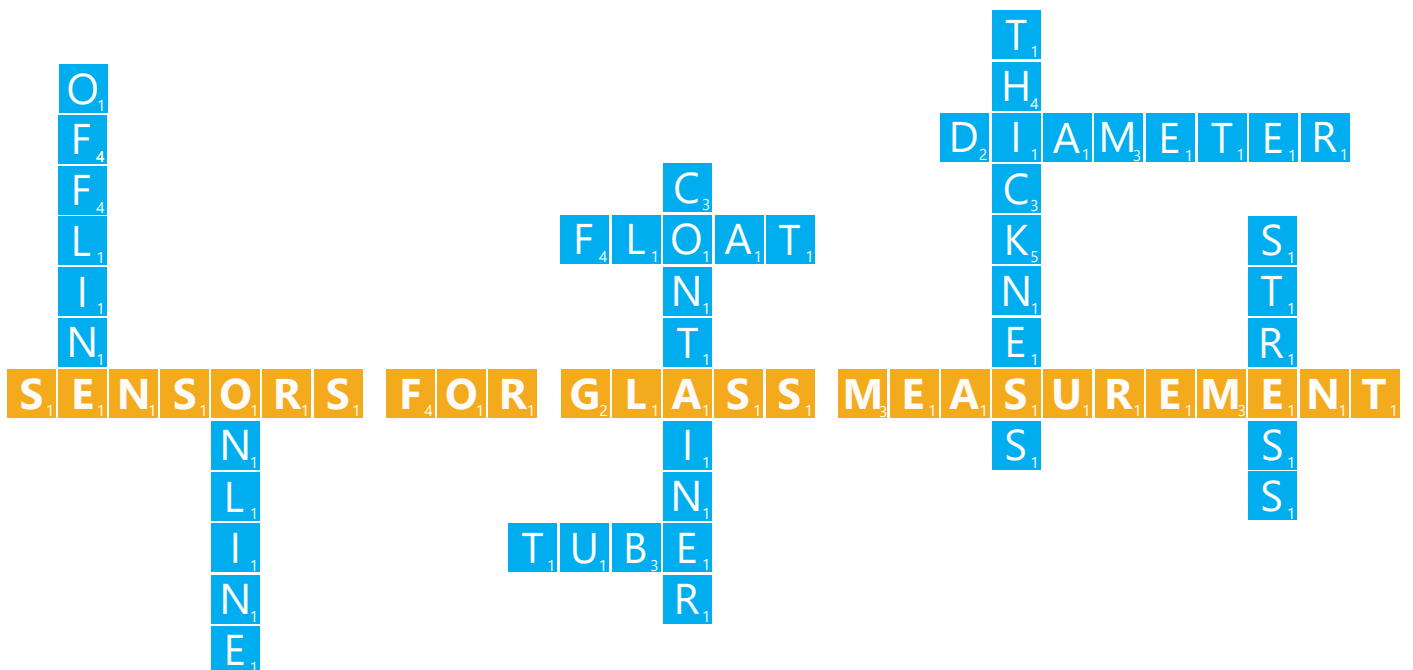
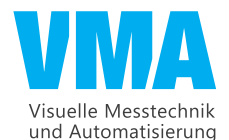
The technology has already been successfully tested in a pilot plant in Europe.

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PHOENIX AWARD COMMITTEE

Roberto Cabrera accoladed as Glass Person of the Year



The Phoenix Award Committee was recently honoured to announce Mr. Roberto Cabrera, Vice President of Engineering and Technology at Vitro Architectural Glass, as the 54th recipient of The Phoenix Award and Glass Person of the Year 2026. The Committee has recognised his outstanding achievements and leadership in advancing manufacturing excellence and sustainability across the flat glass industry. Roberto Cabrera, born on

September 7, 1964, in Mexico City, Mexico, is a highly respected engineering executive and a leading authority in flat glass manufacturing technology. With nearly four decades of professional experience at Vitro, Roberto has played a pivotal role in advancing engineering innovation, operational excellence, and sustainable manufacturing practices across North America. Roberto earned a Bachelor of Science in Chemical Engineering from the Instituto Politécnico Nacional (Mexico City Polytechnic Institute) in 1987. He later completed a Master of Science in Ceramic Engineering at the Universidad Autónoma de Nuevo León in 1998, followed by a Master of Science in Management of Technology from the Sloan School of Management at the Massachusetts Institute of Technology (MIT) in 2000. His academic background uniquely combines deep technical expertise with strategic technology leadership. Joining Vitro in October 1987, Roberto has built an extensive career spanning engineering, quality assurance, research and development, and executive leadership. His early roles included Head of the Screen-Printing Department within Vitro's Automotive business, Quality Assurance Assistant, and Process Technology Engineer for tin bath and furnace operations. He later led research initiatives in glass properties characterisation, contributing to new product development and intellectual property for Vitro Architectural Glass. Roberto went on to serve as Corporate Technology Leader and Corporate Technology Manager, where he was the technical lead for petroleum coke technology development, focusing on fuel conversion, equipment innovation, and process optimisation. In 2009, he was appointed Technology Manager for Vitro Architectural Glass, overseeing float glass process engineering, research and development, and engineering operations. In Au-

gust 2017, Roberto was appointed Vice President of Engineering and Technology for Vitro Architectural Glass. In this role, he oversees engineering and technology across seven float glass lines in the United States, three in Mexico, as well as three coating lines in the U.S. and one in Mexico. He defines and executes technology strategy across Vitro's production network, driving advances in process stability, manufacturing efficiency, and environmental performance. Roberto played a key role in the technical due diligence and integration process during Vitro's acquisition of PPG Glass in the United States in 2016, supporting the successful expansion and modernisation of Vitro's North American footprint. He also led the startup of Vitro's first Jumbo Coater in Wichita Falls, Texas, in 2018, followed by a second Jumbo Coater in Mexicali, Mexico, in 2023. Since 2023, Roberto has been leading strategic initiatives to implement two new glass plants dedicated to solar panel glass production, reinforcing Vitro's commitment to innovation and the energy transition. An inventor or co-inventor of 12 granted U.S. patents, Roberto has made lasting contributions to product, process and equipment development within the glass industry. His achievements have been recognised with the Hotbels BTU Award in 2016. He has also served as a member of the GMIC Board representing Vitro since 2021, further reflecting his leadership within the global glass manufacturing community. Beyond his technical accomplishments, Roberto is widely respected for his collaborative leadership style, professionalism, and commitment to knowledge sharing. He remains actively engaged in advancing industry best practices and fostering innovation through cross-industry collaboration. A devoted family man, Roberto proudly shares his life with his wife, Virginia, their children -Roberto and his wife, Kitzia; Andrea and her husband, Julio; and Maximiliano- and his beloved grandson, Leonardo Robert, who represents the next generation and a source of pride and inspiration. Their support has been a constant foundation throughout his career. The Glass Person of the Year 2026 award recognises not just a lifetime of accomplishments, but an unwavering commitment to responsible leadership, sustainable industry practices, and community involvement. The Phoenix Award Committee is delighted to confirm Roberto Cabrera is the 54th recipient of the Phoenix Award and the 2026 Glass Person of the Year. According to the committee's regulations, the award will be presented to Mr. Cabrera by Steve Egert, the PAC 2026 Chairperson, during a banquet and award ceremony later this year that's scheduled for Friday, 30 October, in Chicago, USA.

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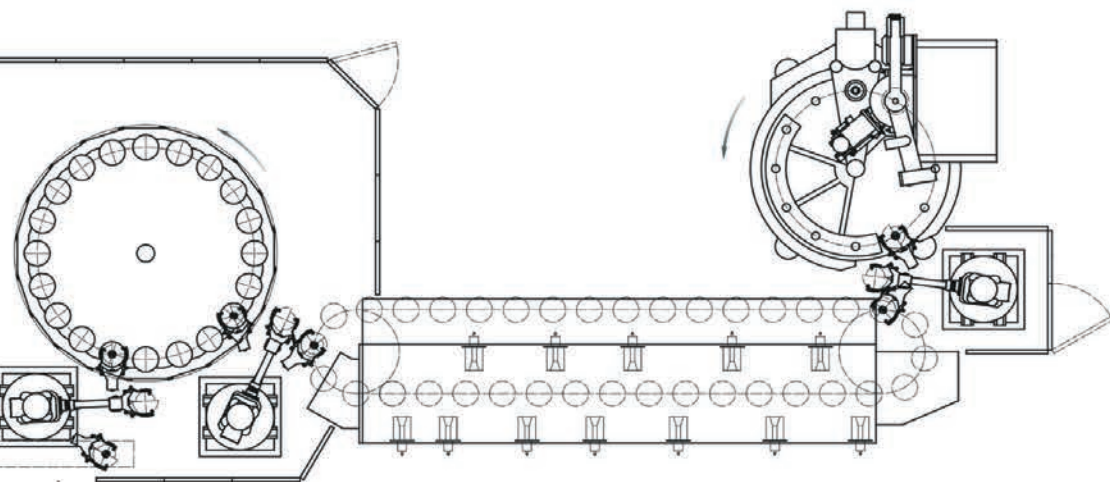


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Innovative servo-driven machinery defines **WALTEC** industry leadership

Across the global glass industry, WALTEC continues to demonstrate how engineering expertise and adaptable machinery can enhance production efficiency. The company's S-Series integrates precision control, flexible forming capabilities and data-driven optimisation – supporting manufacturers in meeting evolving industrial demands while maintaining consistent quality and operational reliability.

With a legacy spanning more than 125 years, WALTEC has established itself as a key partner in the global glass industry. Recognised as a primary reference point for radial glass production machinery, the company combines long-standing engineering expertise with ongoing technological development. Its systems support the production of a wide spectrum of glass products, from tableware and cookware to specialised tech-

nical components such as insulators, washing machine cover glass, and glass blocks. Across these applications, a consistent focus on process control, efficiency, and product quality underscores its industrial approach, alongside a clear commitment to sustainability and cost efficiency.

PERFORMANCE IN MOTION

At the core of the S-Series is a gravity-based spinning machine designed for high-output flexibility. Available in configurations

with 1, 9, 18 and 24 stations, the system can reach production speeds of up to 100 pieces per minute. When combined with the linear ESERVO feeder, it enables the simultaneous production of up to three different articles, each with individually configurable process sequences. Servo-driven acceleration and variable speed profiles ensure stability throughout operation, allowing manufacturers to efficiently handle both large-scale production and smaller batch requirements.

PRECISION FEEDING SYSTEMS

The ESERVO feeder introduces a high level of adaptability through variable gob weight control. This capability allows manufacturers to produce glass articles of differing weights and designs within the same production cycle. Multiple speed options and consistent gob weight distribution contribute to reliable forming conditions for each product type. This integration of flexibility and precision reflects a broader emphasis on accommodating diverse manufacturing needs without compromising output consistency.

INTELLIGENT CONTROL AND OPTIMISATION

Energy efficiency and process stability are central to the S-Series design. Servo drives are integrated into every station, enabling precise control of each spinning spindle and vertical fun-

nel movement. Mould temperature management is achieved through a combination of rapid linear motion, adjustable airflow

cooling, and optional water-based systems, ensuring stable forming conditions. Operational usability is enhanced through an intuitive control interface, while safety is reinforced by automated stop mechanisms and decentralised control systems positioned away from heat and contaminants. Complementing the machinery, the WTRACK software solution provides data-driven monitoring and analysis, supporting continuous process optimisation and integration with existing IT infrastructures. ■



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Market resilience underscores **SORG** success following Polska integration

Following its integration of Techglass, SORG has successfully established SORG Polska as a key regional hub. Combining local expertise with global capabilities, the organisation strengthens engineering, technology and customer support - positioning the Group to deliver resilient, future-ready solutions across Central and Eastern Europe's evolving glass industry.

Back in 2024, the SORG Group strengthened its European presence by integrating the former Techglass, rebranding the organisation as SORG Polska in 2025. By this year, the formal integration of the Polish organisation has proven highly successful. The process has been

built upon an established working relationship and a clear recognition of local engineering expertise. Techglass had already held a strong and well-deserved reputation in the market, making it a natural partner. Just as importantly, both organisations shared a common foundation as family-owned businesses, guided by long-term loyalty, strong

relationships, and a commitment to responsibility, dedication and perseverance. The alignment of values ensured that the transition was seamless. Bringing teams, capabilities and regional knowledge together under one brand has strengthened SORG's ability to support glass manufacturers across Central and Eastern Europe. Customers benefit from consistent standards in products, equipment, technology and service, while SORG Polska has evolved into a key regional hub for engineering, project execution and customer support, combining local expertise with global reach.

A CLEARLY DEFINED STRATEGIC ROLE

From the outset, the integration of Techglass was positioned as a strategic priority. The objective was not to maintain separate operations, but to create a unified organisation working in close coordination. A structured framework supported this process, including cross-functional workshops and dedicated working groups designed to align teams, accelerate decision-making and guide transformation. The rapid rebranding to SORG Polska underscored the depth of integration. A unified brand has strengthened market positioning, increased



customer confidence and reinforced the perception of a cohesive organisation. At the same time, cultural integration was prioritised, with a focus on transparency and fostering a sense of belonging among employees. Today, departments such as sales, engineering, project management and procurement operate in close daily coordination across borders, reflecting a high level of organisational alignment.

STRENGTHENING SCALE AND FLEXIBILITY IN EUROPE

The acquisition was not intended to remove a competitor but to expand

technical capabilities, increase market share and build a stronger platform for sustainable growth. With more than 700 employees worldwide, SORG has further enhanced its scale and technical depth through the inclusion of SORG Polska. This expansion has improved operational flexibility, particularly in delivery performance and responsiveness. A stronger presence in Poland enables closer proximity to customers across Central and Eastern Europe, where shorter communication pathways and faster response times are critical competitive advantages. Sales responsibilities are clearly defined,

with SORG Polska overseeing markets including Poland, Ukraine, the Baltic States and Moldova, as well as selected key accounts. Continuous collaboration between sales teams ensures that customers receive optimised technical and commercial solutions.

EXPANDING THE TECHNOLOGY PORTFOLIO

The integration has delivered immediate technological benefits. SORG Polska now has access to the group's full portfolio, including CLEAN Melter® concepts, VSM® technologies and Viking® forehearth systems, strengthening its market position and enabling broader value creation. Customers of the former Techglass organisation now benefit from an expanded range of furnace concepts and equipment. Complementary systems from across the group, including batch plants and cullet return systems from EME, are incorporated into integrated solutions. At the same time, SORG has enriched its own portfolio with





additional technologies such as SPL-SCOOPA batch chargers and sodium silicate-forming expertise. This exchange represents mutual technological reinforcement rather than one-directional transfer. Customers now have access to a wide spectrum of furnace solutions, from natural gas-fired systems to fully electric and hybrid melting concepts, alongside regionally adapted configurations.

PROJECT EXECUTION WITHOUT BORDERS

In its first year, integration extended well beyond organisational alignment. Project execution has seen specialists from across the group working together on international sites, combining engineering expertise with operational knowledge to ensure reliable implementation. This collaborative approach has strengthened internal coordination while delivering tangible value to customers. Feedback frequently highlights the professionalism, efficiency and teamwork demonstrated by joint project teams, confirming the effectiveness of the integration both structurally and operationally.

NAVIGATING A CHALLENGING MARKET ENVIRONMENT

The first year of SORG Polska coincided with difficult market

conditions, particularly in the services segment for packaging glass manufacturers. Weak demand, intense competition and pricing pressure have defined the environment. In response, flexibility and commercial pragmatism have been essential to maintain continuity of employment. Within this context, being part of a larger group has provided stability. Financial strength, global reach and industry experience have supported resilience during uncertainty. Customers in Poland continue to work with familiar local teams while benefiting from the resources of an international organisation. Clear communication has reinforced this continuity, emphasising that SORG Polska remains locally rooted while operating with global backing.

BUILDING TECHNICAL EXCELLENCE FOR THE FUTURE

Looking ahead, the focus is on deepening integration and unlocking the full potential of the combined organisation. Flexible allocation of personnel across locations enhances resilience and efficiency, allowing workloads to be balanced more effectively. Shared talent pools improve responsiveness to project demands, while a

broader geographic footprint supports recruitment and strengthens employer attractiveness. At the same time, centres of technical excellence are being developed to consolidate expertise, reduce redundancy and drive operational efficiency. For SORG Polska, access to group-wide engineering expertise, modelling capabilities and furnace development experience supports continuous improvement. Comparing legacy solutions with group technologies creates opportunities for further optimisation and innovation.

POSITIONED FOR A TRANSFORMING INDUSTRY

The glass industry is undergoing significant change, shaped by rising global competition, stricter CO₂ emission requirements and geopolitical uncertainty. In this environment, scale, stability and international experience are increasingly important. One year after rebranding, SORG Polska is fully integrated, with strong technical alignment, commercial cohesion and cultural connection across the group. Its combination of local presence and global engineering capability positions it to deliver efficient, future-ready furnace solutions throughout Central and Eastern Europe. The first year has been defined by integration and resilience. The years ahead will focus on growth, technical excellence and long-term value creation for customers across the region. ■

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Efficient NOx reduction strategies implemented by STARA GLASS

Nitrogen oxides (NOx) emissions pose significant health risks, contributing to ground-level ozone formation, photochemical smog, acid rain and secondary particulate matter, while also affecting climate dynamics. Consequently, increasingly stringent emission limits are being enforced worldwide. NOx emissions are regulated through frameworks that establish maximum allowable concentrations. In Europe, limits for glass plants typically range from 500 to 800 mg/Nm³ at 8 percent O₂. The lower value applies to plants equipped with abatement systems, while the higher value applies to those relying solely on primary measures. Local authorities may impose stricter thresholds. Technologies for NOx mitigation are generally classified into primary (preventive) and secondary (destructive) measures. Primary solutions aim to limit NOx formation at the source by acting directly on the combustion process. Stara Glass has developed primary NOx reduction technologies including HEAS (High Efficiency Air Staging)

and SWGR (Strategic Waste Gas Recirculation). Although based on different principles, both approaches operate the main high-temperature combustion phase under oxygen-poor conditions, limiting the availability of excess oxygen to react with nitrogen and thereby reducing thermal NOx formation. Secondary technologies include Selective Non-Catalytic Reduction (SNCR) and Selective Catalytic Reduction (SCR). Both involve injecting a reducing agent, typically ammonia or urea, into flue gases, where it reacts selectively with NOx to form nitrogen and water. SNCR relies on direct injection within a temperature window of approximately 800°C to 1,100°C, while SCR uses a catalyst to enable the same reactions at lower temperatures, typically between 250°C and 400°C. SCR systems are more complex and capital-intensive, requiring additional operational considerations such as catalyst replacement, pressure drop management, maintenance and ammonia handling. By contrast, SNCR systems are mechanically simpler, more compact and

less costly in both capital and operating terms. However, their effectiveness depends on accurate control of the thermal profile, requiring specific expertise in heat exchange systems.

SNCR APPLICATION IN THE GLASS INDUSTRY

Stara Glass has developed SNCR technologies tailored to the requirements of the glass industry.

SNCR FOR UNIT MELTER FURNACES

In unit melter furnaces, reagent injection occurs in the high-temperature flue gas stream after heat recovery. These systems operate with lower combustion air temperatures compared to regenerative furnaces, resulting in lower flame temperatures and reduced thermal NOx formation. This makes compliance with the 800 mg/Nm³ limit more achievable. However, overall consumption and NOx emissions are typically around 40 percent higher than in regenerative systems, and future regulatory changes cannot be excluded.

Addressing tightening emissions regulations, advanced furnace solutions are enabling effective NOx reduction and energy recovery. As explained here by STARA GLASS R&D engineers Elisa Gerali and Ernesto Cattaneo, the company is developing tailored SNCR technologies and heat exchange expertise to ensure controlled thermal conditions – all to deliver measurable emission reductions, operational efficiency and reliable performance across a range of glass furnace configurations.

SNCR FOR CENTAURO FURNACES

Centauro furnaces are particularly suited for SNCR integration due to their hybrid heat recovery configuration. Heat recovery is divided into a regenerative section with short regenerator chambers and a metallic system comprising two double-shell recuperators

and one convective exchanger. This configuration results in flue gas temperatures of approximately 800-850°C at the regenerator outlet, which falls within the optimal SNCR operating range.

INSTALLATION

The system includes storage tanks, metering pumps, flow control and monitoring of flue gas

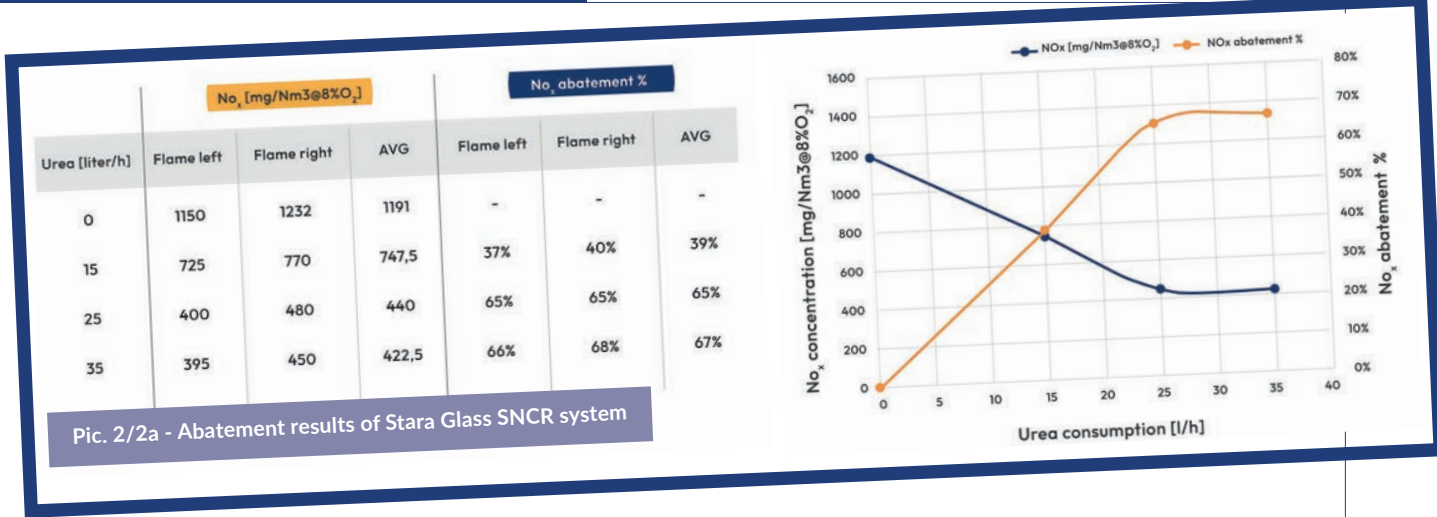
temperature and NOx concentration. The reducing agent is delivered through a network of injection lances optimised using computational fluid dynamics.

Field validation supports this design approach. To date, eight SNCR systems have been installed by Stara Glass, demonstrating consistent performance under real operating conditions.

Pic.1 - The installation of Stara Glass SNCR systems is performed while the furnace is running



DECARBONISATION



The graphs and reported data indicate that SNCR systems can achieve NOx reductions of up to approximately 70 percent, confirming their effectiveness as a solution for emission control in glass furnaces.

METAL RECUPERATORS

Stara Glass draws on decades of experience in furnace and heat exchanger design, supported by systematic field data acquisition, to refine thermal calculation models. Expertise in the dimensioning of regenerators and metal recuperators enables precise control and prediction of flue gas temperatures

throughout the system, a critical factor for SNCR efficiency. This analytical approach is particularly relevant in oxygen-fired furnaces, where flue gas composition differs from conventional air-fuel combustion. By incorporating actual gas composition and temperature-dependent specific heat integration into its calculations, Stara Glass achieves accurate thermal balance evaluations and reliable performance predictions - even in non-standard configurations. Fouling of metal components represents a key limitation to long-term heat exchange performance. To address this, Stara Glass has developed cleaning systems and

procedures for recuperators that restore original performance when fouling occurs, using operations that are rapid, simple and cost-effective. ■

Pic. 4 - The authors, Elisa Gerali and Ernesto Cattaneo, from Stara Glass Innovation Department



Pic. 3 - example of Stara Glass double-shell recuperators for Centauro furnaces



STARA GLASS S.P.A.

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Innovation meets heritage as **FERMAC** redefines packaging appeal

TRADITION & INNOVATION AN UNFORGETTABLE HANDSHAKE

In today's competitive market, the 'shelf appeal' of packaging serves as the first handshake with consumers. Decoration in the cosmetic, beverage, and wellness luxury sectors must consistently meet rising global expectations. At Fermac, more than three decades of technical expertise are embodied in a multigenerational team. This

foundation is reinforced by a meticulous engineering department, a forward-looking R&D team eager to tackle new challenges, and an international sales network focused on pushing the boundaries of decoration. With a strong global printing heritage, the company addresses complex decoration demands through a comprehensive ecosystem of silkscreen and digital printing equipment, complemented by auxiliary systems. These include lehr stackers, customisable pre-

treatment units, antistatic treatments, inflating devices, and registration cameras. All are manufactured in Italy and integrated with a local network of specialised suppliers.

VERSATILE CO-PILOT

A recurring question shapes the company's approach: is packaging working as hard as it could? Over the years, Fermac has positioned itself as a decoration co-pilot, transforming containers into interactive brand assets. Its decoration subsidiaries in Parma and Milan function as continuous testing grounds, handling a wide range of bottles, mugs, tumblers, cosmetic containers, and luxury packaging across glass, plastic, ceramic, and metal. The proximity of these facilities enables real-time problem-solving and refinement, keeping the company closely aligned with machine operators. This dual role -competitive OEM and active supporter of decoration processes- offers a distinctive advantage in maintaining consistent production standards.

THE NEW GOLD (GREEN) DREAM

In an increasingly digital world, products are often experienced virtually before physical



In a rapidly-evolving packaging landscape, sustainability and transformation converge as decoration technologies advance. Through its integrated systems, real-time production insight and energy-efficient solutions, FERMAC supports global manufacturers in elevating packaging performance - ensuring products stand out whilst reducing environmental impact across the glass decoration value chain.

interaction occurs. Packaging must therefore bridge the gap between digital engagement and tangible emotion. Technologies such as printed QR codes can connect consumers to a prod-

uct's history, content, and manufacturing context, extending interaction beyond the physical object. Fermac's technology supports a variety of printing effects, including three-dimensional finishes and transparent

or glossy colour applications, all integrated on a single substrate. To meet evolving production needs, recent developments have focused on redesigning the internal architecture of both silkscreen and digital printing machines. A notable innovation is the integration of a hot stamping module directly on board. Compared to traditional inline systems, this approach offers greater flexibility and impact while remaining available alongside existing solutions. A servo-driven foil management system enables seamless coordination between screen printing and hot stamping, allowing both processes to operate in harmony within a single machine. This integration allows a single operator to manage multiple decoration techniques without interruption. Metallic foils -such as gold or platinum- can be applied across varying surface areas, with adhesion ensured through a primer layer partially polymerised under UV light. Precision and finish quality are achieved through a combination of integrated accessories and advanced automation. Sustainability remains central to this technological evolution. As decoration processes accelerate globally, the need for greener production environments becomes more urgent. By focusing on energy-efficient solutions, particularly through UV and UV LED technologies, Fermac contributes to reducing power consumption and lowering the overall carbon footprint within the decoration chain.

SWORN FRIENDS

Reliable technical support is a cornerstone of the company's operations. The Fermac service team provides flexible and responsive assistance to operators worldwide, ensuring continuity in production - even under



SYNERGIES

challenging conditions. A dedicated service line and a well-stocked warehouse enable the rapid delivery of essential components, reinforcing a proactive approach to maintenance and problem resolution.

DECORATION JOURNEY

Every finished product -whether a commemorative bottle for a family celebration or

a refined perfume container- represents the culmination of a carefully engineered process. Fermac's commitment lies in ensuring that packaging not only stands out visually but also enhances and honours its contents. The goal is to create lasting impressions, allowing the memory of a product -such as a fine whisky- to endure long after the bottle itself is empty. ■



FERMAC

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43126 Parma - ITALY
Tel.: +39-0521-989056
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Tel. +39.0577.304730 - Fax. +39.0577.304755 - com@fonderievaldelsane.com
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Trailblazing crown engineering enhanced by SEFPRO mullite innovations

Explaining how SEFPRO BP Mullite REC overcomes silica crown limitations, the following article by B. Hérout, SEFPRO Insulation & Reinforcement Market Manager, C. Mesnager, R&D Project Leader at Saint-Gobain Research Provence and K. Muvvala, R&D Manager at Saint-Gobain Research India, further demonstrates how it enables higher temperatures, reduced heat losses and safer, more efficient glass furnace operation.

ALTERNATIVE CROWN DESIGN WITH SEFPRO BP MULLITE REC

Among the various ways to design a crown, material selection is done between fused cast or sintered, with a natural dominance of sintered material. In the context of industrial footprint contraction, we observe a tendency to get larger

pull rate per furnace, and this leads to larger designs of spans for the crown, up to 7-9 m. Combining this trend with the rise of electrical boosting and transition to news fuels as energy source, the function of the crown is also to limit the heat losses from the melter, resist to oxy/gas combustion, water vapor and heavy metals generation, alkali vapors in case of soda-lime glass, and carry-overs. The

most encountered crown solution is the use of silica bricks, usually with a cementitious binder. Recent market trends show more silica products with low or no lime content. In various working conditions this material can face spalling or rat-hole degradation, leading to complex repair in hot conditions, such as ceramic welding. This visible degradation appears with silica-based products when

the crown temperature is above 1,620°C. Below 1,400°C, sodium silicate starts to form if the glass chemistry or atmosphere contains alkalis. In case of cold crowns for high-boosted furnaces, the silica material could be at risk. Standard silica is generally bonded with lime or phosphates. Combined with raw material pollution (CaO, MgO, Al₂O₃, K₂O), it will locally decrease the refractory melting point in presence of corrosive agents. The low-lime silica will thus help with corrosion resistance between 1,400°C and 1,620°C. However, as the low-lime silica refractory is poorly bonded, the material is not well sintered and usually heavily microcracked. This leads to a more brittle material. Even though corrosion resistance is better, the potential propagation of cracks during the glass furnace operation and local spalling must be taken into consideration. A bonded alternative to silica is mullite, which has an enhanced corrosion resistance to carry overs and atmosphere vapors. This material is already a worldwide solution for low-alkali glass chemistries, providing limited spalling risk and enhanced creep resistance in various applications.

In the next section, we present

the SEFPRO BP Mullite REC, developed to offer alternative crown design when operating in severe conditions. This is achievable thanks to a material microstructure non-sensitive to water vapor or to temperature, a controlled behaviour in high alkali concentration and very good creep and thermal shock resistance.

DEVELOPMENT OF BP MULLITE REC FOR SEVERE CONDITIONS

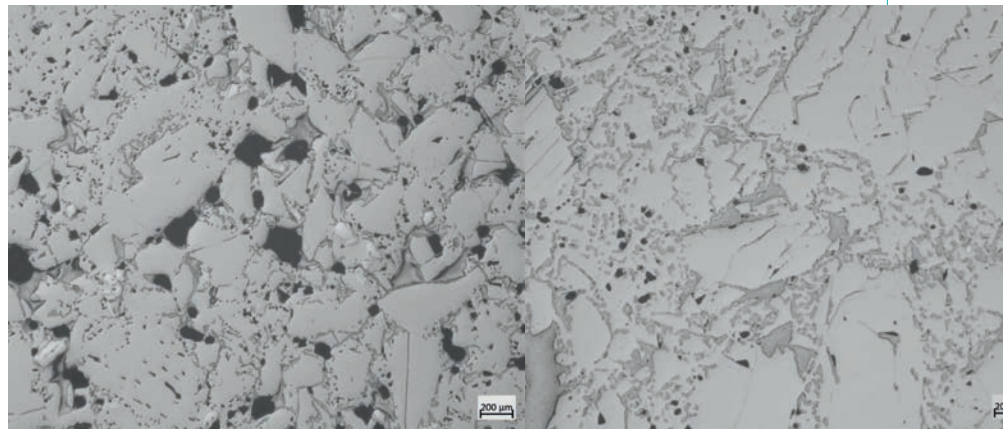
High-creep and chemical resistance with BP Mullite REC solution SEFPRO has developed the BP Mullite solution regarding severe conditions encountered in crown. Objective is to offer to furnace designer and glass maker a material that will have excel-

lent refractoriness under load and high cold crushing strength.

The differences between SEFPRO BP Mullite and BP Mullite REC -for recrystallised- are controlled by a specific manufacturing process, bringing low level of closed porosity and significantly better behaviour for creeping at high temperatures.

UNLOCKING HIGHER PERFORMANCE THROUGH ADVANCED MULLITE TECHNOLOGY

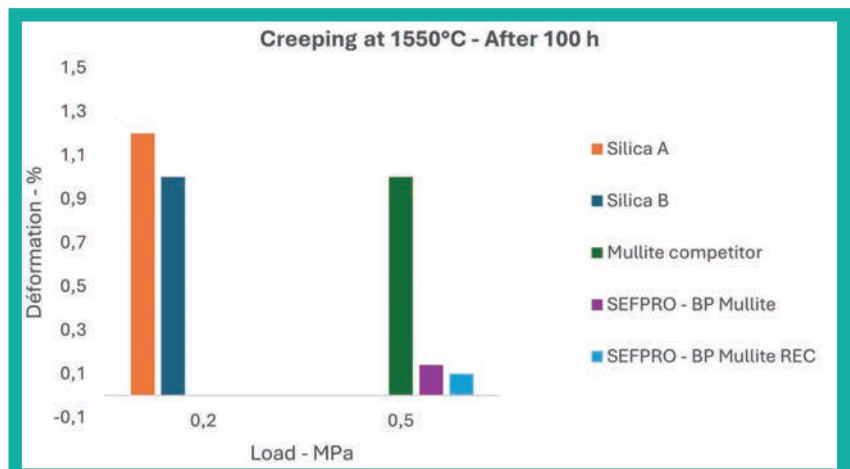
BP Mullite REC superstructure opens the way to new operating conditions Based on enhanced creep and chemical resistance, BP Mullite REC allows to increase the crown temperature by more than 100°C



Material properties © SEFPRO, All rights reserved 2026

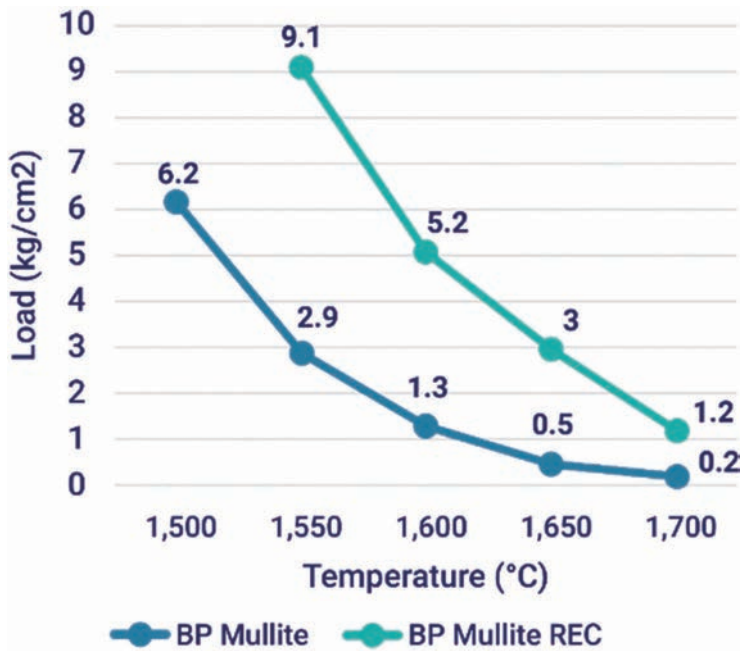


Standard degradation with silica crown © SEFPRO, All rights reserved 2026



Closed porosity (BP Mullite - left / BP Mullite REC - right) © SEFPRO, All rights reserved 2026

DURABILITY

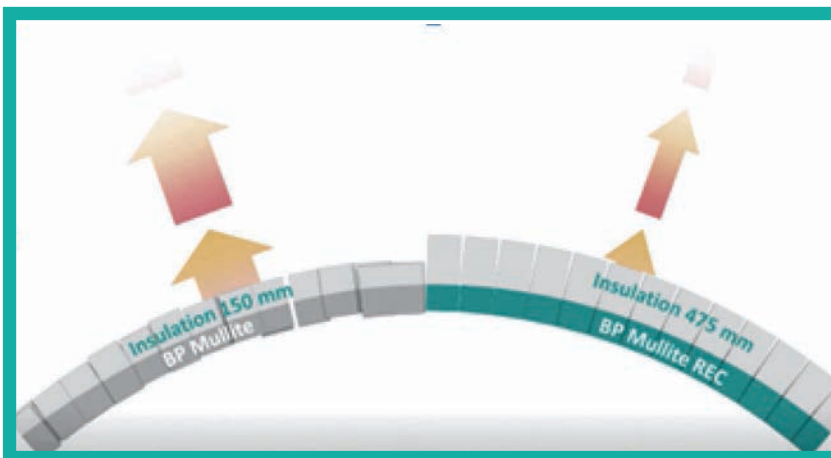


Refractoriness under load. © SEFPRO, All rights reserved 2026

while allowing a safer operation thanks to a much higher creep resistance, up to 6 times at 1,700°C, that were not previously achievable to reinforcement fiber glass, textile fiber glass, ceramic and borosilicate glass furnaces.

A crown material being able to withstand a higher load at higher temperature helps reduce superstructure energy losses by allowing a much heavier insulating package. Higher refrac-

toriness under load also enables an increase in the glass melting temperature to reach a higher pull (above 1,550°C and higher) and improve the manufacturing performance. Refractories integrity and stability during the whole campaign life are the key to high performance melting process, particularly critical for the crown application. BP Mullite REC crown for reinforcement and textile fiber glass melting furnace is



Higher insulation package thanks to BP Mullite REC © SEFPRO, All rights reserved 2026

especially adapted to oxy-firing combustion and its high flame temperatures.

REDUCING THERMAL LOSSES WHILE ENSURING STRUCTURAL STABILITY

Thermal losses reduction in reinforcement glass furnaces A realistic approach is to increase the insulation of furnace superstructures, but it also increases the inner refractory temperature and will strongly challenge the refractoriness under load, especially at higher temperatures. When applied to a glass furnace melter crown, thicker insulation means greater weight and higher constraints on each block of the crown. As the maximum acceptable load decreases with temperature, the risk is consequently exposure of the crown material to a load above its mechanical limit given by the nil creeping curve. The crown may start sagging, and the creeping resistance is challenged. A concrete example of how the SEFPRO BP Mullite REC allows 60 percent heat losses reduction while securing the crown against risk of sagging:

SEFPRO BP Mullite REC provides safer operation against risk of creeping and reduces heat loss by more than half with the use of much thicker insulation. The high refractoriness property of BP Mullite REC ensures a continuous operation without sagging even at very high temperature. ■

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2539 Route de Sorgues
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The precision cutting optimisation in LUBEN GLASS systems

It begins with a drop of molten glass which, after being carefully sized and cut, begins its brief journey toward becoming a container of many possible forms. In this early stage, precision is essential, as even the smallest variation during cutting can influence the entire outcome. The transformation from molten material to finished container is rapid, but the quality of that transformation is determined in these first critical moments.

ORIGINS OF DEFECT FORMATION

Glass containers, valued for their brilliance, transparency and wide variety of shapes, remain highly sensitive to imperfections introduced during production. Among the most critical stages is the cutting of the glass drop. If this process is not executed correctly, visible cut marks can appear on the final container. Despite the adaptability of molten glass, these marks persist, directly affecting the aesthetic and structural quality of the product. In most cases, such defects result in the rejec-



Achieving consistent quality in glass container production depends heavily on precise cutting and effective blade lubrication. Systems developed by LUBEN GLASS address these critical factors – supporting continuous operation while reducing defects and improving overall efficiency in demanding manufacturing environments where reliability and precision remain essential.

tion of the container, contributing to considerable production losses and inefficiencies within the manufacturing cycle. The causes of these defects can be traced to several interconnected factors. The performance of the cutting mechanism itself plays a central role, as does the condition of the cutting blades. However, one of the most decisive elements is the lubrication of those blades. Each of these aspects must function in harmony to ensure a clean, precise cut that preserves the integrity of the glass as it forms.

THE ROLE OF LUBRICATION AND COOLING

Inadequate blade lubrication is a frequent source of operational and quality-related issues. Without proper lubrication, blades deteriorate more rapidly, increasing the likelihood of irregular cuts and surface defects. This deterioration not only affects product quality but can also lead to mechanical complications. In more severe cases, insufficient lubrication contributes to the jamming of the cutting mechanism, potentially forcing a complete shutdown of the IS machine and interrupting production. Closely linked to lubrication is the process of blade cooling,



which plays a fundamental role in container formation. Cooling is not merely a supportive function but an integral part of the cutting process itself. The condition of the blades, influenced by both lubrication and cooling, directly impacts the formation of the glass drop and, ultimately, the quality of the finished container. For this reason, maintaining consistent and effective lubrication is essential for both operational stability and product excellence.

INTEGRATED SYSTEMS FOR RELIABLE OPERATION

For years, Luben Glass has focused on the development of blade lubrication systems designed to address these challenges. Its DLCS line represents a continuation of this effort, emphasising simplicity, reliability and precision in system design. These machines form the core of blade lubrication and cooling systems, supporting consistent cutting performance



across a range of production environments. The DLCS systems operate in conjunction with additional components, including mixing panels, storage tanks and pressurisation units. Together, these elements create a comprehensive system capable of delivering stable and effective lubrication, provided that other operational conditions -such as the efficiency of the cutting system, the quality of the blades and the suitability of the oil- are properly maintained. When these factors align, the result is a cutting process that minimises defects and supports continuous production. Built using high-quality electronic components, DLCS systems are designed for uninterrupted operation. Automatic backup functions enable continuous performance around the clock, while integrated fluid pressure monitoring provides real-time alerts related to system piping across the entire line. This level of monitoring enhances operational awareness and helps prevent issues before they escalate into larger disruptions. The control unit, constructed with commercial-grade components and high-quality electromechanical systems, offers a practical advantage in maintenance. By allowing

users to source replacement parts independently, it reduces dependency on specialised supply chains and supports more efficient long-term operation. This approach reflects a broader emphasis on reliability and accessibility within the system design. Flexibility is another defining feature of the DLCS range. Nozzles, spray bars and spray adjustment systems are available to accommodate different lubrication modes, including oil-in-air and oil-in-water configurations. Additionally, the dimensions and number of lines, as well as the number of oils used, can be tailored to meet specific production requirements. This adaptability ensures that the system can be aligned with varying operational needs while maintaining consistent performance. ■



LUBEN GLASS SRL

Via Antonio Meucci, 23
26010 Offanengo (CR) - ITALIA
Tel.: +39 0373-244396
info@lubenglass.it

www.lubenglass.eu

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Smart automation evolves with E2PACK's EASYROCK

Developed by E2PACK, EASYROCK addresses inefficiencies in pallet unwrapping - a process that's still often performed manually. Instead, this solution delivers automated, adaptable operability that improves safety and ensures continuity while integrating all into existing lines with a reliability that's already proven through extensive testing in real industrial production environments.

At E2Pack, the focus has turned to a long-overlooked inefficiency within industrial logistics, namely pallet unwrapping. Now with the introduction of EASYROCK, the company addresses a process that, despite its impact on safety and productivity, is still frequently handled manually across many production environments.

OPERATIONS

The removal of stretch film and outer wrapping from incoming palletised loads remains one of the least optimised stages in depalletising operations. Indeed in many facilities, operators con-



tinue to rely upon blades, cutters and even ladders to reach the upper sections of loads - practices that introduce risk and variability. EASYROCK replaces this manual intervention with an automated solution designed to deliver consistent performance while significantly improving operator safety. Developed for demanding industrial contexts, EASYROCK is engineered to ensure operational continuity and seamless integration within existing production lines. The system is capable of processing dozens of pallets per hour while maintaining stable, uninterrupted operation. Its patented solutions for uptime reliability are intended to reduce stoppages and support the high levels of efficiency required in modern manufacturing.

ADAPTABILITY

Adaptability is a defining feature of the system. EASYROCK automatically detects pallet dimensions, load configuration and workability, adjusting its unwrapping cycle to suit different formats and conditions. This versatility enables it to handle a broad range of applications, including glass containers, cans and boxed products. At the same time, its cutting system is designed to preserve product integrity, while the compact footprint and accessible layout simplify cleaning and reset operations. The system has already demonstrated its effectiveness in real industrial settings. Prior to its introduction, EASYROCK accumulated thousands of operating hours in a major production facility, confirming its reliability and readiness for continuous use in high-throughput environments.

HERITAGE

E2Pack's approach is rooted in a broader industrial legacy. The Italian company operates in packaging automation and sys-



tem integration, carrying forward the experience of established brands such as Emmeti, Mectra, Logik, Sipac and Zecchetti. This heritage is further reinforced by the backing of Bottero Group, supporting the company's ongoing development in advanced automation solutions. With EASYROCK, E2Pack strengthens its packaging automation portfolio through a solution that combines practical engineering with industrial robustness. By focusing on a critical yet often neglected phase of the process, the company reinforces its role in advancing efficiency, safety and performance across modern production lines.

KEY HIGHLIGHTS

EASYROCK introduces automated pallet unwrapping supported by patented uptime solutions and the capacity to handle dozens of pallets per hour. It

enhances operator safety while adapting automatically to different pallet sizes and load types through real-time detection. The system preserves product integrity, integrates easily into existing lines and features a compact, accessible design for simplified cleaning and reset. Its reliability is validated by thousands of operating hours in an industrial production plant. ■



E2PACK SRL

Via Galileo Galilei 29
42027 Montecchio Emilia (RE) - ITALY
Tel.: +39-0522-861911
sales@e2pack.com
www.e2pack.com

Reducing production inefficiencies with HSTEC through smarter scanning

It would suffice to spend time on any glass manufacturing floor for one reality to sink in: small details can carry significant weight. A worn mould marking, a dirty tool surface or a partially

faded serial number may seem minor, yet each can introduce hesitation, repeated checks and manual corrections. These inefficiencies rarely appear in a single report, but they accumulate

into measurable lost time across operations.

CLOSING THE INFORMATION GAP

Digital scanning is gaining traction not as a pursuit of innovation for its own sake, but as a response to a persistent operational weakness: tool control remains heavily dependent on manual reading, data entry and human memory. Even highly skilled operators should not be required to interpret damaged engravings or repeatedly input data that could be captured automatically. By enabling systems to read tool information directly and link it to digital records, scanning technology reduces identification time, minimises input errors and strengthens traceability. In an environment where every mould, blank or tool plays a role in production flow and quality assurance, accurate identification is critical. Misidentified tools or incomplete records can lead to delays, confusion and flawed decision-making. The issue is often less about the tool itself and more about the reliability of the information surrounding it.



Digital scanning is reshaping tool control in glass manufacturing by improving identification speed, data accuracy and traceability. By reducing reliance on manual processes, systems like HSTEC enable better decision-making and streamline workflows - all while allowing skilled teams to focus upon higher-value tasks across production and maintenance environments.

READING REALITY ON THE SHOP FLOOR

A key enabler of this shift is Optical Character Recognition (OCR), which converts real-world text into usable digital data. In the glass industry, where engraved markings are frequently worn, dirty, or shallow, OCR systems must operate effectively under imperfect conditions. The value of such technology lies in its ability to function reliably in real production environments rather than idealised settings. Speed is equally important. When processes are slow or cumbersome, they tend to be bypassed or delayed. On a busy shop floor, friction leads to work-arounds, not compliance. Fast and accurate scanning removes this friction, making proper tool identification a seamless part of



daily workflow rather than an additional burden.

FROM IDENTIFICATION TO INSIGHT

The impact of digital scanning extends beyond faster data capture. Reliable identification enables better decision-making across teams. Maintenance personnel can trace tool histories more efficiently, quality teams gain clearer insight into recurring issues and production teams spend less time verifying records. Crucially, digital scanning does not replace human expertise. Instead, it allows skilled operators and technicians to focus on tasks that require judgment and experience, rather than repetitive identification processes. Systems such as OSCAR illustrate this approach by targeting specific operational challenges, scanning moulds and tooling, interpreting degraded engravings and integrating captured data into broader plant systems. This integration is essential. A scanning solution delivers value only when the data it captures flows seamlessly into existing operational frameworks. Otherwise, it risks becoming another disconnected tool. Ultimately, digital scanning represents a shift in how tool control is managed. It transforms a process that has long been manual and fragmented into one that is connected, consistent and scalable. By reducing guesswork, eliminating redundant data entry

and improving clarity, it enhances stability and accuracy across daily operations - an outcome that holds far greater value than the adoption of technology alone. ■



HSTec
Glass Systems

**HSTEC GLASS
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Zagrebačka 100
23 000 Zadar - CROATIA
Tel.: 385-0-23-770-595
info@glass-systems.hr
www.glass-systems.hr

How VPI Instruments tackles toughest compressed air flow challenges

Compressed air discharge flow measurement presents extreme challenges including heat, saturation, oil and limited installation space. Different technologies behave differently under these conditions, with trade-offs in reliability and accuracy. Here, VPINSTRUMENTS CEO and founder Pascal van Putten discusses the solutions his company has developed to address such harsh environments while maintaining consistent, dependable flow measurement performance.

Let's talk about compressed air discharge flow measurement. (You can apply most of this to blower discharge as well; it's similar in a lot of ways.) Measuring compressor discharge can feel like uncharted territory in flow measurement. It's probably one of the harshest, ugliest environments you can put a flow meter in. You're really putting the instrument to the test. And why is that?

WHY COMPRESSOR DISCHARGE IS SUCH A TOUGH MEASUREMENT

Compressed air coming straight out of a compressor is warm, sometimes very warm, especially if there's no aftercooler. It's humid. Actually, it's essentially 100 percent saturated. Think of it like a sauna: as soon as that air hits a surface that's even a bit cooler, it will condense. And it can be oily. Sometimes the condensate is aggressive, sometimes even acidic, depending on what's in the system and the nature of the condensate. It's not exactly the environment you'd choose to 'live in' if you were a flow meter. But we build instruments, so we try to make the impossible possible, and we try to make it easy. That's also why we offer flow meters intended specifically

for discharge applications. And we were the first to introduce them about 15 years ago, when introducing our VPFlowScope DP, an insertion-style differential pressure flow meter. One more very practical problem: installer companies and contractors often have a lack of space. The compressed air room is rarely the nicest room in the building; it's often downstairs or in a corner of the factory. Space is limited, compressors have grown over time (more air consumption), and as a result, you often don't have enough straight pipe length to get accurate measurements. Pipes go up, pipes go down, left and right, like a bunch of spaghetti. Sometimes you must install the flow meter in a really ugly spot where the flow goes every way except straight. That's another major challenge.

WHAT A DISCHARGE FLOW METER NEEDS TO HANDLE

So, what technologies are out there to measure discharge flow? First, let's define the basics. A discharge flow meter should:

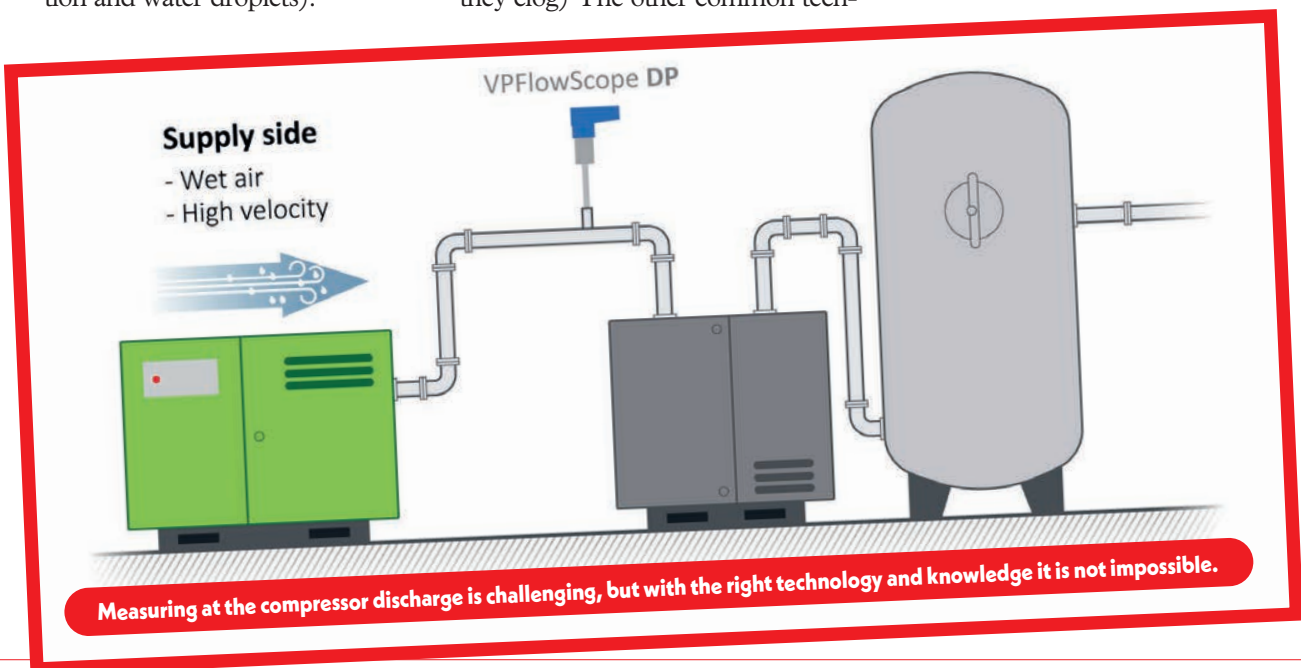
- Be relatively insensitive to high temperature and temperature sweeps;
- Work with short metre runs (limited straight lengths);
- Deal with wet air flow (condensation and water droplets).

THERMAL MASS FLOW METERS (SOMETIMES, BUT OFTEN PAINFUL)

If you put a thermal mass flow meter in these applications, the problem is that it works on heat transfer. Water has much higher thermal conductivity than air, so you can get big spikes in your signal, or even completely flat-lined readings when water sits on the sensor. Add oil to the mix, and the sensor can foul, meaning the sensitivity changes over time. So thermal mass is typically not the technology of choice for discharge. That said, there are tricks to mitigate some of these issues. In the past (and some manufacturers still do this), you can use an 'umbrella' structure to shield the sensor or heat the sensor above a certain temperature so water boils off. We also tried these methods when we introduced the VPFlowMate probe for a large OEM to perform audits back in 2003. In some cases, it can work, especially when the water content isn't too high (for example, when there's a good separator), or when inlet air humidity is lower due to weather conditions. So yes, sometimes a thermal mass metre can work on the discharge of a compressor. Just don't assume it will always work. Differential pressure flow meters (old school, reliable ... until they clog) The other common tech-



nology for compressor discharge flow is differential pressure (DP). It's been used for a long time. If you look at compressor test benches, many are based on critical nozzles or orifice metres, also DP-based methods. The good thing about DP is that, as long as the metre doesn't clog (those pressure holes can be quite small), it's measuring differential pressure over a geometry. The actual sensor isn't really sitting in the process, so it's not exposed to the full temperature, and it doesn't 'see' the water-again, as long as those impulse/pressure ports stay open. Water content changes the density of air a bit, but you can compensate for that quite easily. Use the ISO 1217 directive to find out how you do this. So, it's a straightforward, very reliable measurement method, with some limitations. If you're using an insertion probe, people sometimes (incorrectly) call it a Pitot tube. A Pitot tube (invented



by Henri Pitot back in 1732) was originally used to measure the speed of the River Seine in Paris, and the basic concept is still what you see on airplanes and boats. Those devices can have their own real-world issues (for example, icing). In compressed air, condensate can create a similar ‘instrument gets confused by the environment’ problem, just in a different way. The probes sold for compressed air flow metering, like the VPFlowScope DP, are fundamentally not the same thing, which is why we call them insertion-style differential pressure metres. You’ll also find variations like multi-hole designs that do a kind of averaging over the flow profile. But anyway, back to the story.

WATER: THE HIDDEN TROUBLEMAKER (FOR PROBES AND ORIFICES)

So even with insertion-style DP metres, water can still be a problem. Water can build up on or around the probe and cause misreadings, especially when the compressor is off or during start-up. That’s when you can get a lot of water coming out of the separator (and it gets even worse when drains are broken—which, honestly, happens). This is why orientation matters. You want water to drip off the probe instead of staying on it. I often compare it to water on your car windshield: gravity helps, and airflow can help, but some droplets still ‘stick’ in certain spots. Also, the actual installation point matters. In old, brownfield

plants, the compressed air installation may be so badly designed and maintained that it is recommended to fix these issues before installing any sensor. Talking about condensate in the pipes: you can see the same effect on a car in the rain. Even at speed, there are places where the airflow force is basically zero, and a droplet just doesn’t move. That can happen on probes too—certain shapes and orientations encourage droplets to stay put, even when there’s flow trying to blow them off. So orientation (and even probe shape) has a real influence on how well the probe drains. We have put inlet filters in VPFlowScope DP flow meters on both DP channels. This is not always seen as positive in the market. But let me tell you this: without those filters, excess water can enter the sensor chamber (also true for competitor flow meters) and cause serious issues. So we put in these filters to keep your DP metres measuring even when there is an accidental sludge of water entering the probe. If you use orifice-type metres, you can run into similar issues. The pressure holes can clog with water droplets, and suddenly your signal is gone or distorted. Remember: many of these metres use something like 100-500 mbar of pressure differential full scale to measure flow. A single water droplet can represent a surprisingly large ‘equivalent pressure’ in that world, so it doesn’t take much to excite (or mess up) the DP sensor.

RANGEABILITY: THE CLASSIC DP LIMITATION

Another big point is rangeability. With differential pressure flow measurement, the typical usable range is about 1:10, sometimes 1:20. Anything beyond that is often a bit of a marketing claim, because it usually comes with a catch, like having to re-zero/reset the transmitter regularly due to offset drift. Are you having fun climbing the ladder again to take the sensor out to do this offset calibration? Offset drift is, to some extent, in the nature of a DP sensor. And there’s another fundamental reason rangeability isn’t great: differential pressure is proportional to velocity squared. That means high velocity gives you a strong signal, but low velocity gives you almost nothing, except for the offset. (And yes, this is different from thermal mass, where the relationship behaves more like a square root: high sensitivity at low velocities, and relatively lower sensitivity at high velocities. Keep that in mind when comparing those technologies in other applications.) Back to DP: at low velocities, you can have no signal (or a very small signal). That’s why, if you put a DP insertion probe or orifice in a common header where three compressors discharge into the same line, and only one compressor is running, you might see almost nothing: the metre simply can’t ‘see’ less than about one third of the total design flow. This is one of the reasons discharge flow can be so challenging with DP in real installations. There are newer developments that aim to measure DP over a larger range without the offset effects over time, but the classic limitations are still important to understand.

VORTEX, ULTRASONIC, CORIOLIS, ROTARY - AND WHAT TO WATCH OUT FOR

Vortex metres are sometimes used for wet air and can work, but again, rangeability is also limited. What you often see is that people undersize the pipe (or install a metre





Optimise your compressor efficiency by measuring compressor discharge output. Combine this with other signals and combine data into a centralized monitoring system as VPVision. Get data driven optimizations.

with a reduced bore) to squeeze more signal out of it. That can be a bad idea because you create a permanent pressure loss across the metre, which costs money every hour of every day. Always ask for the pressure loss curve before buying a metre. It's one of the simplest ways to avoid unpleasant surprises in operating cost. Ultrasonic metres are also used for wet air. It sounds great, especially clamp-on, because it's outside the pipe. But water buildup on the transducers (or inside the pipe affecting acoustics) can kill the signal. You can get gaps in your data: the signal disappears, then comes back when the water clears. It can be a viable technology; just be aware of how sensitive it can be to wet conditions. Coriolis metres are the Rolls-Royce of flow metres. You'll find them from vendors like Micro Motion, Emerson, Siemens, and Endress+Hauser. They're very accurate because they measure mass flow directly (first principle). In a way, it's like having a weighing scale for your air. So, you might ask: why doesn't everyone use Coriolis on compressor discharge? Pressure loss is the big issue. You can see a very significant pressure drop, sometimes up to around 1 bar, especially because these metres are often undersized to get enough velocity and a stronger Coriolis effect. And last, but not least, with Coriolis, water buildup can completely mess up the measurement. Orientation matters a lot: you typically want gravity to help water drain naturally. Also consider weight and installation effort. A 4-inch Coriolis metre is a big piece of hardware that needs proper support. It's flanged, so installation is doable, but it's not the

same as installing an insertion probe in a hot tap. For standard monitoring applications, Coriolis is relatively rare. But for test benches, it can be a nice choice. Rotary gas metres are sometimes used for discharge flow too, but you need dry air; otherwise, they can fail. In some test applications, we have seen large dryers to keep them safe. Pressure pulsations can also be devastating. Bearings can wear out due to mechanical stress from pulsation. Pressurization has to be very gentle: think on the order of 100 mbar per second or slower. Otherwise, you can create serious issues. A quick note on compressor test benches. When we talk about compressor test benches, you'll often see critical nozzles used because they're very accurate (first principle). There are companies that make all-in-one compressor test benches with a high level of automation: data collection, automated test runs, and a clean report that can be compliant with CAGI and/or ISO standards. If you're into compressor testing and you don't want to build your own software and measurement setup, a complete solution can be worth looking at.

PRACTICAL LIMITS

And then there are the practical limits that are easy to forget but important in the real world:

- Temperature rating: How hot can the meter actually handle? And how fast can it follow those temperature swings?
- Pressure rating: What is the maximum rating of the built-in absolute pressure sensor (10 bar, 16 bar, 50 bar...)?
- Usability features: Do you need a display, a data logger, Ethernet

connectivity, wireless, etc.?

- Selection complexity: engineered DP vs. 'one size fits all'

With some traditional DP setups, you'll discover you're not buying 'a flow meter.' You're buying a primary element (orifice, venturi, etc.) from vendor A, a differential pressure transmitter from vendor B, and a manifold block from vendor C. And then you engineer the whole thing together. Add to that: complicated selection codes, long delivery times, and a lot of room for ordering mistakes unless you're a subject matter expert (or you work with one). That's why many people prefer solutions that are easier to select and deploy, with less chance of mistakes and faster projects.

WRAPPING UP

Discharge flow measurement is not an easy application. High temperatures, saturated air, condensate, oil contamination, and limited straight pipe length quickly expose the weaknesses of generic flow technologies. Getting reliable data requires instrumentation specifically designed for these harsh conditions, combined with practical application knowledge. ■



**VAN PUTTEN
INSTRUMENTS BV**

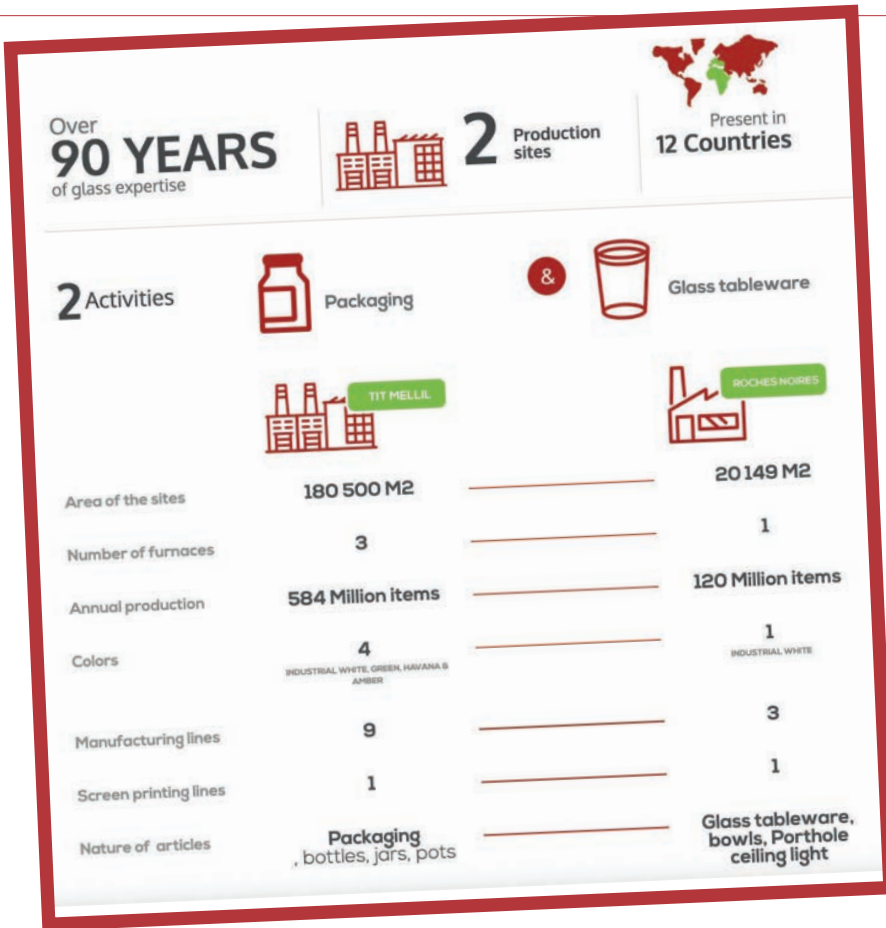
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Tel.: +31-0-15-213 15 80
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Industrial transformation continues as **SEVAM** strengthens production capabilities

With over 90 years of experience, SEVAM has evolved into a leading Moroccan glass manufacturer - combining technological innovation with sustainability. Continuous investments in furnaces and production lines reinforce the company's capacity, quality standards and environmental commitments - positioning it strongly in both domestic and international markets.

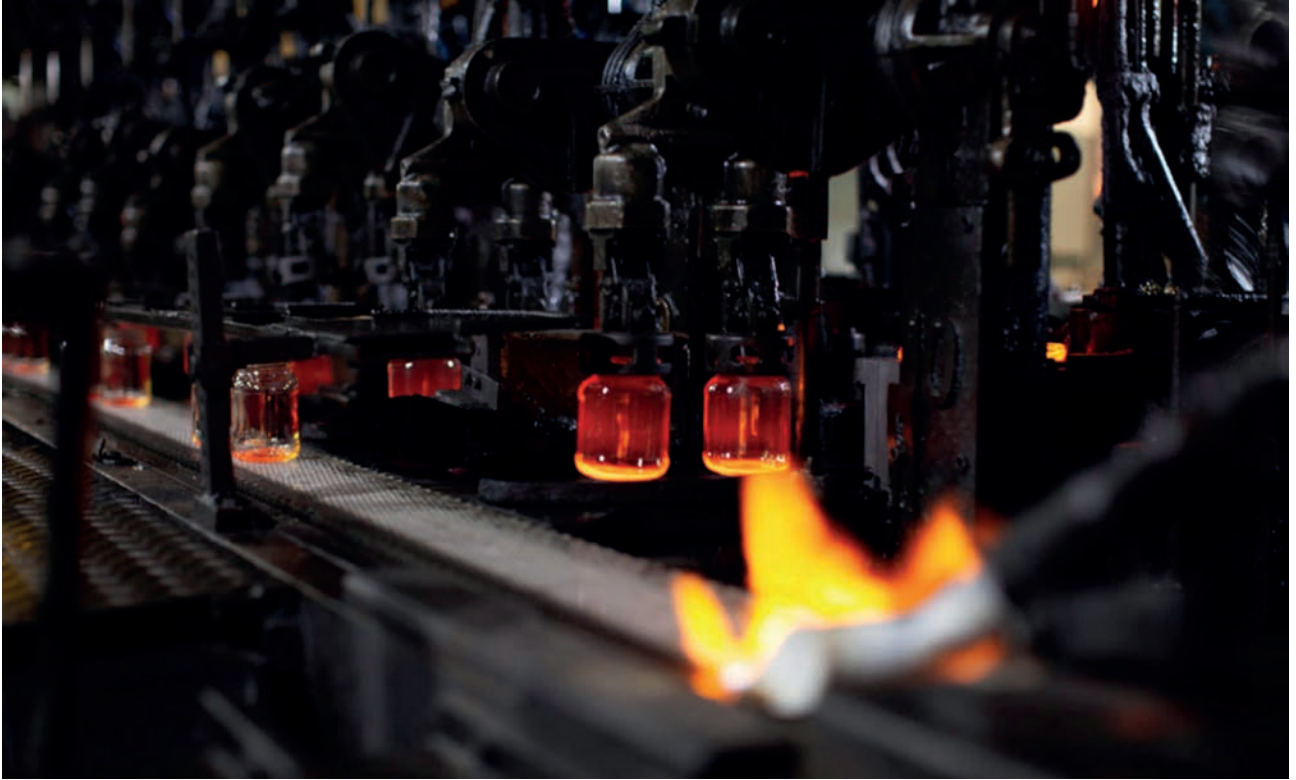
OVER 90 YEARS OF EXPERTISE AND EXCELLENCE

Founded at the beginning of the last century with the creation of the Société Africaine de Verrerie au Maroc, SEVAM's industrial journey formally took shape in 1934 with the acquisition of a manufacturing plant in the Roches Noires district. From that point onward, the company steadily built its expertise, focusing upon delivering high-quality glass products whilst maintaining a clear commitment to environmental responsibility. Today, it operates two state-of-the-art production sites in Casablanca, positioning itself as Morocco's leading producer of hollow glass. SEVAM's reach extends well beyond national borders, with exports to more than a dozen countries. This international presence reflects decades of collaboration with major national and global brands, supported



by continuous investment in advanced glassmaking technologies. The company's product portfolio spans a broad spectrum of applications. Its range of pots and jars serves the food preservation and distribution sectors, developed in accordance with strict hygiene, traceability and recycling standards. In parallel, its bottle production addresses diverse industries, including beverages and edible oils, with a strong emphasis on transparency, durability, and manufacturing precision. SEVAM also maintains a significant presence in glass tableware, offering both functional and decorative products tailored to hospitality professionals as well as domestic consumers. Beyond these core segments, the company has expanded into specialised products such as glass lighting fixtures for the electrical industry and containers designed for collective use.





INVESTMENT IN NEW TIT MELLIL FURNACE

A major step in SEVAM’s industrial development came with the renovation of furnace No. 2 at its Tit Mellil site. The project required a complete shutdown lasting 70 days, during which approximately one hundred personnel worked around the clock to ensure timely completion. The process unfolded in four key phases: furnace emptying, demolition, reconstruction and a ten-day tempering stage. During this final phase, the furnace was gradually heated to 1,500 degrees to prevent thermal stress and ensure operational stability. This modernisation strengthens SEVAM’s competitiveness by enhancing production performance, improving working conditions and reinforcing its role within the regional circular economy.

MANUFACTURING LINE IN TIT MELLIL

The company commissioned a sixth technologically advanced production line at Tit Mellil back

in January 2023, which is dedicated to both bottles and jars. This addition increased its annual production capacity to 160,600 tonnes - equivalent to approximately 555 million units. The

new line reflects SEVAM’s ongoing strategy to align capacity expansion with evolving market demand while maintaining high manufacturing standards.





RENOVATION OF TIT MELLIL FURNACE

Thereafter, on 18 November 2023, the company completed the refurbishment of kiln No. 1 at the same site - marking another significant investment in its industrial infrastructure. The project focused on optimising production

processes, improving energy efficiency and reducing greenhouse gas emissions. Through the integration of advanced technologies, the upgraded furnace is designed to operate as a more sustainable and efficient production asset - supporting long-term competitiveness.

TOWARDS INNOVATION AND SUSTAINABILITY: INAUGURATION OF THIRD GLASS FURNACE

Then, on 15 September 2025, SEVAM inaugurated a third glass furnace at its Tit Mellil facility, marking a decisive milestone in its modernisation strategy. The new installation, designed to meet rising market demand, has an annual production capacity of 226 million items while ensuring consistently high glass quality. Advanced melting technologies enhance process reliability, precision and uniformity - directly benefiting customers and end markets. This investment consolidates SEVAM's commitment to combining industrial performance with environmental responsibility. By expanding its production capabilities while adhering to sustainability objectives, the company continues to align growth with its long-term vision of responsible manufacturing. ■

GIMAV BUSINESS MISSION TO MOROCCO

Italian glass-processing companies will soon be joining a Casablanca business mission organised jointly by GIMAV, the association that brings together Italian manufacturers and suppliers of machinery, accessories, equipment and special products for glass processing, and the Italian Trade Agency and Confindustria Assafrica & Mediterraneo, which has supported Italian companies pursuing growth in the Middle East, the Mediterranean region and Sub-Saharan Africa. Running from 4 to 7 May 2026, the MOROCCO initiative will include B2B meetings, company visits and personalised agendas for its participants. The initiative is intended to bring Italian companies from the glass-processing technology sector into direct contact with the Moroccan market.

Access to the Moroccan market

The Casablanca mission is designed to accompany companies from the sector directly into the Moroccan market. Its aim is to encourage meetings with local companies operating in the same field and to create opportunities for networking, exchange and commercial collaboration. By placing participants in direct contact with the local business environment, the initiative seeks to support a practical understanding of Morocco's potential for companies active in glass-processing technologies.

A cross-section of Italian expertise

The mission will involve companies representing the Italian supply chain for glass-processing technologies: **ADI, Antonini, Bovone, Cugher Glass, Denver, GE.MA.TA./Rollmac, Mappi International, Neptun, Pilkington Italia, R.C.N. Solutions, Schiatti Angelo Officina Meccanica, Skill Glass, Tecnovati, Triulzi Cesare Special Equipments.**

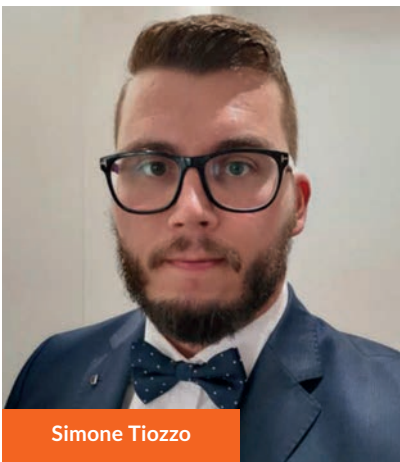
SEVAM

شركة تصنيع الزجاج بالمغرب
Société d'Exploitation de Verreries au Maroc

SEVAM

Boulevard Ouk'at Badi
Roches Noires
20300 Casablanca - MOROCCO
www.sevam.ma

Hydrogen milestones reached by the Horizon Europe H2GLASS Project



Simone Tiozzo

Within the framework of the Horizon Europe H2GLASS project, Stazione Sperimentale del Vetro has played a central role in the first industrial-scale hydrogen combustion trials conducted in oxy-fuel glass furnaces. These trials, carried out at Steklarna Hrastnik in Slovenia and at Owens Corning facilities in France, represent a significant step toward understanding how hydrogen can be integrated into existing glass manufacturing processes while maintaining product quality, process stability and environmental performance.

The H2GLASS project, running from January 2023 to June 2027, aims to develop and demonstrate hardware and software solutions that support the replacement of fossil fuels with hydrogen in the glass and aluminium sectors. The ultimate objective is to enable 100 percent hydrogen combustion while ensuring process safety and the required product quality. Within this context, the trials coordinated and analysed by Stazione Sperimentale del Vetro focused on validating hydrogen combustion under real industrial operating conditions.

INDUSTRIAL HYDROGEN TRIALS AT STEKLARNA HRASTNIK

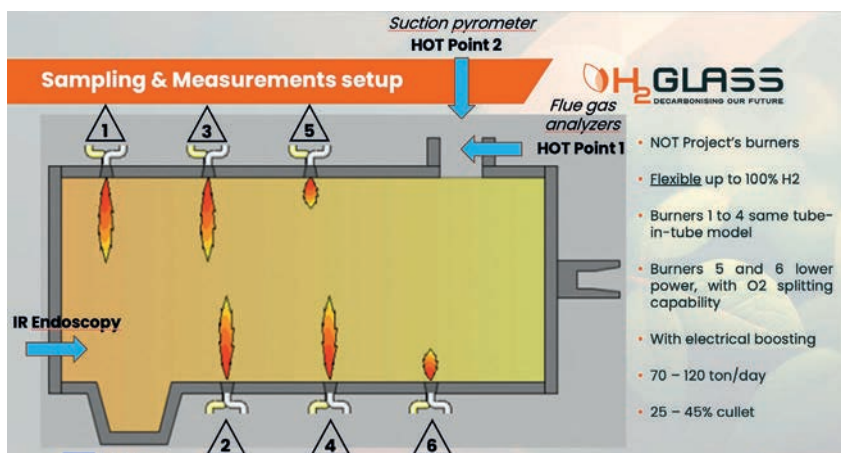
At Steklarna Hrastnik, two cam-

paigns of grey hydrogen combustion trials were conducted in an oxy-fuel, high-quality flint soda-lime container glass melting furnace. The first campaign took place from 20 to 24 November 2023 and consisted of single-day discontinuous trials operated at a low pull rate. The second campaign followed from 27 November to 1 December 2023 and involved three consecutive days of continuous operation at a high pull rate.

Hydrogen was supplied by truck and fed through an H₂ skid with a maximum flow rate of 600 Nm³/h, divided into two branches capable of supplying one left-side and one right-side burner at a time. The system allowed operation at a blending rate of up to 100 percent



Hydrogen combustion trials performed at the industrial demonstrator sites of Steklarna Hrastnik and Owens Corning, and scientifically monitored on site by STAZIONE SPERIMENTALE DEL VETRO demonstrated that up to 100 percent hydrogen firing in oxy-fuel glass furnaces is feasible without compromising glass quality, production stability or energy efficiency – all whilst enabling substantial reductions in carbon dioxide emissions.



hydrogen on selected burners (leaving the rest powered by natural gas), corresponding to a maximum of approximately 33 percent of the total energy input from hydrogen, equivalent to around 60 percent hydrogen by volume in the overall fuel feed.

The trials were conducted on an existing industrial furnace equipped with electrical boosting, processing between 70 and 120 tonnes of glass per day and operating with cullet levels ranging from 25 percent to 45 percent. Extensive sampling and measurement setups were installed, including suction pyrometers, flue-gas analysers and IR endoscopic cameras, enabling detailed monitoring of temperatures, combustion behaviour and emissions.

COMBUSTION BEHAVIOUR AND OPERATIONAL STABILITY

During the first week of trials, three single-day tests were designed to investigate the impact of hydro-

gen combustion on pairs of opposite burners positioned in different zones of the furnace. Despite initial hardware issues related to hydrogen flow meters, recalibration allowed tighter control of the combustion atmosphere. Once stable conditions were achieved, no adverse effects on energy consumption, production rate or glass quality were observed.

At a low pull rate, operation with 100 percent hydrogen on selected burners did not lead to flame formation problems. During the second week, the focus shifted to continuous 24/7 trials with increased pull rates, rising from 70 to 115 tonnes per day. Although flame lift-

ing issues occurred on one burner at high power, operational adjustments allowed the trials to continue without any interruption or adverse impact upon glass production. Any impact on glass quality or colour was indistinguishable to the untrained eye.

EMISSIONS ANALYSIS AND NORMALISATION

A key contribution of Stazione Sperimentale del Vetro was the rigorous acquisition, elaboration and normalisation of emissions data. Raw dry flue-gas concentrations were translated into pollutant mass flow rates and then into specific emissions expressed per tonne of molten glass. This approach enabled reliable comparisons between natural gas and hydrogen-blended combustion.

Under low pull rate conditions, nitrogen oxide emissions were found to be more strongly influenced by combustion ratio optimisation and residual oxygen levels than by fuel switching itself. When residual oxygen concentrations were comparable, no relevant differences were observed between natural gas and 60 percent hydro-



APPLIED TRIALS

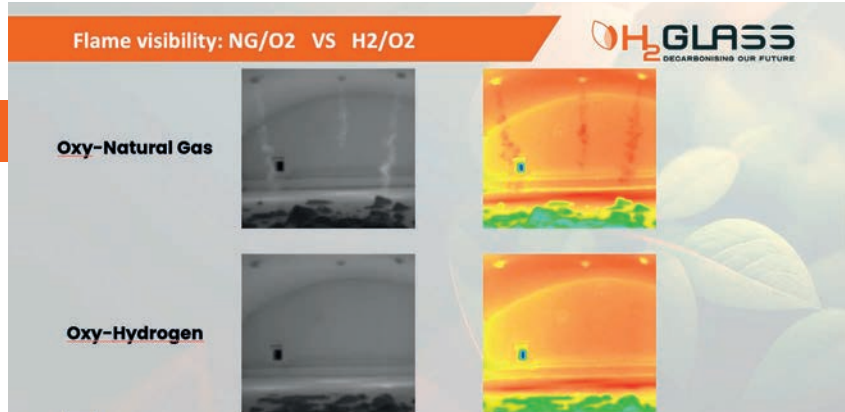
gen blends. At high pull rates, once combustion systems were properly tuned, nitrogen oxide specific emissions remained unchanged or even showed a slight decrease - approximately 5 to 6 percent - when switching from natural gas to hydrogen-blended fuel.

The trials demonstrated that a volume blending of up to 60 percent of hydrogen-blended fuel does not have a negative impact on nitrogen oxide emissions in oxy-combustion conditions, provided that burners, skids and combustion control systems are appropriately managed.

VOLATILE ELEMENTS AND GLASS QUALITY

Discontinuous sampling of volatile metals, including selenium and antimony, showed that switching from natural gas to 60 percent volume of hydrogen-blended fuel did not produce a strong impact on evaporation or sublimation of these elements. Observed variations were more closely linked to pull rate and overall furnace temperature regimes than to fuel composition.

Analyses of produced glass articles confirmed these findings. The retention level of selenium in the glass bulk remained substantially constant throughout the hydrogen



combustion trials. Colour measurements, viscosity, redox ratio and XRF analyses indicated that the glass properties remained essentially unchanged, with only very slight colour variations that were not appreciable to the untrained eye.

INDUSTRIAL HYDROGEN TRIALS AT OWENS CORNING

Further industrial trials were conducted at Owens Corning facilities in France, with the objective of preparing for long-duration green hydrogen combustion. These trials involved oxy-fuel furnaces with electrical boosting and focused on boron-free continuous filament reinforcement glass fibre production.

Over two weeks of testing in November and December 2024, hydrogen substitution levels were progressively increased, reaching up to 100 percent hydrogen combustion for extended periods. Despite logistical challenges in hydrogen

supply, stable furnace operation was achieved. At high hydrogen substitution levels, no negative impacts on furnace or glass temperatures were detected, while more than 95 percent reduction in carbon dioxide emissions was achieved, with residual CO₂ attributed to raw material impurities.

TOWARD OPTIMISED HYDROGEN COMBUSTION IN GLASS FURNACES

Across both industrial sites, the trials coordinated and analysed by Stazione Sperimentale del Vetro demonstrated that hydrogen combustion can be integrated into existing oxy-fuel glass furnaces without compromising production stability, glass quality or energy efficiency. The results highlighted the critical importance of optimised burner design, precise combustion control and a well-engineered hydrogen supply ecosystem. These findings provide a robust technical foundation for future long-duration trials with green hydrogen and represent a concrete step toward decarbonising industrial glass manufacturing. ■

Trials in Owens Corning, France

- **Objective:** Prepare for long-duration green H2 combustion trials.
- **Company:** Owens Corning, OCV
- **Location:** L'Ardoise (France)
- **Date:** November and December 2024.
- **Trial Type:** 2 weeks of preliminary trials with grey H2 supplied by trucks
- **Furnace:** oxy-fuel furnace No 2, with E-boost
- **Product:** Boron-free continuous filament reinforcement glass fibre
- **100.000 Nm³** of H2 burned, up to 100%vol H2

ACKNOWLEDGEMENTS

A big thanks to the **Steklarna Hrastnik** and **Owens Corning** teams that made these tests possible, and to all the members of the **H2GLASS** consortium working hard for the success of the project !

STAZIONE SPERIMENTALE DEL VETRO

Via Briati, 10
 30141 Murano, Venice - ITALY
 Tel. + 39-041-2737011
 stiozzo@spevetro.it
www.spevetro.it



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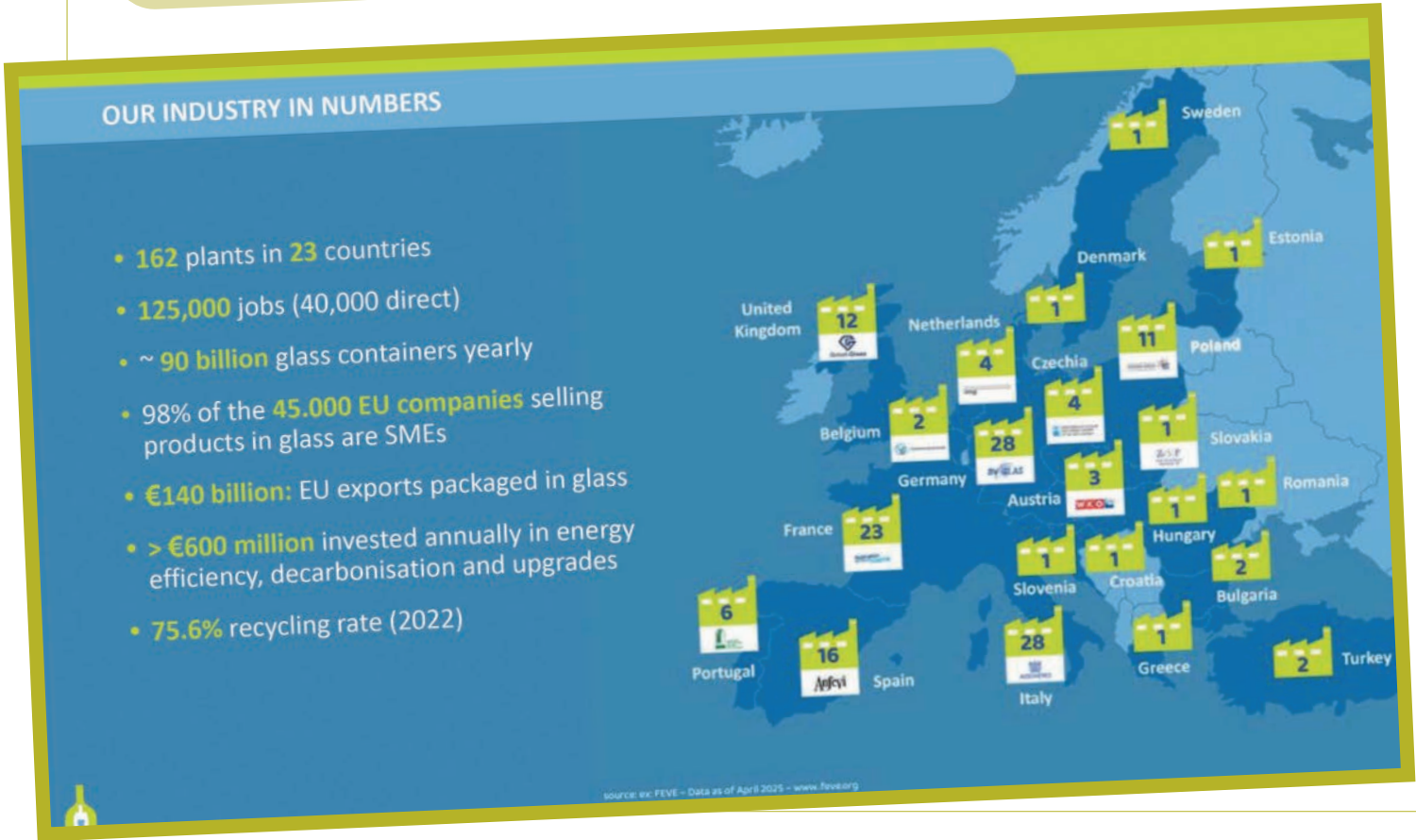
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CIRCULARITY

Closing the glass loop across Europe with FEVE

Leading the European container glass industry towards climate neutrality through advanced furnace technologies, FEVE has increased recycled content and supportive EU policies. By combining circularity, innovation and pragmatic regulation, it aims to secure a competitive, low-carbon future for glass packaging across Europe.



OUR DECARBONISATION PATHWAYS



Decarbonising the European container glass industry is a central strategic priority for FEVE -The European Container Glass Federation- which represents a sector deeply embedded in Europe's industrial, economic and social fabric. With 162 container glass plants operating across 23 countries, the

industry provides around 125,000 jobs -40,000 of them directly- and produces close to 90 billion glass containers every year. The sector is characterised by a strong SME base, with 98 percent of the 45,000 EU companies selling products in glass falling into this category.

Glass packaging plays a vital role

across food and beverages, pharmaceuticals and cosmetics and perfumes, supporting European value chains while enabling circular material use. Each year, over EUR 140 billion worth of EU exports are packaged in glass, underlining the material's strategic relevance. At the same time, the industry is already investing

IN THE GLASS INDUSTRY, THE CO₂ EMISSIONS COME FROM:



The Furnaces of the Future



A vision for net zero glass production

'Close the Glass Loop'



The European ambition to collect glass more and better, together

CIRCULARITY

WHAT WE NEED TO



- 1 Secure **sufficient availability** of low-carbon energy carriers for container glass plants
- 2 Ensure the **affordability of low-carbon energy carriers** for the container glass industry
- 3 Promote development of **necessary infrastructure** for the transport and distribution of low-carbon energy carriers to container glass plants
- 4 **Take into account investment cycles** for the container glass industry
- 5 Call for increased **support for capital and operational decarbonisation expenditure**

more than EUR 600M annually in energy efficiency, decarbonisation and plant upgrades, reflecting a long-standing commitment to continuous improvement and environmental performance.

TOWARDS CLIMATE-NEUTRAL CONTAINER GLASS

FEVE has set out clear pathways towards climate-neutral container glass production, structured around five interconnected areas:

furnaces for the future, closing the glass loop, sourcing and design and transport and delivery. At the heart of this transition lies the transformation of melting furnaces, which are responsible for the majority of CO₂ emissions in glass manufacturing. Approximately 80 percent of emissions stem from the combustion of natural gas, while around 20 percent result from process emissions linked to the decomposition of carbonates in virgin raw materials.

To address these emissions,

FEVE identifies electrification, hydrogen and biomass as potential solutions for furnace decarbonisation, alongside increasing the use of recycled glass in the batch. This dual approach combines technological innovation with material efficiency, forming the basis of a long-term vision for net-zero glass production in Europe.

CLOSING THE LOOP

A cornerstone of FEVE's decarbonisation strategy is the ambi-

WHY CLOSING THE GLASS LOOP?

Benefits of closed-loop glass recycling

- ✓ Each tonne of recycled glass cuts 580 kg of CO₂ and replaces 1.2 tonnes of raw materials
- ✓ A 10% cullet increase reducing CO₂ emissions by 5% and furnace energy use by 2.5%

Average Recycled content in Europe: 53.55%

Container glass collection for recycling in Europe

In 2023, in the EU27, on average **80,8%** of glass packaging was collected for recycling

Country	Collection Rate (%)
IE	84
UK	79
NL	81
DE	85
PL	70
SE	86
EE	77
LV	75
LT	70
FR	84
LU	92
CZ	81
DK	79
SI	79
AT	87
HU	30
RO	66
PT	57
ES	76
GR	91
HR	63
BG	73
EL	35
MT	43
SK	49
NO	96
FI	99

close the glass loop
More details on www.closestheglassloop.eu

CLOSE THE GLASS LOOP: MOBILISING AT NATIONAL LEVEL



13
National
Platforms

Close the Glass Loop is a European partnership involving the entire glass packaging collection & recycling value chain

tion to 'Close the Glass Loop' - a European-wide effort to collect more glass, and collect it better, together. In 2023, an average of 80.1 percent of glass packaging placed on the market in the EU27 was collected for recycling, while the average recycled content in European container glass reached 53.55 percent.

The climate benefits of closed-loop glass recycling are substantial. Each tonne of recycled glass used in production avoids approximately 580 kg of CO₂ emissions and replaces 1.2 tonnes of virgin raw materials. Moreover, a 10 percent increase in cullet use can reduce CO₂ emissions by 5 percent and lower furnace energy consumption by 2.5 percent. To accelerate these gains, Close the Glass Loop operates as a European partnership spanning the entire glass packaging collection and recycling value chain, with 13 national platforms mobilising action at country level.

POLICY FRAMEWORKS ENABLING DECARBONISATION

FEVE actively engages with

European policy developments that are critical to enabling industrial decarbonisation. The EU Emissions Trading System (ETS), as the flagship EU climate policy, requires all industrial sectors to purchase allowances corresponding to their CO₂ emissions, with the total number of allowances gradually decreasing. Under the current trajectory, allowances would run out by 2039, effectively requiring all sectors to be carbon neutral. FEVE therefore calls for a pragmatic review of the ETS trajectory to reflect industrial realities, alongside enhanced earmarking of ETS revenues for industrial decarbonisation, which currently stands at just 3 percent.

In parallel, FEVE highlights the importance of the EU ETS State Aid Guidelines, which allow Member States to compensate certain sectors for indirect CO₂ costs passed through electricity prices. At present, the container glass sector is not eligible, creating a significant barrier to electrification. FEVE advocates for the inclusion of container glass to support both competitiveness

and decarbonisation, particularly in light of revised CO₂ price assumptions.

Further policy initiatives, such as the forthcoming Industrial Decarbonisation Accelerator Act and the proposed Industrial Decarbonisation Bank -with a budget of up to EUR 100 billion- are seen as key opportunities. FEVE stresses the need for streamlined permitting, faster grid connections, sufficient funding levels and fair access across industrial sectors to ensure that decarbonisation investments can be deployed at scale and in line with industry investment cycles. ■



FEVE

Avenue Louise 89, Bte 4
B-1050 Brussels
BELGIUM
Tel.: +32-2-536-0080
secretariat@feve.org

www.feve.org

Environmental progress driven by VERALLIA ITALIA strategic collaborations

Through its CSR Supplier Award, VERALLIA ITALIA recognises partners driving measurable environmental and social impact. The initiative highlights innovations in energy efficiency, circular resource use and sustainable processes - reinforcing the role of collaboration across the value chain in achieving long-term industrial sustainability objectives.

PARTNERSHIPS

Verallia Italia has recognised a selection of partner companies for their contribution to corporate social responsibility - highlighting their impact across procurement practices as well as social, environmental and ethical commitment. The initiative reflects a structured evaluation process carried out by an internal committee, which assessed both the benefits generated for the company and the broader sustainability performance of its suppliers.

A STRUCTURED APPROACH TO RESPONSIBLE SUPPLY CHAINS

The CSR Supplier Award 2025 ceremony took place on 16 March 2026 at the Verallia plant in Corsico, near Milan in Italy. The event provided an opportunity to present projects that have contributed concretely to the Group's sustainability objectives, while fostering dialogue around results, best practices and a shared vision. It also reinforced the principle that sustainability is achieved through collaboration across the value chain.



This commitment extends beyond the event itself. Thereafter, on 19 March, Verallia Italia participated in the Treviso stage of the CSR and Social Innovation Exhibition, part



of a national roadshow focused on promoting sustainability initiatives across local territories.

RECOGNISING INDUSTRIAL INNOVATION AND ENVIRONMENTAL IMPACT

The selected suppliers represent key industrial and technological players, each distinguished by a focus on innovation, efficiency, and responsibility. Air Liquide was recognised for introducing an oxy-combustion furnace equipped with HeatOx™ technology. The system reduces fossil fuel consumption by 12 percent and cuts approximately 7,800 tonnes of CO₂ emissions annually, while also lowering nitrogen oxide emissions. By recovering heat from flue gases, it delivers additional energy savings of up to 10 percent compared to systems without heat recovery, contributing to the decarbonisation of industrial processes. ENGIE Italia received recognition for a heat recovery project integrated into the district heat-

ing network at the Corsico site. The initiative applies circular economy principles to energy use, improving efficiency and supporting local decarbonisation - all while positioning the plant as an active contributor to the surrounding community.

CIRCULAR MODELS AND MATERIAL EFFICIENCY

Fonderie Valdelsane was awarded for its CIRCULARITY project, which promotes the use of recycled raw materials while maintaining production quality. Within its collaboration with Verallia, obsolete moulds are sold as scrap, reintroduced into the production cycle, and transformed into new castings for mould production, closing the loop and reducing reliance on virgin resources. Mi.Gra. was recognised for a project focused on recovering and transforming calcium carbonate mineral waste. Developed in collaboration with the Apuan Alps Regional Park, the initiative converts potential waste

into secondary raw materials for other industrial sectors. In 2025, the company obtained Environmental Product Declaration certification, ensuring the supply of fully secondary raw materials and the exclusive use of renewable energy sources.

SHARED VALUE THROUGH LONG-TERM COLLABORATION

The CSR Supplier Award underlines Verallia Italia's commitment to building a responsible and innovative supply chain. By recognising partners capable of delivering measurable environmental and social impact, the initiative highlights the importance of collaboration in achieving climate and sustainability objectives. The programme reflects a broader strategy centred upon long-term partnerships, where shared value is generated through innovation, efficiency and a consistent focus upon responsible industrial practices. ■



Verallia Italia SpA

Via Del Lavoro, 1
36045 Lonigo VI - ITALY
Tel.: +39-01955701
info.italia@verallia.com
www.it.verallia.com



Strategic upgrade boosts **HRASTNIK1860** furnace efficiency and output



A refurbished furnace has enabled HRASTNIK1860 to restore production capacity, improve efficiency and extend operational life. This restart highlights energy cost challenges, workforce constraints and decarbonisation ambitions - all whilst reinforcing the company's industrial importance and positioning it for continued, sustained growth in international glass markets.

Steklarna Hrastnik has restarted its smaller oxy-fuel furnace following a partial refurbishment - marking a measured return of production capacity and reinforcing operational stability. The unit, temporarily shut down for upgrades, now re-enters service with improved efficiency and reliability.

EXTENDING FURNACE LIFE AND CAPACITY

The refurbishment programme has extended the furnace's operational lifespan by four to five years while increasing melting capacity by approximately 120 tonnes per day. The 120-tonne oxy-fuel furnace is now linked to four production lines, supporting a gradual scaling of output. Initial



production batches completed over the weekend confirmed system readiness, with two lines currently active and further capacity

scheduled to come online progressively.

TECHNICAL UPGRADES AND EXECUTION

The project involved a technically demanding cold repair carried out in three distinct phases. Internal teams first prepared the furnace for intervention, after which external contractors from across Europe undertook nearly three weeks of refractory repairs. This was followed by a two-week heating process, bringing the furnace from ambient temperature to 1,300°C. Cullet was then introduced, and within three days, glass production resumed across connected lines. The complexity of the operation underscored the coordination between in-house expertise and specialised external partners.



Christian Fröba



Sašo Fekonja

RESILIENCE

ENERGY PRESSURES AND DECARBONISATION NEEDS

The restart introduces increased demand for natural gas and electricity, placing the company within a challenging energy pricing environment in Slovenia. According to CEO Christian Froba, securing competitively priced energy remains critical, particularly as the company seeks to advance decarbonisation. While the furnace is capable of incorporating electrical-driven melting processes, broader adoption depends on access to affordable, low-carbon power. Engagement with government and industry bodies continues as part of efforts to align energy policy with the needs of energy-intensive manufacturing.

WORKFORCE AND REGIONAL IMPACT

The phased restart also high-

lights workforce constraints, as additional personnel are required to operate all four production lines. Recruitment efforts are extending across Europe to address this gap, reflecting a broader industry challenge in securing skilled labour. The development carries significant regional implications, particularly for Hrastnik and the Zasavje area, where the glassworks

ABOUT HRASTNIK1860

Part of the Vaider Group, Hrastnik1860 has been a trusted global partner since 1860 in the development and production of premium speciality glass packaging for the most demanding beverage segments. The company produces technically complex products from some of the purest glass in the world and offers a comprehensive range of services, from concept development, design, engineering and production to graphic design, decoration and logistics support. Its approach is built on flexibility, responsiveness and delivering high-quality, tailored solutions.

remains a longstanding industrial pillar. With more than 500 employees, the company plays a central role in sustaining local economic activity and infrastructure development. Steklarna Hrastnik will continue to align production levels with market conditions and energy considerations while maintaining supply reliability and quality standards. The furnace restart strengthens operational resilience and positions the company for continued growth in competitive international markets. ■



ABOUT VAIDER GROUP

Bringing together Steklarna Hrastnik and Vaider Srpska Fabrika Stakla, Vaider Group enables brands to create premium user experiences in glass packaging. It is recognised for its commitment to quality, sustainability and innovation. Operating across manufacturing, trading and services, Vaider Group is a reliable partner in the global glass industry.

HRASTNIK1860
MEMBER OF VAIDER GROUP

**STEKLARNA
HRASTNIK, D. O. O.**

14 Cesta 1 Maja
Hrastnik 1430 - SLOVENIA
Tel.: +386 35654600
info@hrastnik1860.com

www.hrastnik1860.com



VAIDER GROUP AG

Alpenquai 30
Lucerne, LU 6005 - SWITZERLAND
info@vaider.com

www.vaider.com

Brewing expansion accelerates container glass industry in MEXICO

Strong beer production growth and export dominance continue to drive container glass demand across MEXICO, supported by capacity expansions, recycling initiatives and major industry investments. Upcoming global events are expected to further accelerate consumption trends, reinforcing long-term opportunities for glass manufacturers serving the beer sector.

Author: Rajeev Jetley

A population of 133 million, high per-capita beer consumption and rising disposable income have turned Mexico into a beer production hotspot in Latin America. This momentum has driven a surge in container glass production and consumption over the past fifteen years, closely tied to the needs of the beer industry.

A BEER HOTSPOT

Characterised by strong per-capita consumption, high production volumes and deep cultural integra-





tion, Mexico’s beer industry ranks among the most dynamic globally. The country is the world’s largest beer exporter, the fourth-largest producer, and a leading consumption market, creating significant opportunities for container glass manufacturers. In 2025, Mexico produced an estimated 142 million hectolitres of beer. Exports account for a substantial share of this output, with the country consistently leading global beer exports since 2010, surpassing established exporters such as the Netherlands, Belgium, and Germany. Capacity expansions announced by brewers reinforce long-term demand for container glass. Heineken has committed to a new brewery in Kanasin, Yucatán, with a capacity of 4 million hectolitres, expected

to begin operations in 2027. Meanwhile, Grupo Modelo has announced investments exceeding USD 3.6 billion to expand production capacity.

PACKAGING CHOICES FOR BEER INDUSTRY IN MEXICO

Packaging has become a strategic consideration for brewers, balancing operational efficiency with environmental goals. Producers are increasingly seeking solutions aligned with circular economy principles without compromising productivity. Container glass remains the dominant packaging format for beer in Mexico. Although recyclable cans and alternative bottles have gained some traction over the past decade, their share remains limited.

Returnable glass systems are deeply embedded in consumer behavior, with many customers routinely returning bottles for refill. Standard bottle sizes are typically 325 ml, with larger formats such as 925 ml, 940 ml, and 1-litre also available across select brands.

CONTAINER GLASS INDUSTRY

Growth in Mexico’s container glass industry over the past two decades has been remarkable, outpacing regional peers across the Americas. This expansion is closely linked to rising beer production, which continues to generate strong and sustained demand for glass packaging.

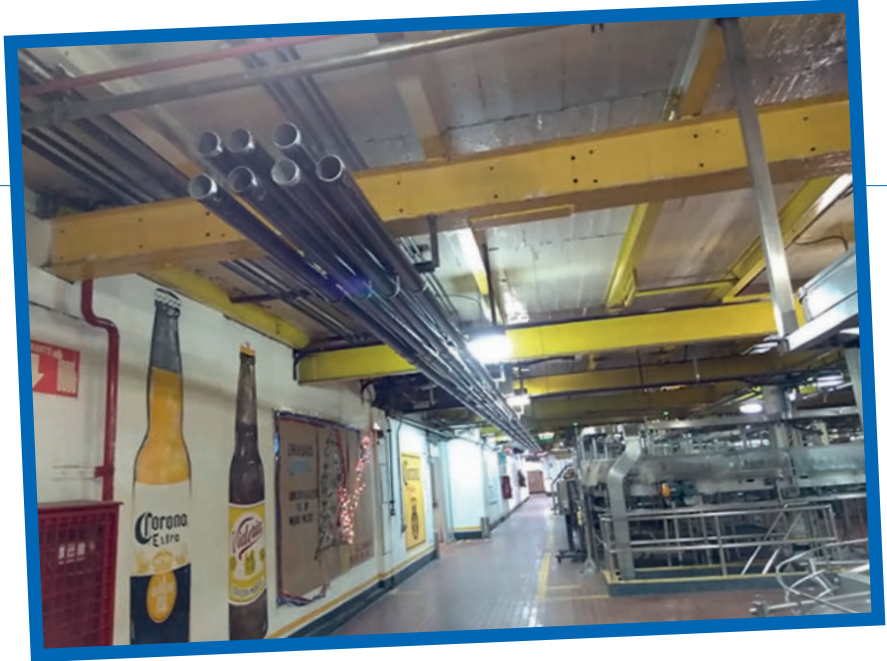
O-I

O-I Glass is a major player in Mexico, operating six production plants. Its growth strategy has combined organic expansion with acquisitions, notably the 2015 purchase of Vitro’s food and beverage glass container business for approximately USD 2.15 billion. This

transaction included five plants in Mexico and one in Bolivia. In 2019, O-I further strengthened its position by acquiring Nueva Fanal from Grupo Modelo. Located near Mexico City, the facility operates four furnaces and produces around 300,000 tonnes of glass containers annually, primarily supplying brands such as Corona, Modelo Especial and Pacífico.

GRUPO MODELO

As a subsidiary of AB InBev since 2013, Grupo Modelo is both a major brewer and a significant container glass producer. Its three glass plants -located in San Luis Potosí, Mexico City, and Tierra Blanca- collectively produce 15 million bottles per day, meeting most internal demand. A USD 154M expansion at the Tierra Blanca facility back in 2022 increased daily capacity from 3.5 million to 5.5 million bottles, equivalent to 1.4 billion bottles annually. Grupo Modelo accounts for more than half of Mexico’s beer output and operates 11 breweries alongside vertically integrated facilities, including glass production.



FEVISA INDUSTRIAL

Fevisa Industrial has supplied container glass to the beer industry since 1987. It operates two plants: one in Mexicali serving export markets and another in San Luis Potosí focused on domestic demand.

SIVESA

Owned by Crown Holdings, Sivesa is among Mexico’s oldest glass producers. Its Veracruz facility, operational since 1975, has a capacity of 360 tonnes per day. Following Crown’s acquisition of Heineken’s packaging division Empaque in 2015, a new plant was established in Meoqui, Chihuahua, in 2018 with a capacity of 450 tonnes per day, supplying Heineken breweries. In 2025, the Veracruz facility underwent a major furnace repair project, modernising its 375-tonne-per-day furnace while maintaining its original design.

SAVERGLASS

Saverglass, though focused on premium wine and spirits, operates a modern facility in Acatlán de Juárez near Guadalajara. Since entering Mexico in 2018, it has contributed to the country’s high-end glass packaging segment.

EMPHASIS ON GLASS RECYCLING

Recycling initiatives are central to reducing costs and carbon footprints. In 2024, O-I Mexico partnered with SILICE to launch a recycling hub in Chihuahua,

processing 300 tonnes of glass monthly for reuse in production. Grupo Modelo has also made significant progress, recovering more than one billion bottles since 2017 and reintegrating 18,000 tonnes of recycled glass in 2025. Over 88 percent of its products are distributed in returnable or recycled packaging. The company reports that 34 percent of its glass containers are made from recycled materials, while 51 percent are reusable. To address losses in the return system, Grupo Modelo introduced the ‘Every Bottle Counts’ programme to recover bottles across the value chain.

FIFA WORLD CUP 2026 IMPACT ON BEER AND CONTAINER GLASS INDUSTRY

The 2026 FIFA World Cup, co-hosted by Mexico, the United States and Canada, is expected to boost beer consumption significantly. Scheduled from June 11 to July 19 across 16 cities, the event is projected to attract 6.5 million spectators. According to Barclays, previous tournaments have consistently driven beer demand. South Africa 2010 saw a 6.1 percent increase during the event, Brazil 2014 recorded a similar rebound alongside a 140-million-litre sales rise for AB InBev, and Qatar 2022 posted a 9.9 percent increase despite regulatory constraints. Comparable trends are anticipated in 2026, reinforcing demand for container glass. ■

Climate-neutral production gains traction across FEVE member industries

Glass bottle manufacturing across Europe and the UK is progressing towards climate-neutral production, supported by new evidence indicating measurable results. The Decarbonisation Report 2025 published by European Container

Glass Federation confirms that the transition to low-carbon glass manufacturing is already underway across Europe. Its findings align closely with the Glass Sector Net Zero Strategy 2050 developed by British Glass, demonstrating a coordinated approach

based on investment, innovation and the deployment of emissions-reducing solutions.

THE GLASS SECTOR IS NOT WAITING FOR CHANGE

The combined findings of both reports point to a sector moving



Coursing a path towards net-zero packaging for the European glass container industry necessitates an urgent, annual strategic replacement of old furnaces with low-carbon alternatives. As detailed in a recent report by FEVE, this includes substantial capital investment of 20 billion, as well as affordable access to green energy.



from ambition to implementation. Manufacturers across Europe and the UK are introducing new technologies, improving energy efficiency and reshaping production processes. Electrification is emerging as a key pathway for reducing combustion emissions, with companies working to increase the share of furnace energy derived from electricity. All-electric and hybrid furnaces are already being deployed, achieving emissions reductions of up to 60 percent in certain applications. Where full electrification is not yet feasible, alternative fuels such as hydrogen and biogas are being explored to further lower emissions. Circularity remains a central strength of the sector. More than 80 percent of glass packaging in Europe is

collected for recycling, contributing to lower energy demand and reduced emissions during manufacturing. These developments reflect the trajectory outlined in the UK strategy, reinforcing a shared commitment to accelerating innovation and achieving climate-neutral production.

GLASS IS A PERMANENT, ENDLESSLY RECYCLABLE MATERIAL

The coordinated progress of the sector also highlights its resilience during a critical period for European industry. Glass, as a permanent and endlessly recyclable material, plays a key role in supply chains across food, beverage, pharmaceutical and cosmetics sectors. Advancing towards climate-neutral production supports the long-term sustainability of these industries while helping to safeguard skilled manufacturing jobs and maintain competitiveness in global markets. Dr Nick Kirk, Federation Director at British Glass, noted that the findings demonstrate tangible progress, with both UK and European sectors aligned in their efforts to deliver real emissions reductions and move towards climate-neutral production.





Decarbonisation of glass packaging is underway

POLICY AND INFRASTRUCTURE SUPPORT IS ESSENTIAL

Both reports emphasise that, although technological pathways are now established, scaling them across the industry depends on supportive policy and infrastructure. Barriers to electrification include grid connection costs and timelines, as well as the capital investment required for new furnaces and the higher operational cost of electricity. Ensuring adequate grid capacity and prioritised connections for energy-intensive industries will be critical,

particularly as furnaces reach replacement cycles. Alternative fuels will also contribute to further emissions reductions. The UK has introduced mechanisms to support hydrogen production for industrial use at costs comparable to natural gas. Additional measures, including support for biomethane and its treatment within emissions trading systems, could further accelerate progress. The report identifies 2025 as a transition phase, in which decarbonisation pathways have been technically validated and multiple solutions are emerging. The next stage

will focus on full-scale deployment, dependent on infrastructure readiness, regulatory frameworks and strategic investment. The overall message is clear: the glass industry is already implementing the technologies required for net zero and is positioned to accelerate further with appropriate policy support. ■



FEVE

Avenue Louise 89, Bte 4
B-1050 Brussels
BELGIUM
Tel.: +32-2-536-0080
secretariat@feve.org
www.feve.org



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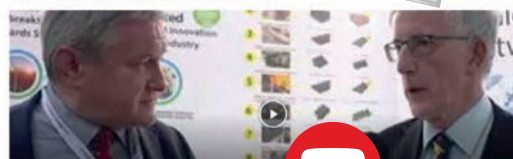


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Customers involve IOCCO in feasibility studies for whole car glass sets

Among IOCCO's contribution in the manufacture of systems for the air extraction during the lamination of windscreens, laminated sidelights and sunroofs is the notable improvement for both concept and fabrication of vacuum bag furnaces....



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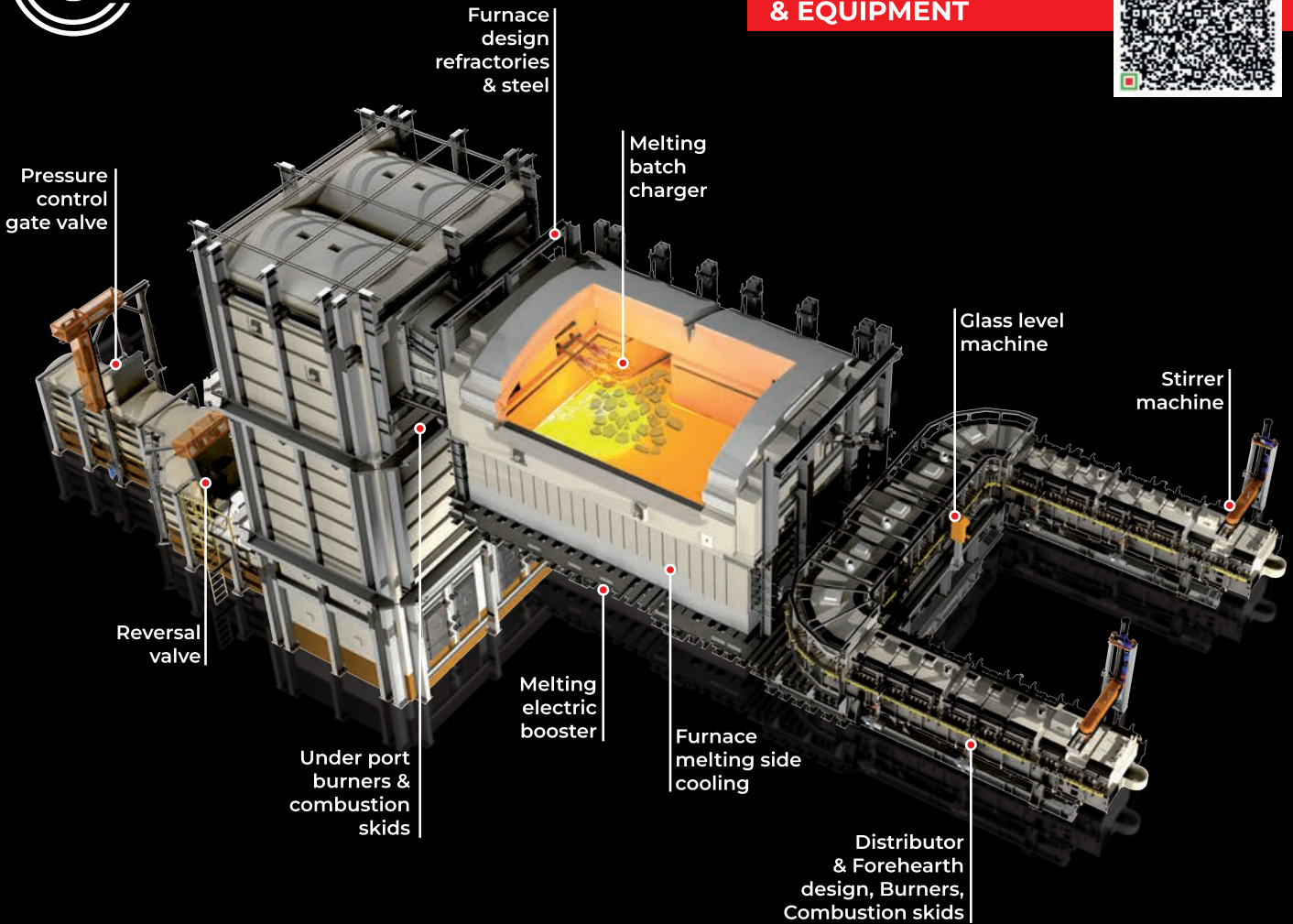
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