GLASS FUTURES team-up with STARA GLASS for clean manufacturing

Built by the glass industry for the glass industry. The unique, independent, GLASS FUTURES' industrial scale pilot facility now in operation in St Helens, in the UK features a highly innovative oxy-fired multi-fuel multi-purpose furnace designed by STARA GLASS. The Centre of Excellence aims to accelerate sustainable glass manufacturing globally through alternative fuels, carbon capture, digitalisation and circular economy innovation - all to de-risk disruptive technologies from laboratory concept to commercial deployment.

For the glass sector, the transition to low carbon production is as much about de-risking innovation as it is about rethinking energy and raw materials. Glass Futures has been created precisely to address this challenge. Built by the glass industry, for the glass industry, its Global Centre of Excellence in St Helens, UK exists to make materials industries clean, circular and driven by digital innovation. Operating as a research and technology membership organisation, Glass Futures is dedicated to leading the global shift to sustainable manufacturing while supporting companies along their sustainability journeys. Glassmaking members include AGC, AGI Glaspac, Ardagh, Encirc, Guardian, Knauf, O-I, Pilkington, SINA Medical Glass, Sisecam, Stoelzle, Verallia and Wiegand Glas. Brands such as Diageo, Edrington, Molson Coors, Nestlé and Velux are also members, alongside leading suppliers and academic bodies that form a collaborative network spanning the global glass supply chain. At the heart of Glass Futures' vision lies a clear mission: turning breakthrough ideas into industrial-scale impact. To

achieve this, Glass Futures positions itself not simply as a research body but as a collaborative platform. It works to support organisations as they define and implement their sustainability strategies, to demonstrate disruptive technologies under realistic operating conditions and to generate new, impactful ideas whose benefits can be felt from raw material suppliers through to brand owners and consumers.

WHY GLASS FUTURES?

What makes Glass Futures distinctive is the scale and configuration of its Global Centre of Excellence in St Helens. The site comprises a 165,000 square foot industrial facility and a 100,000 square foot industrial yard, conceived from the outset as an independent innovation ecosystem. Within this environment, a 30-tonne-per-day glass R&D capability offers industrial scale melting and forming capacity, supported by laboratory space, warehousing and logistics functions and a digital supply chain proving ground. This combination allows members and partners to explore solutions under conditions that closely mirror commercial operations, but without putting their own production furnaces at risk. The facility has been deliberately configured for flexibility and agility. It can support container and flat manufacturing processes, enabling a broad cross section of the glass industry to test technologies, process parameters and raw material strategies. Circular economy principles are embedded through the ability to trial new materials, alternative batch compositions and increased recycled content, while logistics and digital supply chain capabilities allow the wider implications of process changes to be explored in context. Around 60 highly skilled jobs and apprenticeships are associated with the site, reinforcing its role not just as a research hub but also as a training ground for the next generation of glassmakers and technical specialists.

BRIDGING THE TRL GAP

A central purpose of Glass Futures is to bridge the technology readiness level (TRL) gap that often separates academic research from commercial adoption. On one side of this gap lies fundamental research: solution focused work with limited commercial validation and no direct link to full scale industrial operation. On the other side stand commercial furnaces that typically run 24/7 for more than 20 years and are understandably risk averse, with operators reluctant to test unproven technologies on assets that underpin their business. Between these two worlds sits a significant technology block: ideas that look promising in the laboratory but cannot be trialled at production scale without unacceptable risk. Glass Futures addresses this block by providing a test and development environment that operates at industrial scale yet is dedicated to innovation and experimentation. The pilot line, with its 30-tonne-per-day nominal pull, sits between small scale, one-tonne-per-day trials and commercial scale, hundred-tonne-per-day furnaces. It responds to market demand for full-scale solutions while allowing both industry and academia to explore process changes, new fuels and alternative raw materials in a controlled setting. Here, technologies can be evaluated, refined and proven before being deployed on risk averse commercial furnaces. The membership model is open to any organisation and is central to this innovation ecosystem. By inviting cross-sector participation -drawing in manufacturers, suppliers, technology providers and academic partners- this model facilitates collaborations that might not otherwise occur. Members can engage with projects on the pilot furnace, share knowledge and help

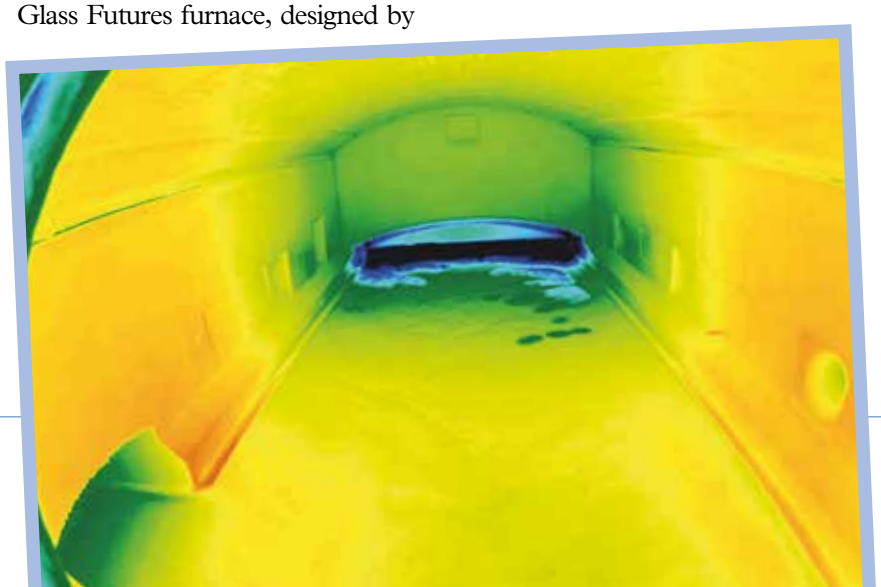
steer development programmes that are aligned with real world needs, all while spreading the risk and cost of experimentation across a broader community.

THE GLASS FUTURES PILOT LINE

The pilot line trial programme recognises the multiple pathways towards sustainable glass manufacturing. Phase one of the trials focuses on alternative fuels, addressing one of the most pressing challenges facing foundation industries: how to reduce carbon intensity while maintaining high temperature process performance. Subsequent phases of work are dedicated to raw materials and cullet trials, opening the way for new batch compositions, higher recycled content and industrial symbiosis concepts that integrate glass production with other sectors' waste streams. Within this framework, Glass Futures identifies several key opportunities to advance sustainable glass manufacturing. Alternative fuels -including options that are also relevant for other foundation industries- form one important pillar. Carbon capture technologies and strategies to increase recycled content and industrial symbiosis represent additional levers. Waste heat recovery, Industry 4.0 digital technologies, advanced sensors and automation all contribute to improved energy efficiency and process control. Finally, the exploration of new raw materials and batch compositions expands the range of technical solutions available to manufacturers seeking to reduce environmental impact while safeguarding product performance.

INSIDE THE GLASS FUTURES FURNACE

At the core of the pilot line is the Glass Futures furnace, designed by Stara Glass as a unique platform for the global glass industry. Conceived by industry experts for industry use, the furnace combines versatility with advanced engineering. It has a nominal pull of 30 tonnes-per-day and a melting area of 20 square metres, with a glass depth of 1.3 metres. The system is oxy-fired and capable of operating with different fuel types, including natural gas, hydrogen and other sustainable liquid fuels, as well as blends. Bottom electric boosting and bubblers provide additional flexibility in controlling temperature profiles and melt quality. The refractory configuration has been specified for both performance and experimentation.



Glass contact refractories are based on fused-cast AZS, while the crown uses low-lime silica. A full width doghouse and two batch chargers manage the introduction of batch materials, ensuring realistic simulation of industrial conditions. The furnace design includes a dedicated test pocket in the tank for glass contact refractory testing, allowing new refractory materials to be evaluated under genuine molten glass exposure. This is complemented by space in the waste gas duct for checkers testing and a very large waste gas duct that can be used for multiple purposes. The flue system is deliberately configured for trial work. It offers flexibility for testing waste heat recovery concepts, carbon capture approaches, sensor development and new refractory materials. In practice, this means that Glass Futures can host projects covering everything from flue gas composition and heat exchanger performance to the durability of novel materials and the behaviour of monitoring systems in real operating environments.

DESIGNING WITH SIMULATION AND DATA

Stara Glass has applied its proprietary FurnaceMaster® design and simulation software to the Glass Futures furnace, drawing on experience from hundreds of operational furnaces worldwide. All walls of the furnace and its overall performance have been analysed in detail. Design work has included comprehensive heat balance calculations, simulations of different pull and boosting conditions and the study of parameter variations such as cullet ratio and batch mix humidity. Heat loss analysis and three dimensional modelling have been used to understand and optimise thermal behaviour, feeding into both engineering refinement and didactic objectives. The result is not only a robust industrial scale furnace but also a teaching instrument for future generations of glassmakers. The extended design report produced for the furnace serves dual purposes: it provides the technical basis for reliable operation and constitutes a didactic resource that can be used to train engineers in furnace design, operation and optimisation. For Stara Glass, the project represents a turning point, marking the company's recognition alongside the highest levels of glass furnace expertise and significantly increasing its visibility and credibility in the market.

A PROVING GROUND FOR DECARBONISATION

Beyond its technical configuration, the Glass Futures furnace has already become a catalyst for broader collaboration and project development. Through its involvement with the facility, Stara Glass has embraced the organisation's purposes and has become part of cooperative efforts aimed at enabling truly sustainable worldwide glass production. Among these is the COREu project, focused on the introduction of carbon capture and storage technologies into the glass industry. Other significant cooperative initiatives are also emerging around the platform, reflecting its role as a focal point for decarbonisation-oriented innovation. In essence, Glass Futures provides the glass community with something that has long been missing: an industrial scale, independent proving ground where alternative fuels, new materials, digital tools and circular economy strategies can be tested under realistic conditions without placing commercial assets at risk. By combining a versatile oxy-fuel furnace, flexible flue gas infrastructure, laboratory support and a membership driven innovation ecosystem, it creates a space where disruptive technologies can be demonstrated, refined and translated into commercially viable solutions. As the Global Centre of Excellence in St Helens moves fully into operation, the furnace will quite literally begin to 'spit fire and glass' in the service of the industry that built it. Its 30-tonne-per-day pilot line, advanced design and membership structure position Glass Futures as a central actor in the journey towards sustainable glass manufacturing bridging the TRL gap, enabling cross sector collaboration and helping to make glass the low carbon material of choice for a sustainable future. ■

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