Focused on decarbonising industry

Rana Ghosh has worked in industry for 30 years – but the current period, with its focus on decarbonisation and digital manufacturing is the most exciting, he states. Air Products' Director of Industrial Gas Applications R&D discusses how the company can help glass manufacturers with their sustainability aims.



In my current role, I am responsible for leadership and execution of our application-focused growth strategy around new and existing market segments. Industrial gases are used across industries, including glass, metals, chemicals, food and electronics.

Our Applications Research and Development (R&D) group works with customers in these segments to help improve their process efficiency, productivity, and quality.

We provide enabling equipment and technology solutions, in addition to helping our customers use industrial gases safely and efficiently.

The glass industry is an important customer segment for Air Products. We have been a technology solutions provider to the industry for decades, with many industry-first solutions around oxygen enrichment and oxy-fuel melting.

As the glass industry continues its decarbonisation journey, we are working with our customers to develop cost-effective solutions both for now and the future.

Excitement

I have been in various R&D roles over my 30 years of professional life and this phase is probably the most exciting.

Decarbonisation and the Industrial Internet of Things (IoT) have presented many new opportunities for innovation in mature industries, in ways that were unthinkable even a few years ago. Being in a role that allows me to help develop solutions to challenging real-life industrial problems is one of the most energising parts of my job.

Seeing a solution progress from an idea to a viable technology offering provides a strong sense of accomplishment for me and my team. Sustainability is another key driver – even before decarbonisation became an industrial theme.

I have been interested in developing solutions that help the environment, and through the gas-based technology solutions that we develop, we have an opportunity to make a difference.

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Objectives

Decarbonisation is a strategic objective for many glass manufacturers that creates the need for new technology solutions to make the glass manufacturing process more efficient.

Regionally, Europe continues to be at the leading edge of development for many of these technologies as supportive policies drive the development of newer decarbonisation solutions, like hybrid melting or using hydrogen as a fuel.

Meanwhile, in the US, several glass manufacturers are working to implement industrially-proven decarbonisation technologies like oxygen enrichment/oxy-fuel as well as waste heat recovery, that can be used for preheating raw materials and fuel, or for other uses like generating process steam or electricity.

Additionally, data-based optimisation, including Artificial Intelligence (AI) and machine learning, is helping customers drive more energy efficiency into their manufacturing processes, which is often a key step in improving overall energy usage and carbon footprint reduction.

Technology solutions

While full decarbonisation with carbon-free fuels remains the end goal, there are many technology solutions offered by Air Products that are designed to reduce the energy consumption and carbon footprint of a glass manufacturing process.

These technologies could be divided under three broad themes: (1) oxy-fuel burners that allow for directed heating of the melt, thereby improving

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heat transfer and lowering fuel consumption; (2) novel waste heat recovery technologies that can preheat oxygen, natural gas, cullet and/or batch materials for improved fuel efficiency and reduced emissions; and (3) AI-based smart technologies that allow for condition monitoring and optimisation of the burner functionality in real time, improving productivity and reducing fuel and oxygen usage.

Besides these, our burners are fully capable of using 100% hydrogen or hydrogen/natural gas blends, while maintaining acceptable nitrogen oxide (NOx) emission levels, and we continue to work with industry partners to further develop and refine hydrogen-based melting technologies.

As the global leader in hydrogen production with world-class expertise in process integration, safety and applications knowledge, we can help glass manufacturers implement the right fuel-flexible solution.

Glass industry example

We recently commissioned a new Integrated Oxygen Supply/Cleanfire HRx Combustion system at CertainTeed's Chowchilla, California facility.

The furnace uses our low NOx HRx burners, and our low-pressure oxygen VSA has 30% lower power consumption, as compared to the previous oxygen facility that was installed there.

The power savings, combined with increased furnace efficiency, is saving the plant over 3,000 tons of carbon emissions per year and $750,000 in cost savings.

In late-2024, we will conduct a new commercial-scale demonstration of a waste heat recovery technology that has the potential to decrease furnace fuel consumption and carbon emissions by an additional 10-12% as compared to our previous-generation oxy-fuel burners.

Other manufacturing sectors

The glass industry is somewhat unique in its decarbonisation challenges, however, there are lessons to be learned from decarbonisation initiatives in other industries like power and steel.

Low-carbon or carbon-free fuels like hydrogen are more expensive compared to carbon-based fuels, so combustion technologies that improve fuel efficiency and deliver acceptable NOx emissions can be broadly applied in glass.

These fuels also have different combustion characteristics compared to carbon-based fuels, so as new, more efficient combustion processes are developed to better utilise the properties of these low-carbon fuels, they can be implemented for glass melting.

Finally, AI and machine learning-based technologies that have been successfully implemented in other industries to improve productivity and reduce waste and fuel usage are also relevant tools in glass manufacturing to help with the industry's decarbonisation goals.

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Fuel of the future

Glass furnaces of the future will likely use a combination of solutions, based on regional carbon penalties and incentives as well as availability and cost of nuclear, wind and solar energy.

Hybrid melting technologies with energy recovery, using low or zero-carbon fuels, will likely be viable solutions in the future as technology challenges are resolved and fuel cost and supply infrastructure improve.

Depending on availability, biofuels can also offer a lower-cost approach to decarbonisation, compared to electric melting.

Digital technology

Air Products has been working with industry partners across various end-markets to implement smart technology solutions for improving productivity, cost, and quality in their manufacturing processes.

For glass, we introduced the industry's first smart burner HRe in 2015 and since then, we have continued to introduce other offerings, like the Synchronised HRx burner for zero-port oxy-fuel boost, that can automatically adjust flame properties and avoid the negative effects of turbulence with air-fuel flames caused be regenerator reversal.

We can help customers monitor burner condition and performance data continuously and provide reports and alerts to ensure stable, safe, and uninterrupted performance. Recently, we've been working on an exciting new project that uses AI and machine learning to improve glass quality in the float glass segment.

Our new Tin Bath Atmosphere Monitoring and Optimization system uses modelling, process, and defect data to guide operators to optimise bath operating conditions to minimise tin-based defects.

A digital twin runs live alongside the real process to help the plant increase its overall glass quality and yield.

By reducing defects, the technology also reduces the carbon footprint per ton of glass produced.

Industry President

Air Products is proud of Marie Kistler's leadership appointment as President of the GMIC for 2024. Marie is passionate about helping the glass industry to meet its decarbonisation goals.

She has been instrumental in the execution of GMIC's new Strategic Plan aimed at increasing member value and amplifying the voice of the glass industry through advocacy, education, and research.

Marie also spearheads Air Products Foundation's grants to GMIC for student programmes and the new Women in Glass award, first presented at this year's Glass Problems Conference. ■

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https://www.airproducts.co.uk/applications/melting-glass