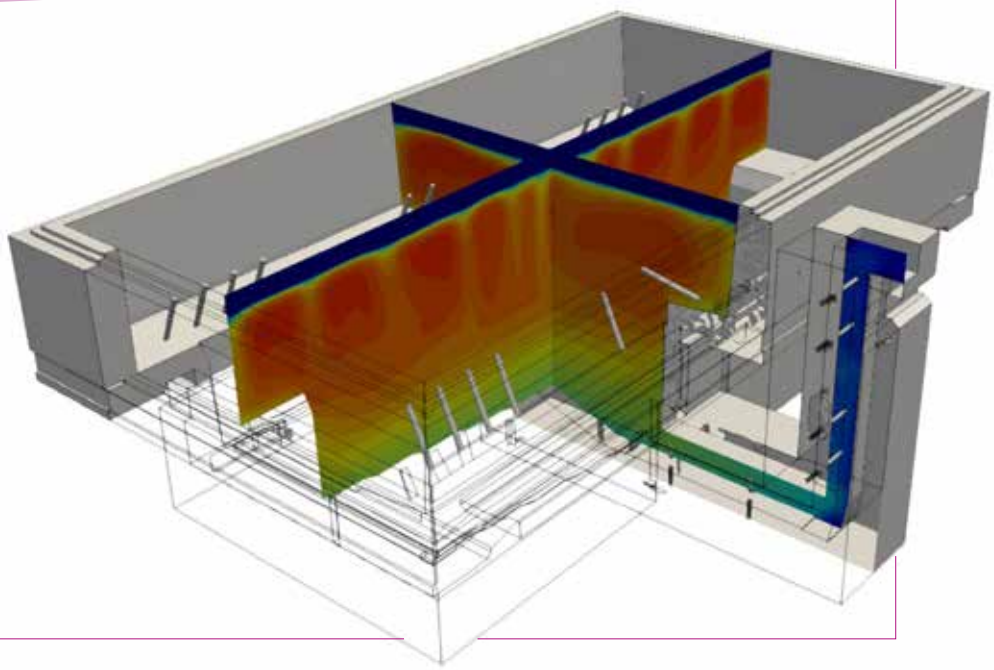
Scalable electric and hybrid glass melting advances from FIVES

Glassmakers face escalating energy costs, stringent decarbonisation goals and rising demand for flexible production. Here FIVES is accelerating the shift toward electric and hybrid melting - delivering industrial-scale performance, advanced heat-transfer designs and adaptable furnace configurations that support large-volume output while driving significant emissions reductions across operations.

LOW-CARBON MELTING THROUGH HYBRID AND ALL-ELECTRIC TECHNOLOGIES

Glass manufacturers around the world are navigating a period of rapid change: rising energy costs, stricter decarbonisation targets and the need for more flexible production. Against this backdrop, the shift toward electric and hybrid melting is no longer experimental - it is becoming a central pillar of long-term strategies. Drawing on more than 45 years of experience in electric melting and furnace design, Fives is playing a key role in this



transition, and its recent projects offer a window into how the technology is maturing.

ELECTRIC MELTING REACHES INDUSTRIAL SCALE

Electric melting furnaces first appeared in production applications in the 1960s, but only recently have grown to capacities relevant for large-scale container production. One of the clearest indicators of this progress is the all-electric furnace with a capacity of 180 tonnes per day, developed and delivered by Fives to Verallia's Cognac plant in 2024. The furnace reached nominal pull within a month for premium glass bottles - an outcome that would have been difficult to imagine a decade ago. Ongoing adjustments, such as fine-tuning composition, refining melt-rate strategies, and aligning batch-blanket and melt temperatures, reflect a mature technology now operating at a level suitable for high-volume industrial production. Current development paths targeting 300-400 tonnes per day capacity and extending the technology into coloured glass production, illustrate how quickly the ceiling is rising. What is particularly interesting for glassmakers is how routine these technologies are becoming. The current work on new temperature - control approaches, melt-rate strategies, and furnace superstructures suggests not an emerging technology, but a mature one steadily pushing its upper limits. Development paths targeting 300-400 t/d capacity, including for coloured glass, illustrate how quickly the ceiling is rising.

HYBRID MELTING: FLEXIBILITY AS A DESIGN PRINCIPLE

While electric melting is advancing quickly, some glass producers require production flexibility that hybrid melting can provide. Over the years, hybrid designs at Fives have evolved from modest electric boosting to systems capable of 20-80 percent electric input with no pull restriction. They are also compatible with all types of glass. Technologies such as Prium® Eco-Flex and Heat Recovery Area (H.R.A.™) originated from innovations, such as oxy-gas cross-fired furnaces incorporating up to 80 percent electric boosting and heat recovery systems, which later became a foundation for hybrid melting. These efforts produced a remarkable result. Fives is supplying the first air-gas hybrid furnace for glass packaging applications to O-I's Veauche plant in France in 2026. The furnace is capable of replacing up to 70 percent of conventional fossil fuel with electricity. CO2 emissions at the site will be reduced by 43 percent in comparison to conventional technology. The furnace is equipped with a revolutionary heat recovery and air preheating system which creates further efficiency gains. In addition to the decarbonisation impact, the new technology will also further reduce NOx emissions.

HEAT TRANSFER RESHAPING FURNACE DESIGN

The HRA™ superstructure marks a significant shift in the management of heat transfer in contemporary melting furnaces. By lowering the superstructure section and preheating the batch, the fur-

VERALLIA COGNAC: FURNACE DESIGN

nace can operate efficiently across a wider temperature range than conventional crowns can sustain. This expanded operating envelope is essential for maximising electric boost usage, as it reduces the need to overheat the melt surface during fining. This also helps to avoid the efficiency losses associated with traditional crown designs. The HRA™ technology also plays a key role in dust management. The modified geometry creates optimal conditions for capturing and evacuating particles generated during charging or decrepitation, which helps protect the superstructure from corrosion.

VARIETY OF CONFIGURATIONS FOR GLASSMAKERS

A variety of configurations are emerging from these developments, including Prium® Float-Melt regenerative furnaces, which are capable of producing 350 to 1,000 tonnes of container and flat glass per day, as well as oxy-fuel melting technology enhanced with L.E.M.® technology. Hybrid technology and various super-boosting configurations with different levels of electric input demonstrate how manufacturers are combining combustion and electric energy in various proportions to achieve decarbonisation targets. Rather than pointing to a single "best" solution, the current landscape shows a diversification of furnace architectures - regenerative, recuperative, oxy-fuel, hybrid or all-electric - each suited to different raw material mixes, energy-price environments, and carbon reduction objectives. The inclusion of high boosting or fully electric operation within these designs reflects a broader industry trend toward modular, adaptable melting strategies. This long-term evolution has helped establish a clearer understanding of how decarbonised melting approaches can be scaled and integrated within existing production infrastructures. ■