STARA GLASS extends Hydra Group's vast technical expertise

In continuing its commitment to developing unique products and solutions for the Glass Industry, Hydra seeks to guarantee for all its customers worldwide the best results in terms of quality, productivity and sustainability. Here, respecting coordination of the Group's activities for the glass market, STARA GLASS focuses on glass furnace design (end-port, unit melter, oxy-fuel, electrical, hybrid).

Thanks to its R&D investments, Stara Glass produces its own thermal design software, which is based upon exhaustive field data for the detection and operation of furnaces as well as for heat balance computation - all of which equips it to offer reliable performance guarantees.

Furnaces

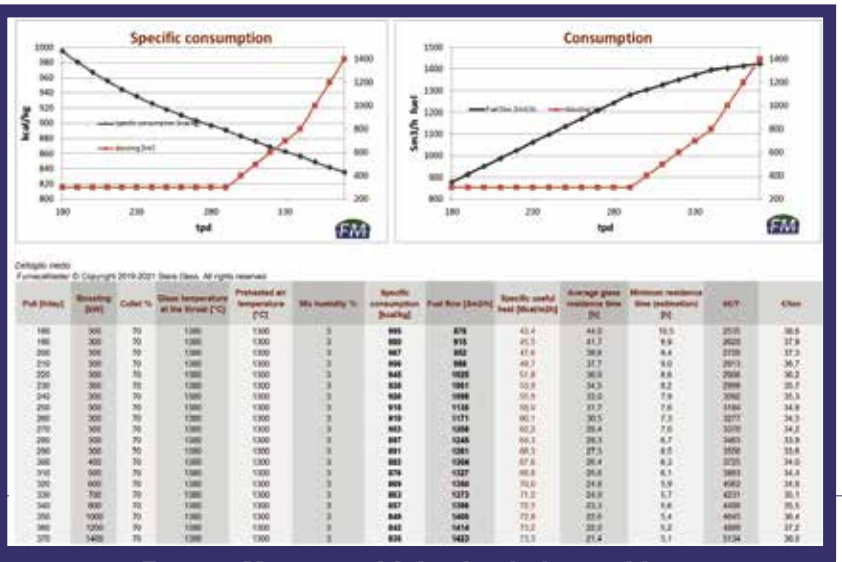
DESIGN TOOLS

FurnaceMaster®

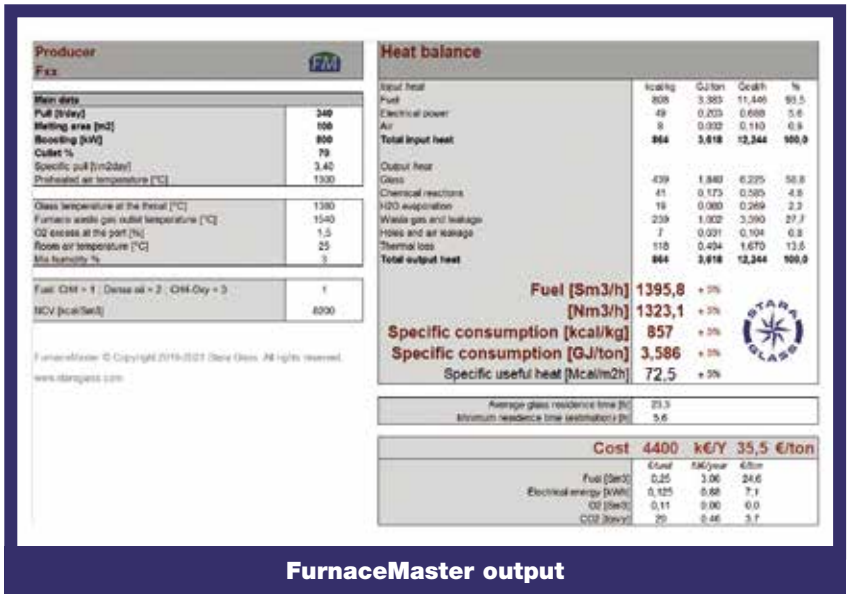
FurnaceMaster® affords the designer an ability to precisely identify all computer input whilst collecting every significant output - a model applied for hundreds of real heat balances which, by its thermal-dynamics, is based upon physical, non-empirical modelling.

Here, FurnaceMaster® computing includes:

- Evaluation of specific useful heat, introduced as a primary design criterion;
- Accurate simulation of regenerative, recuperative, oxy and Centauro furnaces;
- Generation of consumption curves, depending upon each significant parameter or working condition (pull, boosting, glass temperature, preheated air temperature, cullet utilization, thermal loss, mix humidity, etc.);
- Computing of all thermal and mass flows involved in the process;
- Thermal loss statistical hypothesis, depending upon furnace size and the particular product identified for pre-design;
- Statistical hypothesis of infiltrations, holes and leakage;
- Gas combustion, oil combustion and oxy-fuel combustion;
- Glass chemistry (reaction heat, loss on ignition);
- Multi-language output currently available in English, Italian, French, Spanish, Russian and easily implementable with any language;
- Constant update;
- Surface heat loss.



FurnaceMaster multiple simulation ambient



FurnaceMaster output

CFD analysis

Over the past years, Stara Glass has developed a close cooperation with the team of Professor Carlo Cravero at the University of Genoa - thanks to which the company's technicians were afforded a chance to integrate and fine-tune the design with CFD analysis, accompanied by a comprehensive collection of field data.

The same cooperation recently evolved the creation of two innovative start-ups, namely SireLab and SGRPRO, both of which are all set now to power Stara Glass' CFD computing team as well as to support its field technicians.

The company's CFD skills currently encompass the following:

- Analysis of regenerators and ports;
- Flame and combustion analysis;
- Hybrid air staging design;
- Strategic waste gas recirculation design;
- Urea mixing in SNCR systems for Centauro.

OTHER STARA GLASS SOFTWARE

RNB (Regenerators)

- Heat recovery computing with cruciforms and chimney blocks;
- Parameter utilization (exchanging surface/waste gas flow volume);
- Infiltrations and leakage, depending upon pressure;
- Fourier series based upon transient heat storage and release mechanism;
- Under implementation for waste gas recirculation coupled-design computing.

Metal recuperator models: PDRSim®, CDRSim®, PTRSim®

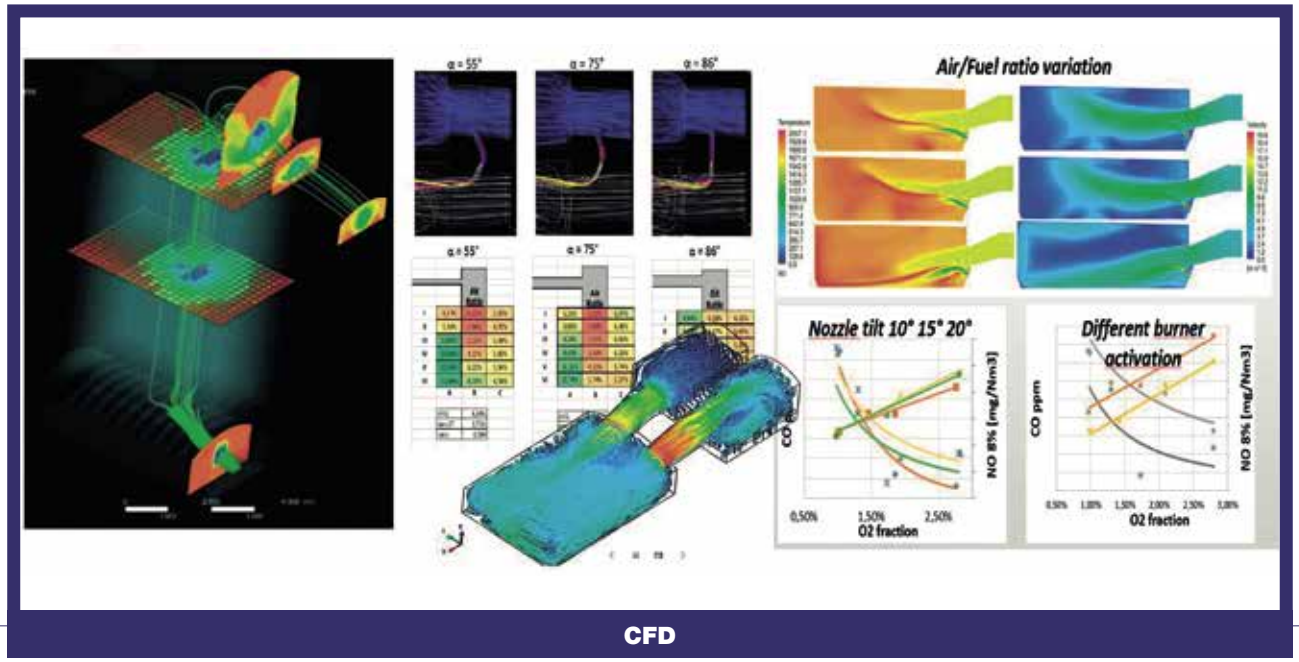
- Geometry of the component;
- Input temperatures and flows;
- Fouling level.

HEAT BALANCE SERVICE

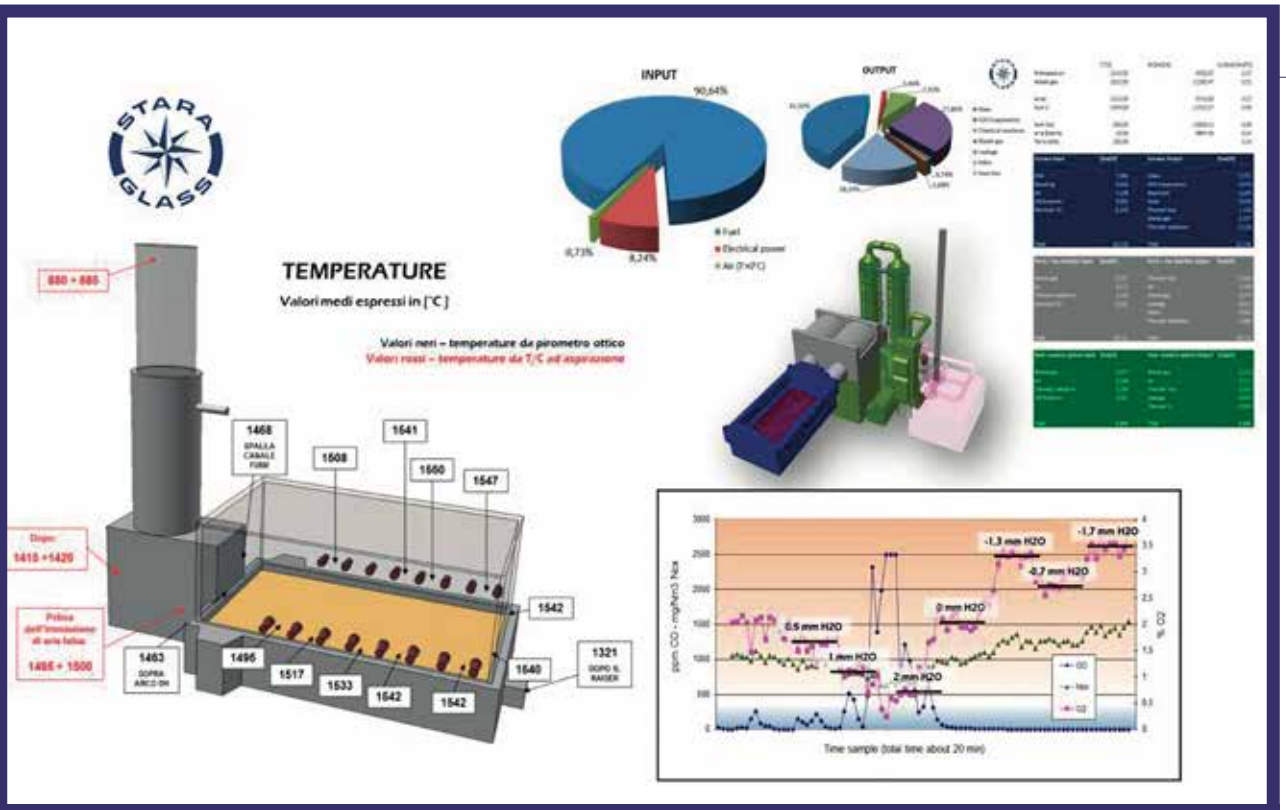
Performed by three to six specialists, heat balance is a three to five day measurement campaign from which an «image overview» of the furnace condition is rendered visible. Indeed, over the heat balance period Stara Glass technicians are already equipped to provide the customer with useful furnace operation suggestions. Once all data is collected, the Customer receives a report that accurately describes the condition of the plant and suggests operational optimization.

This allows for:

- A general check of plant conditions;
- Performance maximization in terms of consumption and quality;



CFD



Heat balance

- An understanding of the furnace's strong and weak points in order to solve existing problems and optimize future campaign design;
- Precision verification of the measuring instruments installed on the plant.

The Stara Glass HB team's owns all the expertise and equipment necessitated for this high-level task. During the operation, the following measurements (among others) are detected:

- Pressure, to evaluate furnace stability as well as any heat recovery system anomalies that may arise;
- Temperature, to verify performance of both the heat recovery system and the furnace;
- Chemical analysis (O2, CO, NOx), to optimize combustion from the energy and ambient point of view, as well as to detect any infiltration.

HB activity is important for the optimization of every furnace and should be performed at least twice per campaign. Furthermore, all obtained field data remains confidential and, as such, is never divulged - which allows Stara Glass to keep all computing models tuned and updated in order to provide customers with models that are ever more advanced and reliable.

HYBRID FURNACES

Centauro

Thanks to the high precision of Stara Glass design tools, the company's specialists have been able to develop different hybrid heat recovery systems that maximize the benefits of regenerative/recuperative and ceramic/metal technologies.

As a hybrid regenerative/recuperative glass furnace, the Centauro system guarantees performance of a well-dimensioned, end-port furnace - with the following added advantages:

- Layout flexibility;
- Reduced depth of regenerators;
- NCR system;
- Better-working regenerator conditions (higher thermal homogeneity/reduced condensation);
- A reduced exhausting/cleaning period during reversion;
- Clean hot air stream availability (additional free thermal power).

As a new-conception furnace with high thermal performances coupled with clear geometrical advantages, Centauro offers significant opportunities for furnace rebuilding/converting/empowering - thus minimizing the surrounding impact and cost.

Minotauro and Ciclope

Stara Glass' high precision design tools has allowed the specialists to develop different hybrid heat recovery systems that can maximize the benefits of regenerative/recuperative and ceramic/metal technologies.

Minotauro and Ciclope systems are hybrid solutions dedicated to borosilicate glass production. Compared to traditional, high-performance unit melter furnaces with metal recuperators that are made up of a hot-stage, tube-nest recuperator coupled with a cold-stage double-shell recuperator, here the hot-stage is constituted instead by a continuous cross-flow ceramic recuperator that exhibits the following important features:

- Flexibility inlay-out;
- Pre-heated air temperature up to 950-1050°C as opposed to the UM700-800°C level with its related important energy saving;
- The system is dimensioned to ensure that most borate condensation occurs within the robust, cleanable refractory duct connecting the ceramic and metal heat recovery components – therefore limiting any problems associated with high-chemical aggression of the compounds.

Minotauro features a side combustion similar to that of the unit-melter - for which air at 900-1000°C flows through a ceramic distributor.

Ciclope utilizes an M-shaped flame by installing one gas duct for waste, together with two air ports that are in contintual operation.

ENVIRONMENT PROTECTION TECHNOLOGIES

Advanced systems for NOx containment

Thanks to its concerted involvement in R&D activities, Stara Glass has developed three NOx containment systems – all offered jointly with its expert combustion management service:

1. Primary abatement. Strategic waste gas recirculation: up to -35 per cent in NOx field results - EGR valve for regenerative furnaces;
2. High efficiency air-staging: up to -40 per cent in NOx field results - Regenerative-temperature, post-combustion.
3. Secondary abatement. SNCR system for Centauro furnace: up to -85 per cent in NOx field results: a simple, robust, cost-effective, CFD-optimized, non-catalytic abatement system.

RESEARCH AND INNOVATION PROJECTS

Past innovation

Prime glass (funded)

With a view to rendering the industry ever more sustainable, it remains Stara Glass' enduring aim to stand at the forefront of glass production research to advance its dual objective of constantly lowering pollution and consumption. As such, the company has hitherto been involved – as it still does today - in numerous research projects, among which it now lists the Prime Glass LIFE project, LIFE12ENV/IT/001020, which saw Stara Glass coordinating Stazione Sperimentale del Vetro and the University of Genoa to further the development of strategic waste gas recirculation and high-efficiency air-staging technologies.

PAST RESEARCH

IPS-Filsehumming

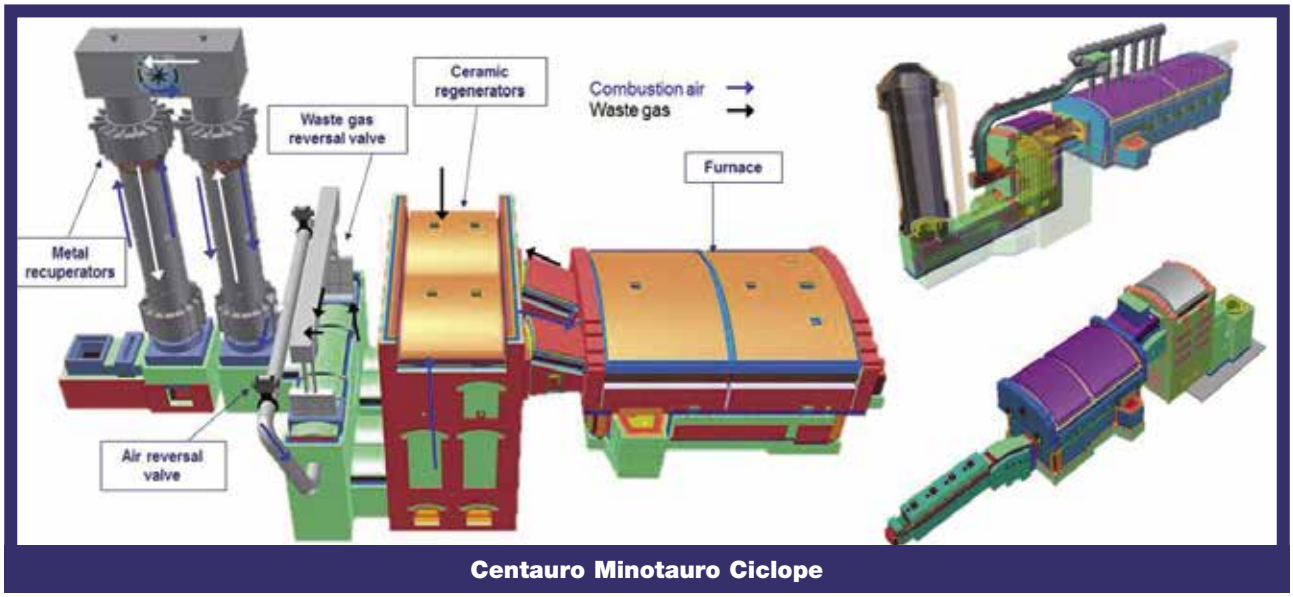
Control and detection of thermo-acoustic instability in power gas turbines. Wide-reaching in its scope, this project has Stara Glassco operating with Ansaldo Energia, Tirreno Power as well as Genoa University and Consorzio SI.RE. – all to develop mathematical models and measure combustion optimization control systems for temperatures – whether high or very elevated - that traverse different industrial fields.

Recave

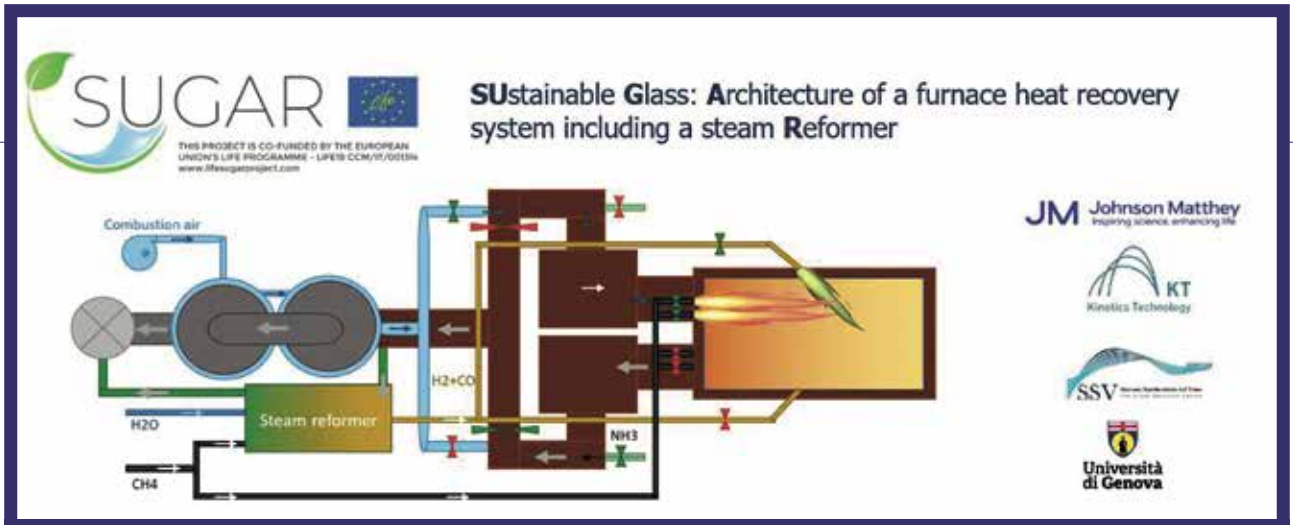
Advanced Heat Recovery in Glass Furnaces, with Consorzio SIRE (Dynamic simulation and Virtual Reality). Starting from a detailed study on regeneration chambers optimization, Stara Glass began a significant cooperation with a leading Computational Fluid Dynamics entity of Savona University.

Sempre

Development of design methods and new technological solutions tailored to increase energy recovery in complex plants. Early experimentation performed in the glass industry, together with the following partners: CETMA (Brindisi), ENEA (Faenza), Neubor Glass (San Vito al Tagliamento – PN).



Centauro Minotauro Ciclope



LIFE SUGAR project

Core

Development of new components, conceived with a view to increasing plant thermal efficiency and prolonging glass furnace life, in partnership with Ansaldo Ricerche (Genoa).

Puma

(Progetto Unit Melter Avanzati – Advanced Unit Melter Design), with the partners: Ansaldo Ricerche (Genoa), CETMA (Brindisi), ENEA (Faenza), Scandiuzzi SUD (Brindisi), Saint Gobain Vetri (Gazzo Veronese - VR).

Current innovation projects

Sugar

SUstainable Glass: Architecture of a furnace heat recovery system including a steam Reformer. Given that a regenerative furnace expels waste gas with a significant energy content at about 500°C, the same heat can be reutilized within the melting process. However, practice shows that batch heating and fuel heating are, for various technical reasons, not entirely satisfactory. First of all, they will disallow re-use of all the available heat, which motivated Stara Glass to take advantage of Centauro's particular architecture to utilize thermal power with the purpose of transforming methane into hydrogen by way of steam reforming. By so doing, the chemical reaction becomes an energy vector, thereby totally recovering the furnace and saving about 15 per cent in energy as compared to state-of-the-art regenerative technology.

GLASS FUTURES

- Stara Glass is an active participant of the GFL association;
- Stara Glass has won the GFL furnace design tender;
- Stara Glass has designed the experimental GFL furnace, which has the following features:
- Oxygen combustion;
- Utilization of different fuels (Methane, Oil, Hydrogen, biofuels);
- Further experimental features.

FUTURE INNOVATION PROJECT

Divina

The Italian acronym for "decarbonization of glass industry, hydrogen and new settings".

- Still under development, DIVINA features the following high-level partnership:
- SNAM: Italian largest natural gas distributor;
- RINA: Italian engineering, innovation and certification leader;
- Bormioli Luigi & Bormioli Rocco: glass producers;
- Stazione Sperimentale del Vetro;
- University of Genoa;
- IFRF: Italian section of the International Flame Research Foundation.

The project investigates how, and to what extent, glass furnace design needs to change to better foster the transition to clean fuels (hydrogen combustion). Here Stara Glass is on board with SGR PRO and Stara Tech, both of which already share the joint aim of developing an appropriate burner type. It also participates in the Dutch DNV project, which is directed to the achievement of similar goals. ■

PATENTS

- Centauro - IT1386349 / WO 2009/093134
- High-efficiency air-staging - IT1408494
- Strategic waste gas recirculation - IT1414478
- SUGAR technology –10201700073758

STARA GLASS - HYDRA GROUP
Piazza Raffaele Rossetti, 3A1
16129 Genova GE
Tel.: +39-010-576391
Fax.: +39-010-564763
E-mail: staraglass@hydragroup.it
www.staraglass.it