



SGRPRO

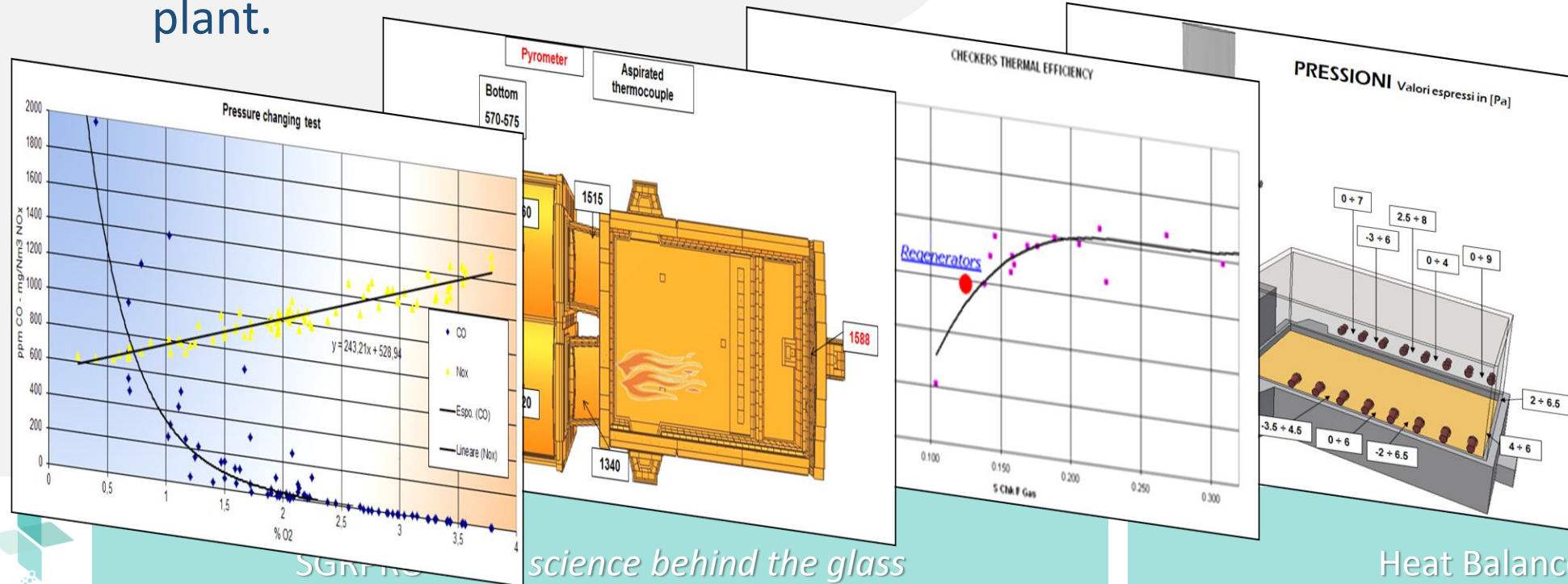
The science behind the **g**lass – *Heat balance*



SGRPRO

Scope of the heat balance

- Check the general plant conditions;
- Maximize performance, in terms of consumption and quality;
- Understand the strong and weak points of the furnace, in order to solve present problems and optimize next campaign design;
- Verify the precision of measure instruments installed on the plant.

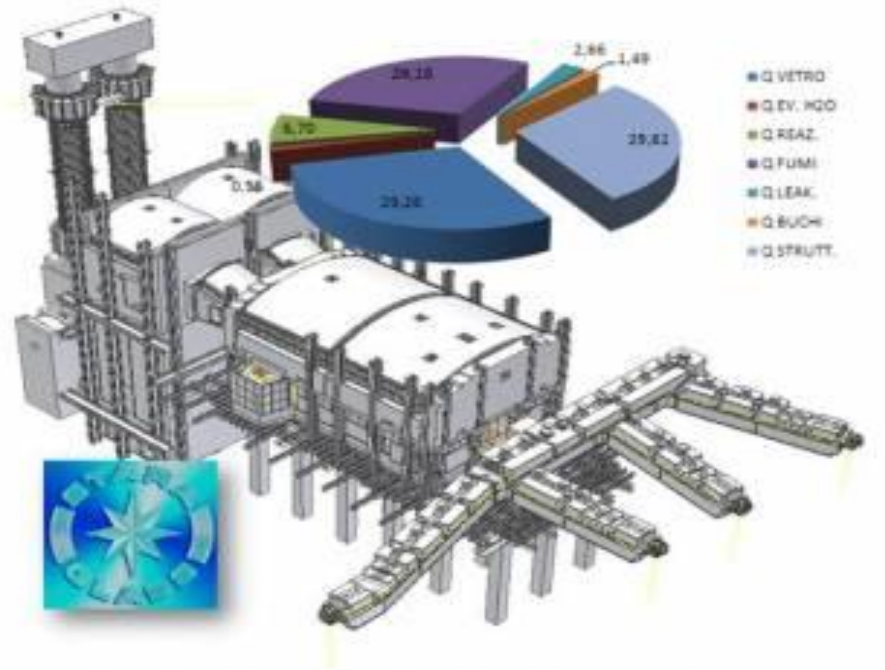


SGRPRO science behind the glass

Heat Balance

What is a heat balance

Heat balance is a **3-5 days campaign of measurements, performed by 2-4 specialists**, from which a **performance evaluation of the furnace** comes out. Often, SGRPRO technicians, during the heat balance period, are already able to provide the Customer with useful suggestions about the furnace operation. Once all data are collected, the Customer receives a **report that accurately describes the condition of the furnace and suggests strategies to optimize the operation**.



Instrumentation

SGRPRO owns all necessary instrumentation to evaluate the conditions of the plant and, for a correct data collection, **we only ask the customer a cooling water line and an air one**, for the proper operation of our instrumentation.

The cooperation of one or more plant technicians can fasten the procedure and result training for them, too.

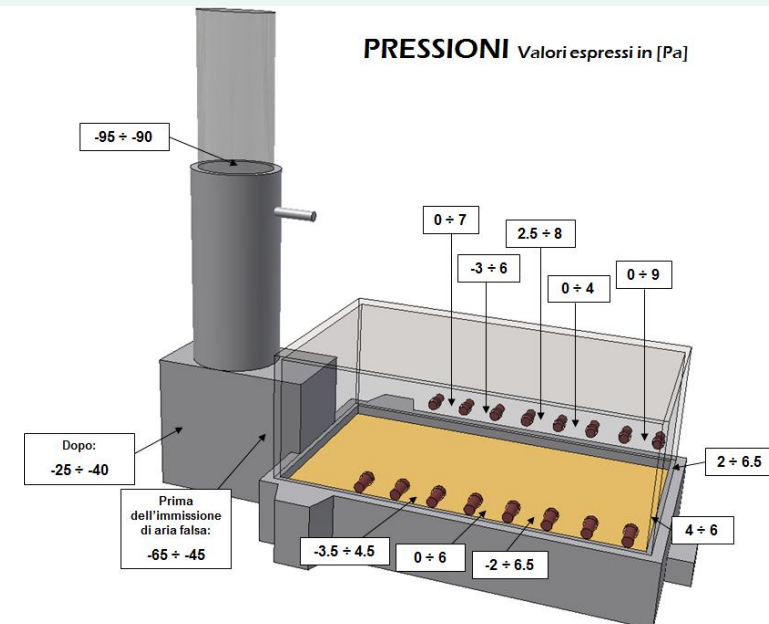
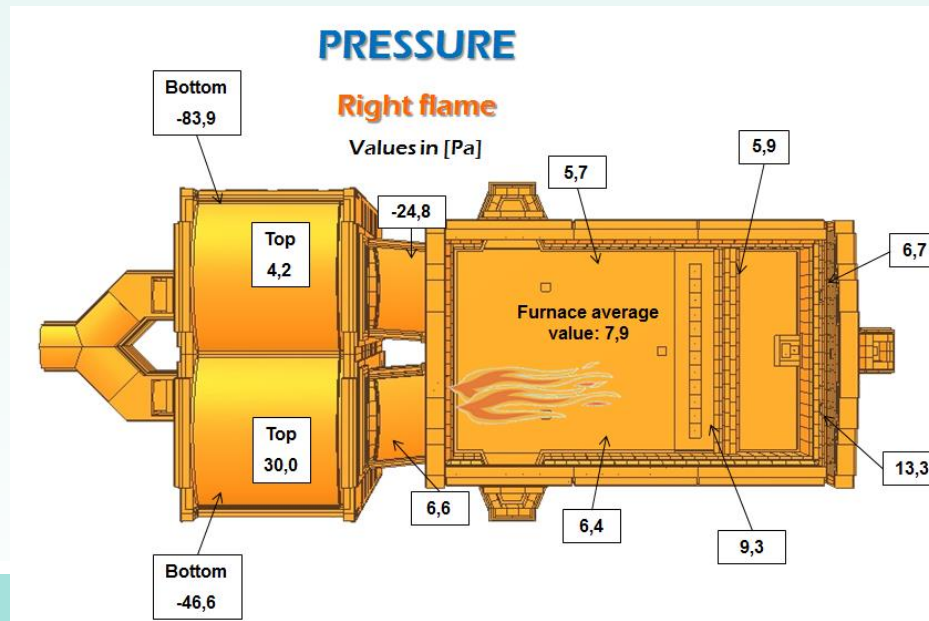
During the last phase of the balance, if the procedure does not result critical (in case of advanced deterioration of furnace structures), SGRPRO will ask plant technicians to modify, for few minutes, some operating parameters like furnace pressure, air/fuel ratio, etc. Thermal losses are calculated with SGRPRO internally developed software on the plant drawings.



Measurements: pressure

Pressure measurements are taken in different points of furnace and heat recovery system, in order to evaluate:

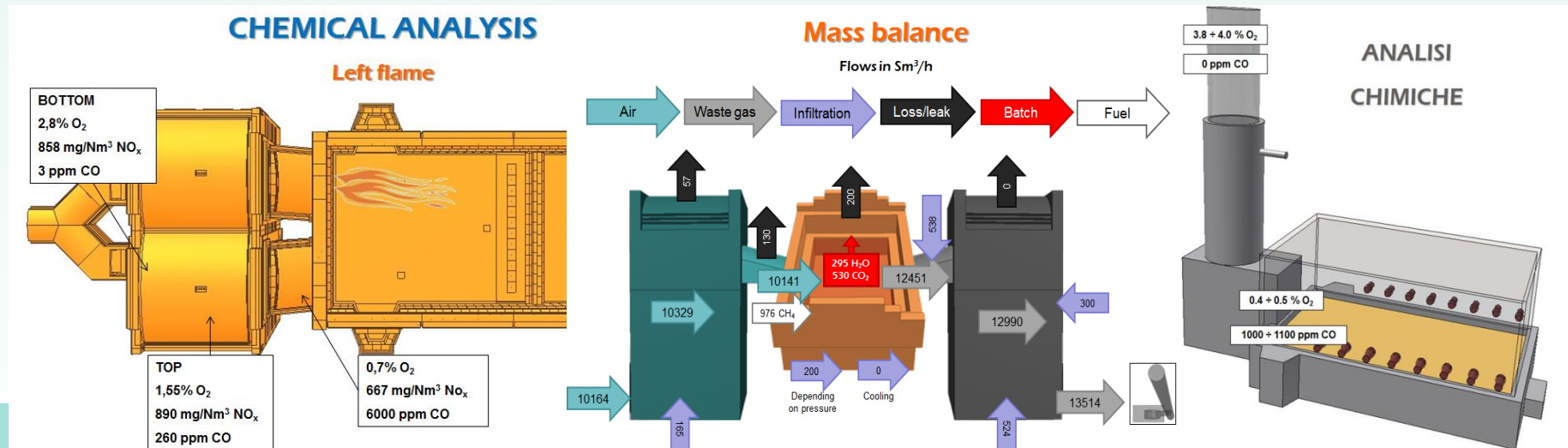
- **Calibration** of plant instruments;
- **Eventual presence of obstructions** in the heat recovery system;
- The **stability of operating conditions** (average values and standard deviation of sampled values).



Measurements: waste gas analysis

The procedure foresees the sampling of O_2 , CO and NO_x concentrations at the furnace exit, in different points of the heat recovery system and in ducts, in order to evaluate:

- Correct **combustion ratio** and flame managing;
- Air **infiltration** in the plant;
- Eventual need of corrective actions to **decrease the presence of nitrogen oxides** and to **balance CO production**;
- Mass balance.



SGRPRO – The science behind the glass

Heat Balance

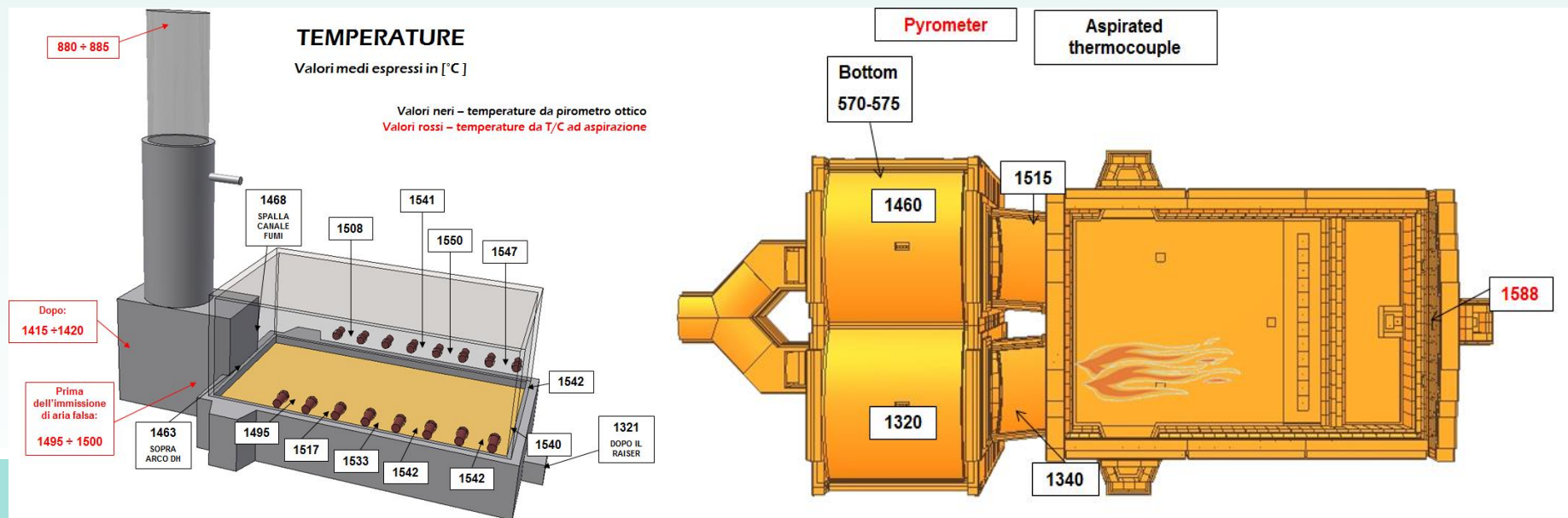
6/13

Measurements: temperature

Air and waste gas temperature are evaluated utilizing suction thermocouples that, screening the probe from outside ambient radiation, measure values much more precise than plant instruments. Temperature measurements allow to:

- Compute total and zone mass and **heat balance**;
- Evaluate heat **recovery system efficiency** and its adequacy to production;
- Point out **eventual anomalies and asymmetries** in operation.

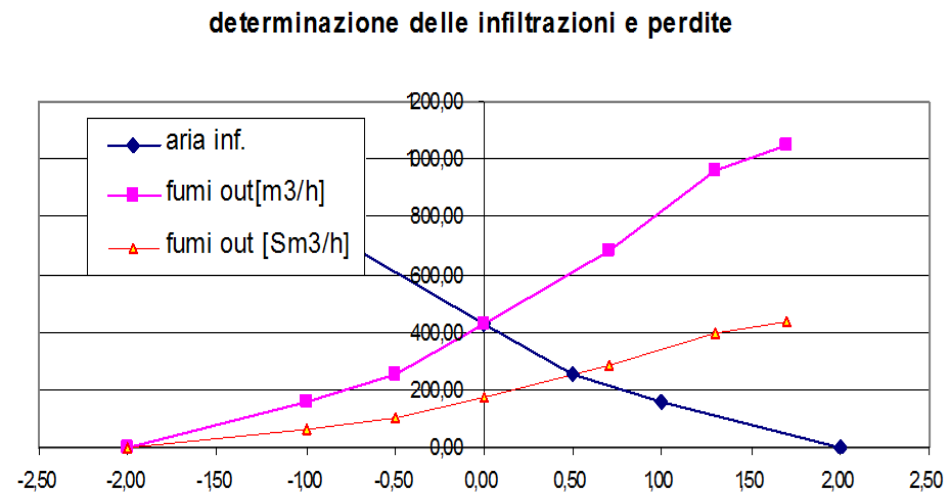
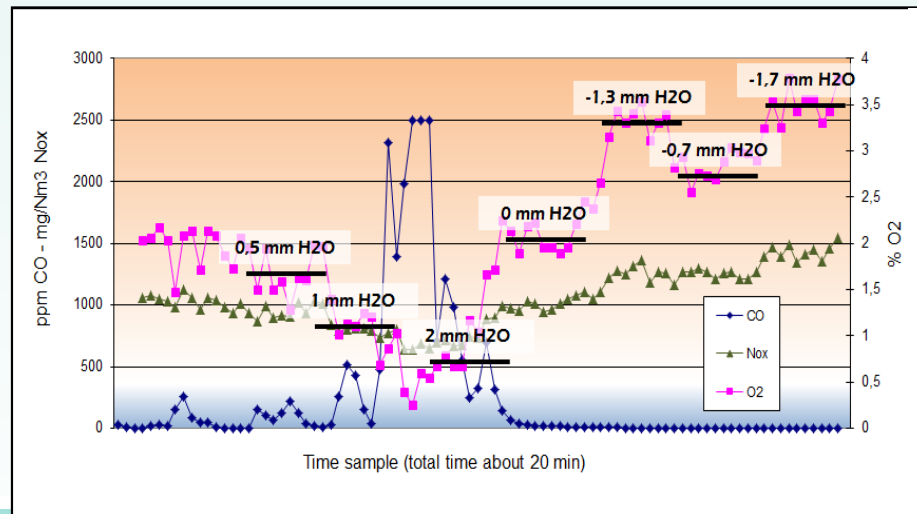
For particular application, optical pyrometers and traditional thermocouples are utilized too.



Other measurements

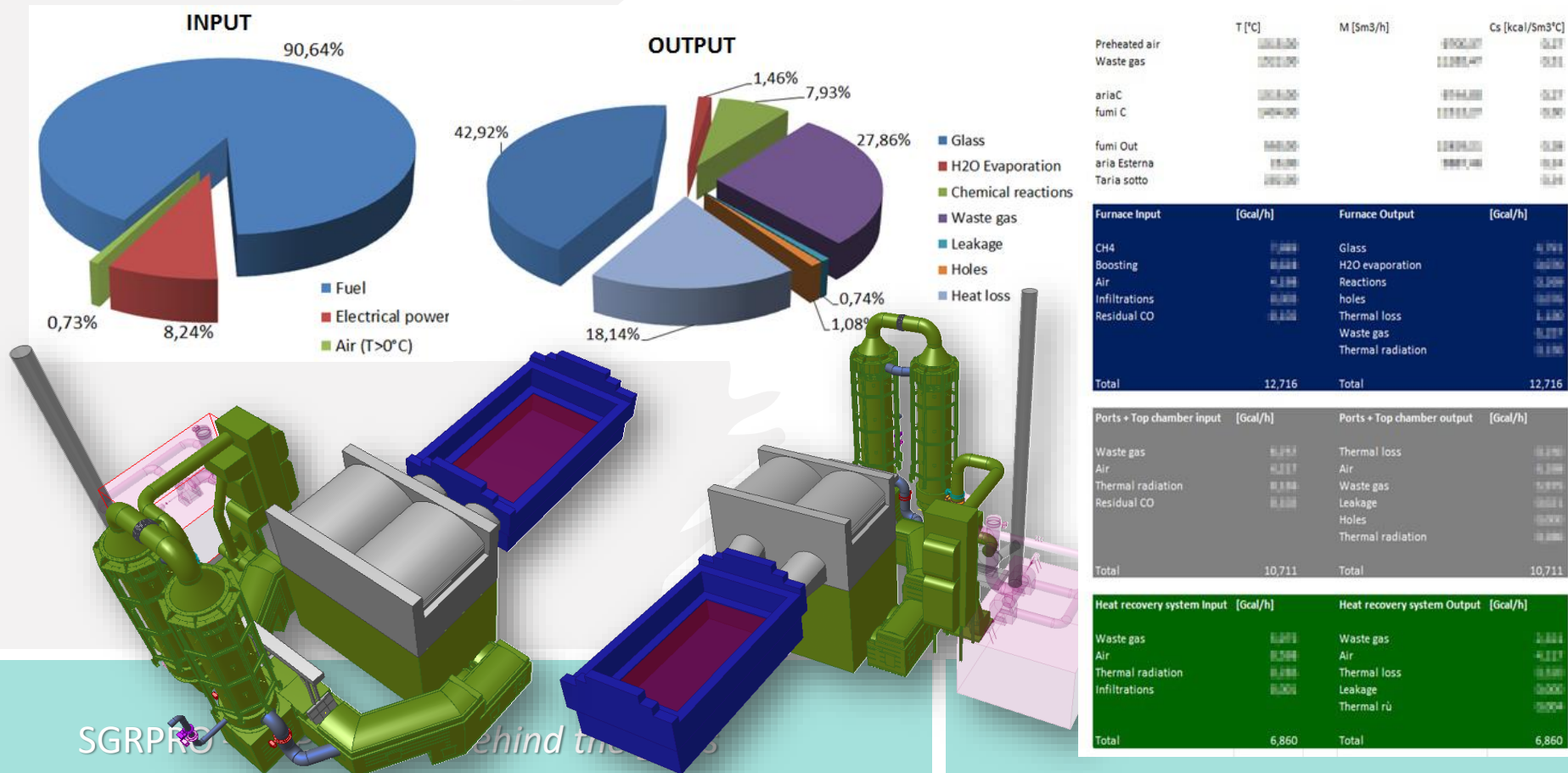
During heat balance period, the following measures are taken too:

- **Oxygen percentage in waste gas under different conditions** of furnace pressure set point and structure cooling, to evaluate the presence of holes and, in general, furnace permeability;
- Flow and temperature of **cooling waters**, for a correct balance closure;
- **Humidity of the mix**;
- And other functional parameters.



Heat balance closure

Once collected, data are analyzed in order to compute mass and thermal balance of the plant. To verify the correctness of the computing, **the system is ideally divided in sub-system and the total heat balance is considered «closed» only when the coherence of all sub-balances is verified.**



Benefit examples

- **Customer #1:** analysis and correction of air/fuel ratio made the company **save 70.000 €/year** for natural gas and significantly reduce NOx production.
- **Customer #2:** after an anomaly of furnace infiltration had been detected, a pressure tuning and a sealing operation allowed to obtain a **120.000 €/year natural gas saving**.
- **Customer #3:** the analysis of the furnace insulation allowed to optimize the next campaign design and **save 130.000 €/year** for natural gas.
- **And more...**

Results

- Computing **results are evaluated by technicians** that, in their career, have computed tens or hundreds of heat balances on different types of plant;
- The Customer receives a **results presentation of all measured values and a document that describes the status of the plant and suggests the eventual corrective actions;**
- The measurements taken on the plant will affect SGRPRO computing models, in order to always provide the Customer with the most reliable design.



References

Some of the companies that used and use SGRPRO heat balance for furnace performance optimization:



SEVES

BORMIOLI LUIGI
GLASSMAKER



Vetrerie Riunite

Contacts



www.sgrpro.it

ernesto.cattaneo@hydragroup.it +39 345.678.34.28