# OXYCOMBUSTION INNOVATION

## Reducing Energy Consumption with innovative technologies

# Market Trends & Needs

## Statement with glass

- **Reinforced regulations on hazardous emission and carbon footprint**
- **The melting representing 60 to 80 % of total energy consumption**
- **Demand in term of short payback time**

## Ambitions

**Cost savings and efficiency**

- **Energy reduction:** electric boosting, fuel and oxygen
- NOx and $CO_2$ emissions reduction
- **CAPEX** <3 years payback

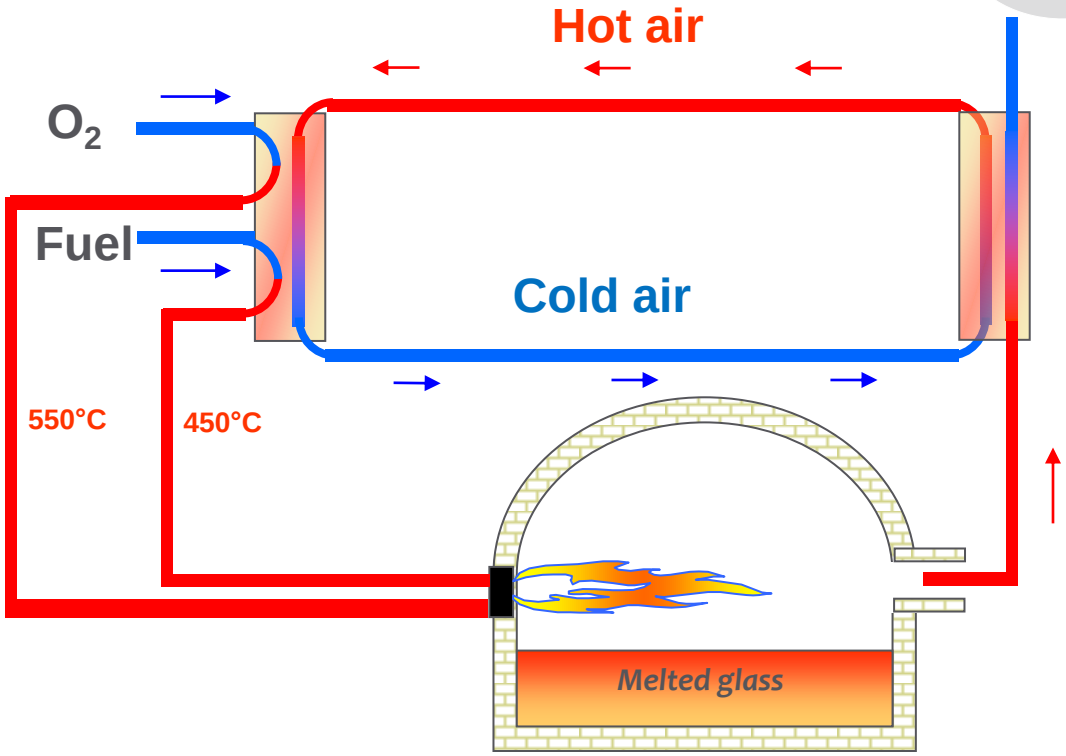
# Oxygen and natural gas preheated at high temperature

## HeatOx

**GREEN SOLUTION**

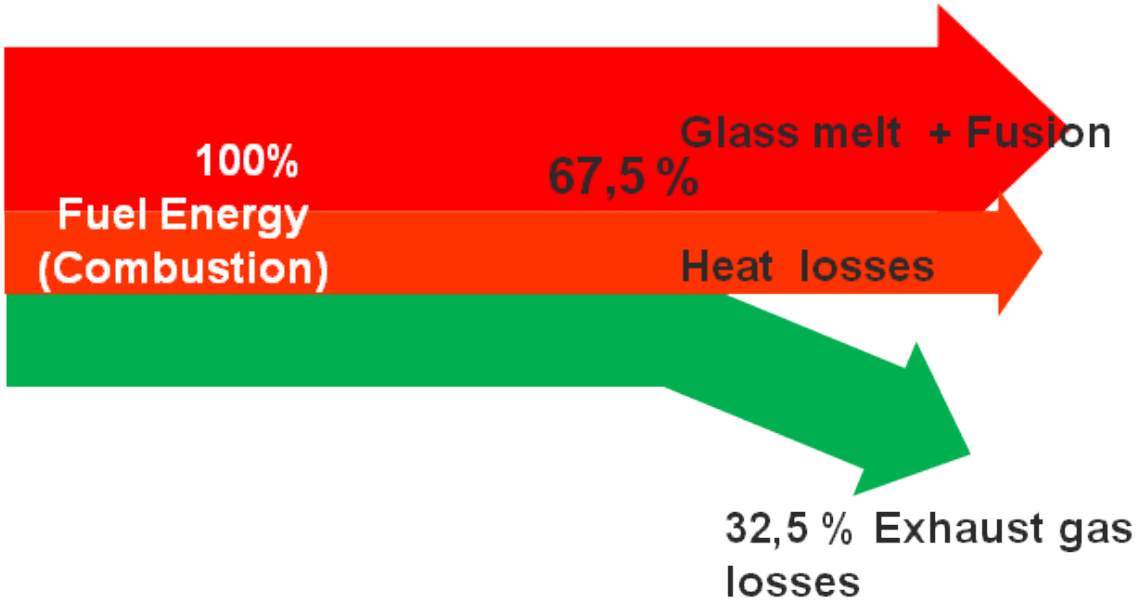
NOx & CO2 reduction

A COMPETITIVE SOLUTION



# ColdOx efficiency

- Oxy combustion with cold reactants – real case

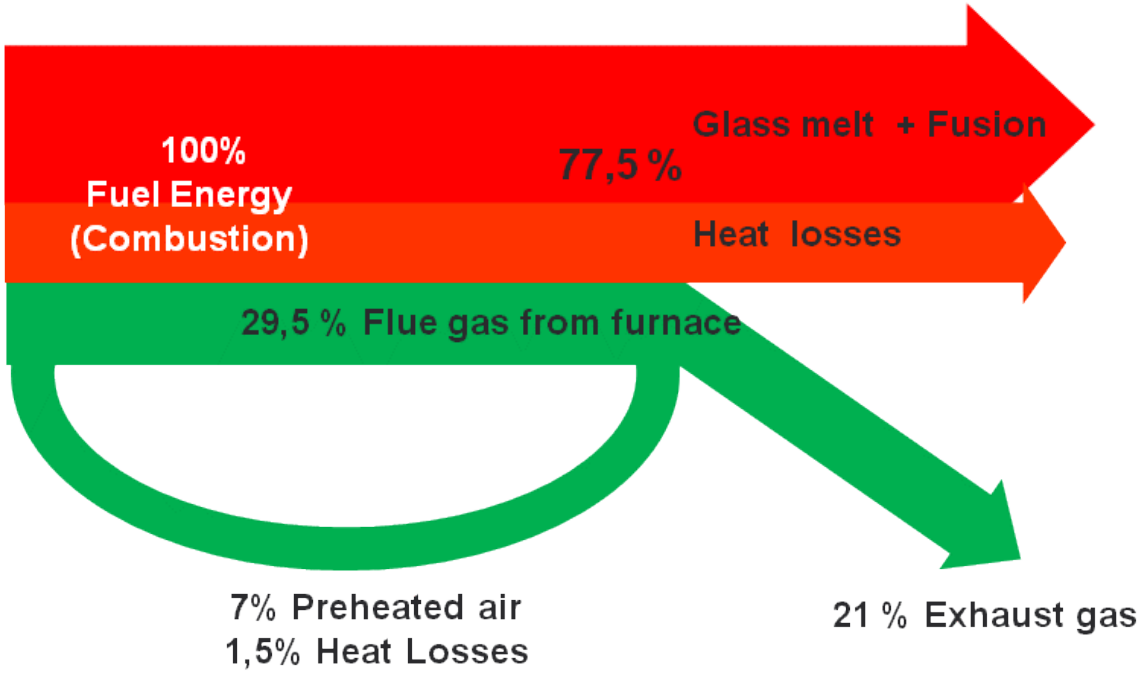



$$\text{Combustion efficiency Coldox} = \frac{\text{Fuel Energy at the burner} - \text{Exhaust gases losses}}{\text{Fuel Energy at the burner}}$$

$$\text{Combustion efficency Coldox} = 67{,}5\ \%$$

# HeatOx efficiency

- Oxy combustion with Hot reactants (550°C O2, 450°C NG) real case




$$\text{Combustion efficiency Coldox} = \frac{\text{Fuel Energy at the burner} - \text{Exhaust gases losses}}{\text{Fuel Energy at the burner}}$$

$$\text{Combustion efficiency Coldox} = 77{,}5\ \%$$

# HeatOx efficiency

- Savings:
  - Reactants enthalpy → -6.3 %
  - Less fumes flow (-7.5% mass flow) → -2.2 %
  - Higher flame emissivity / Fumes T decreasing (-50°C) → -1.5 %

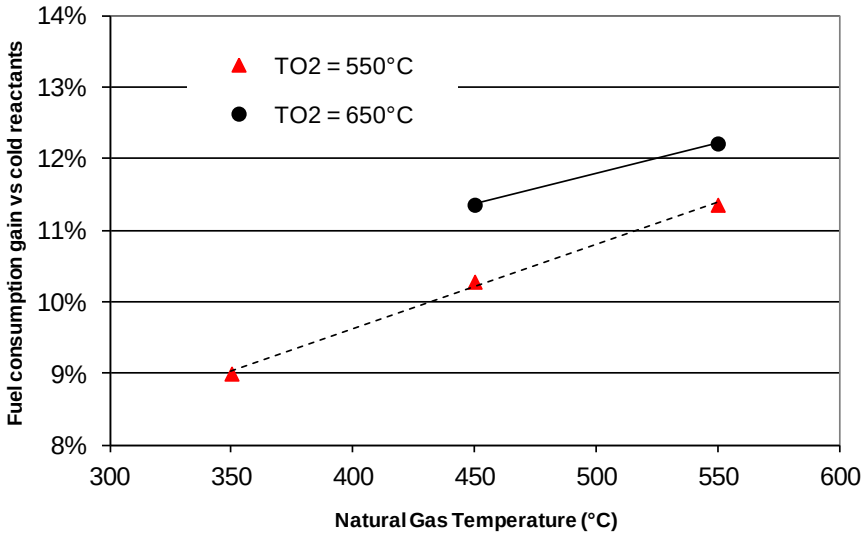
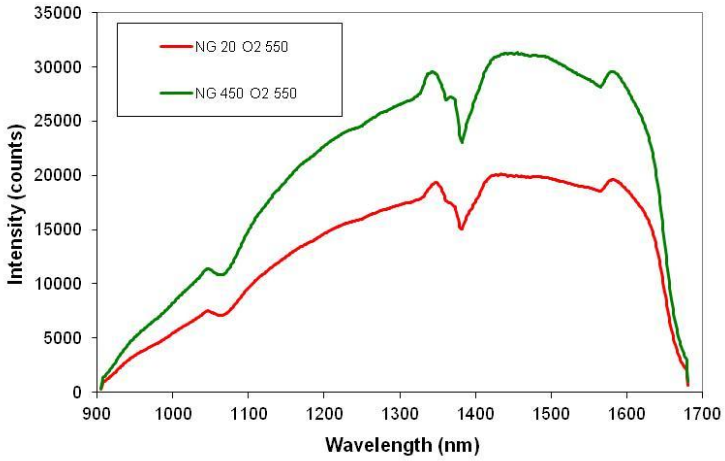



Fig. 1. Spectral emissivity of flame root



# Background (Cont.) : 10 years of experience

- One challenge of heat recovery project at the beginning was related to the evaluation of the preheated oxygen/natural gas hazards.
- Main risks :
  - Ignition & Flame propagation:
    → Promoted combustion study
  - Corrosion:
    → Long term exposure tests
    → Cyclic oxidation state

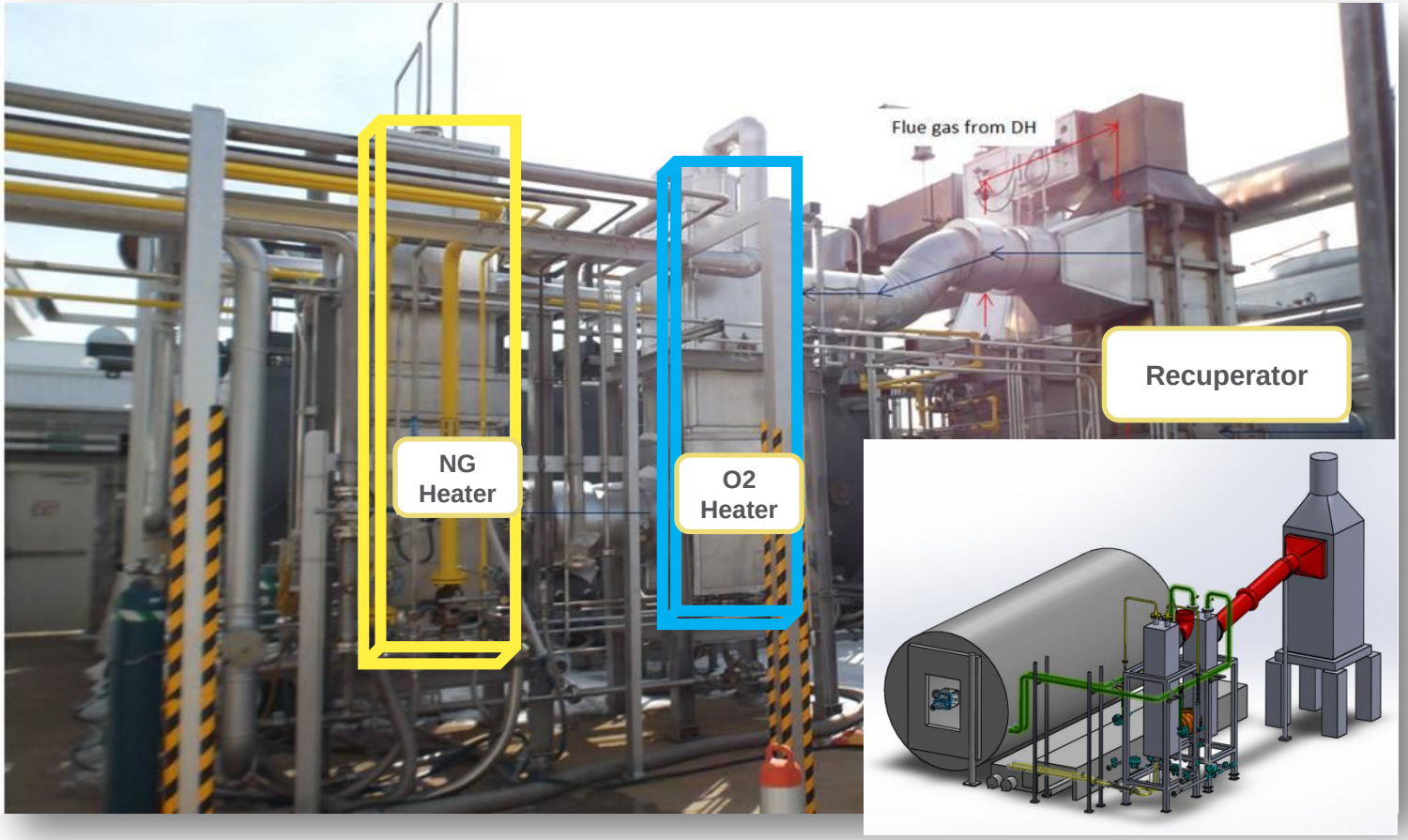
*Fig 4: Promotion Ignition Test*

➡ Material :

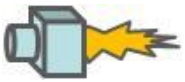
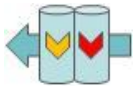
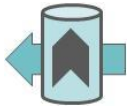
- ❖ Specific design / Material selection / Flange design / Dedicated gaskets and leaks control / Design of oxygen equipments / Procedure
- ❖ Automatic control and regulation of reactants temperature
- ❖ Manufacturing process for the heat exchangers

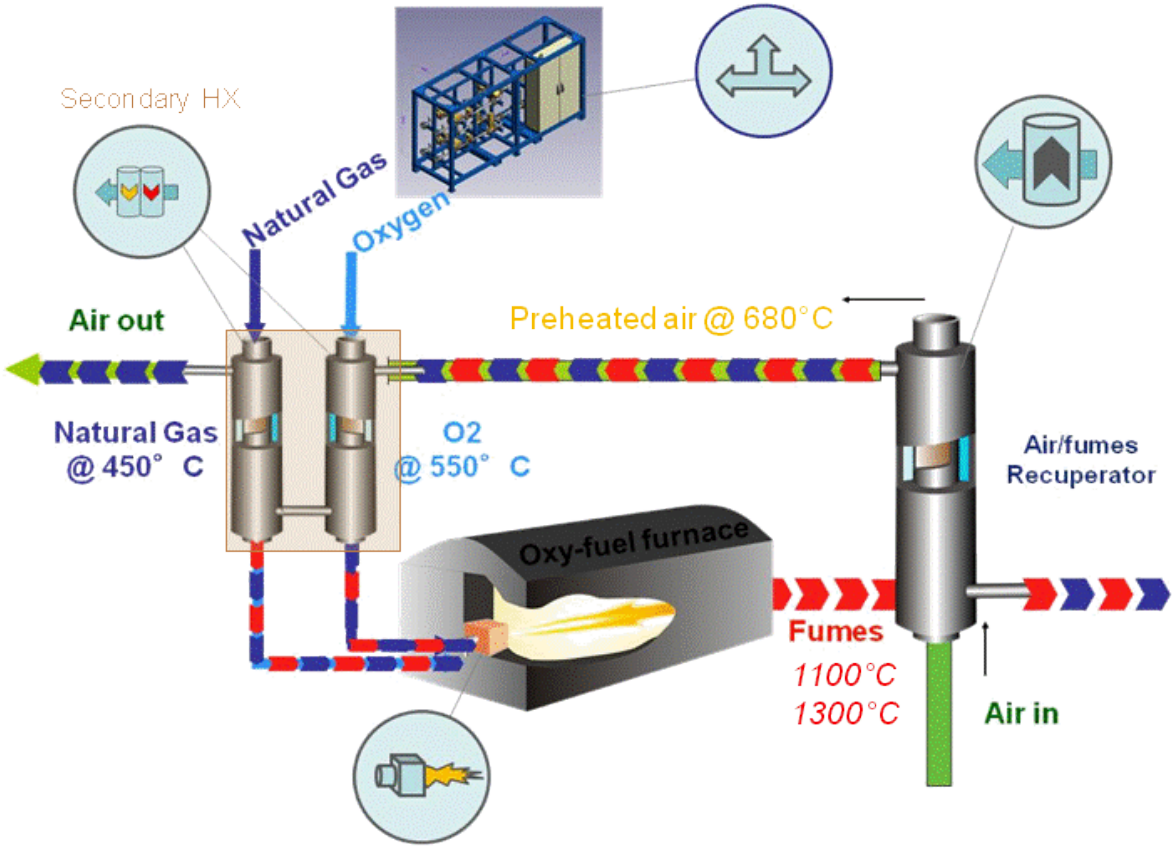
# Background (Cont.) : 10 years of experience

- **HeatOx Platform** – USA: fumes heat recovery & reactant preheating
- **1-2MW burners**
- **Heaters with temperature control schemes**



# HeatOx: Features

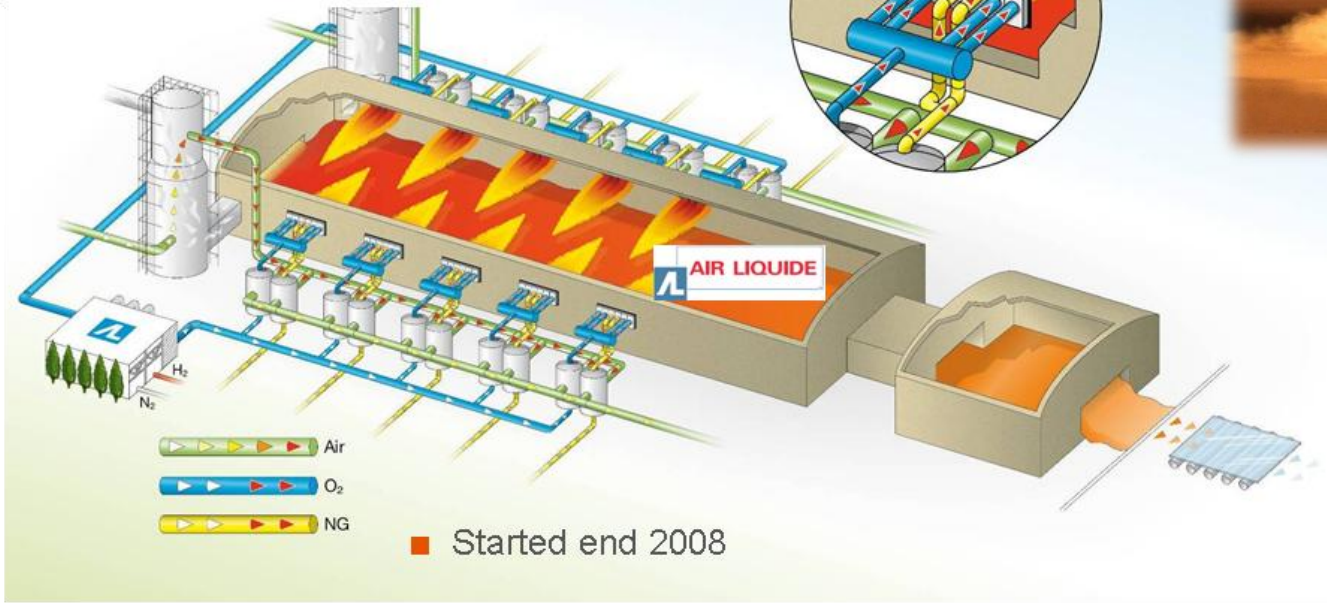
| Components | Item |
|---|---|
|  | Burners |
|  | Valve train |
|  | O2/NG Heaters |
|  | Heat recuperator |
|  | Engineering, installation and integration |




✓New Patented AL Technology: Oxygen preheating in glass melting

# **HeatOx** : Proven on float glass

- Air/fumes recuperator
- Air/Reactants exchangers
  - Oxygen T ~ 550°C
  - Gas T ~ 450°C
- ALGLASS SUN burner

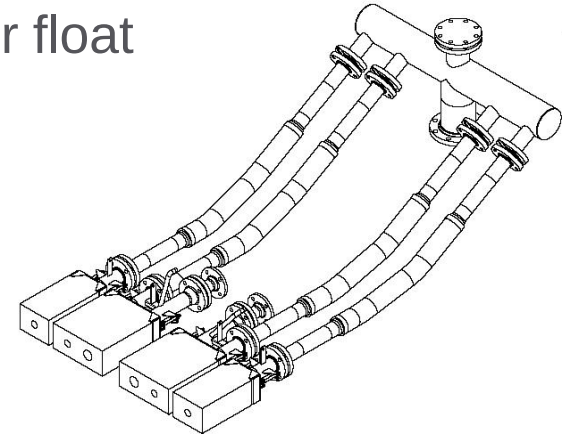



- Started end 2008

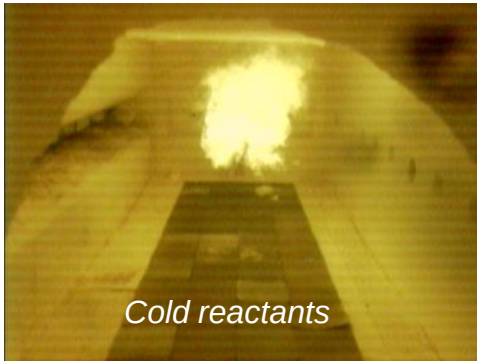
- **HeatOx** 20 to 25% fuel saving is validated with **two** float glass tanks.
  - Burner ALGLASS SUN HeatOx
  - Parallel hot air flow distribution & 2 secondary HX per burner

# HeatOx : Proven on float glass

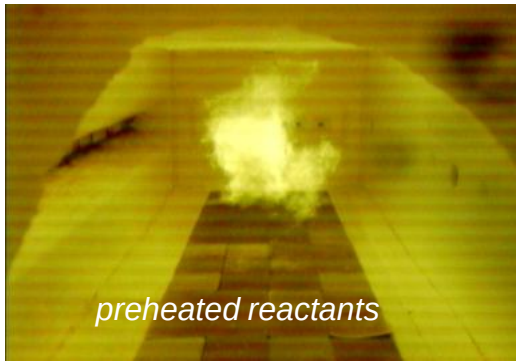
- Highly separated jets burner adapted to HeatOx for float
  - Long and wide flame
  - Ultra low Nox (~ 0,1 kg Nox / t SLS glass)
  - Highly flexible
    - Bi-fuel (oil & gas)
    - Easy to implement (multi-block design)
    - Compatible with air (back-up)
    - Variable flame length with dispatching of O2 flow
    - High turndown ratio (50-150% of nominal power)
    - Large capacity: 0,5 – 1 – 2 – 4 MW
  - Manage hot & cold reactant



*ALGLASS SUN Burner schematic view*



*Cold reactants*

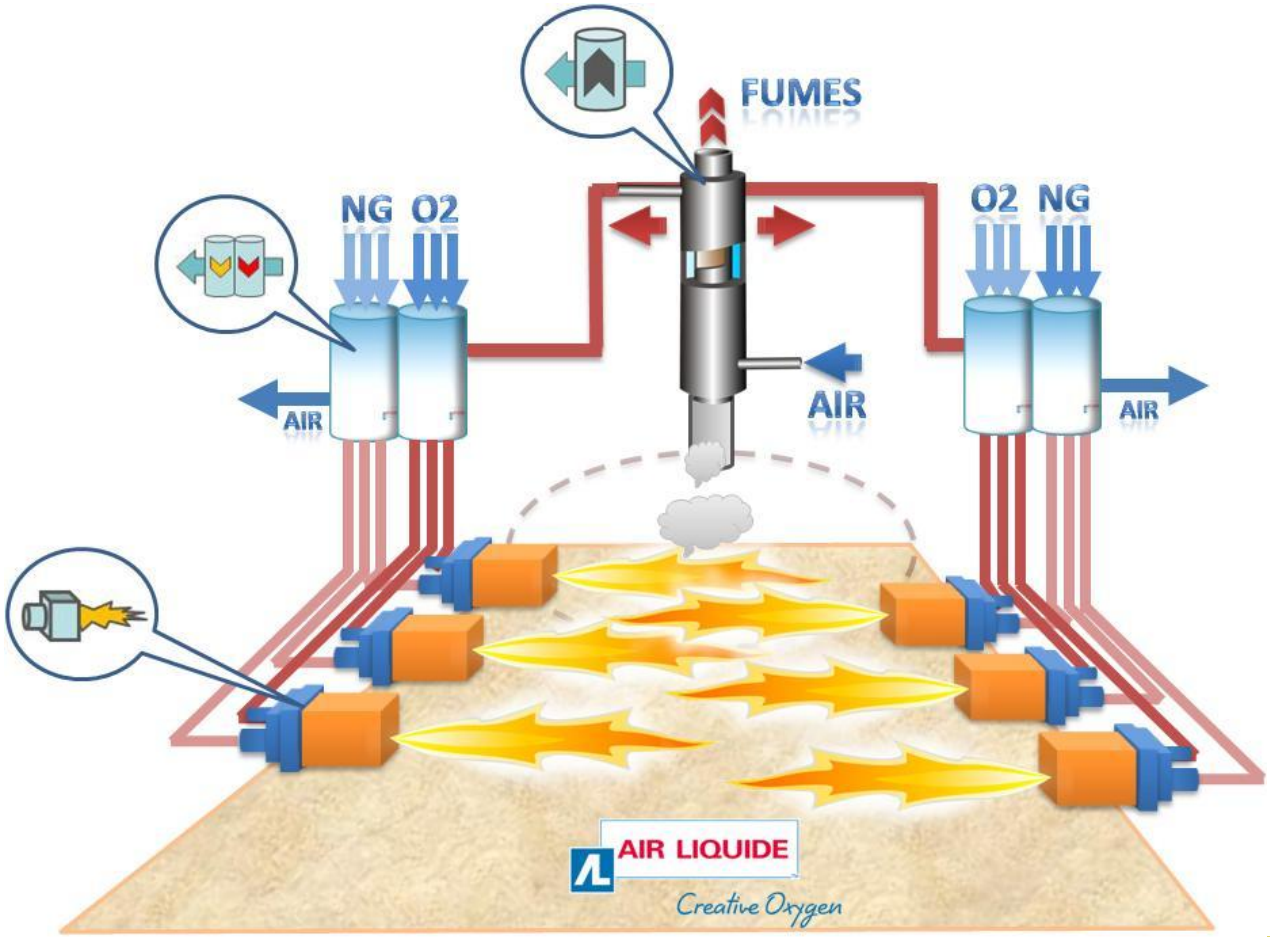


*preheated reactants*

# ALGLASS HeatOx for small-medium size furnaces

**HeatOx** tailored for **mid-size furnaces (50-300tpd)** as glass packaging or fiber furnace.

**ALGLASS FC Burner** managing **cold & hot reactants**
**Heat exchangers** which could **feed multiple burners independently**



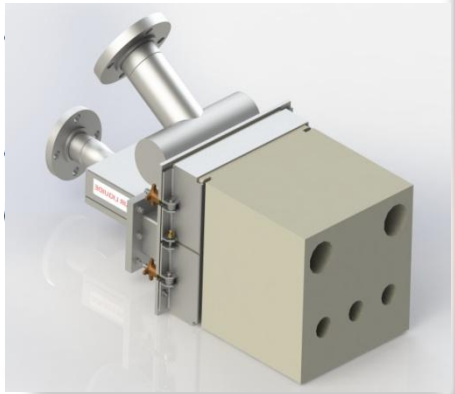

# New HeatOX

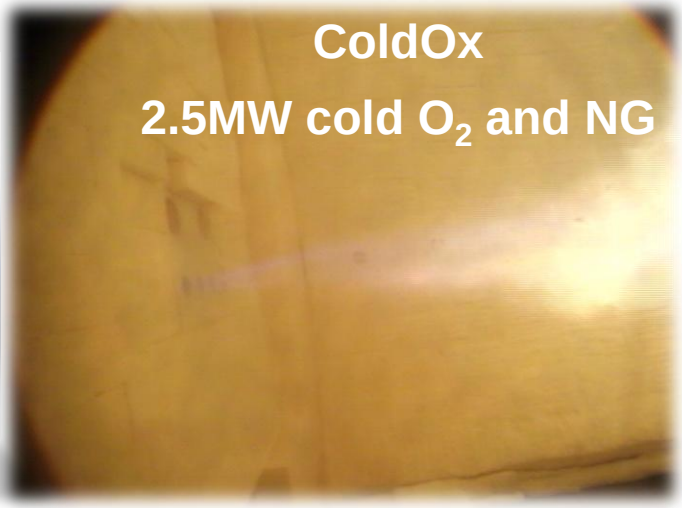
- **New Patented AL Technology**: Oxygen preheating in glass melting for small/medium furnaces
  - One heat exchanger (O2/NG) can accommodate multiple burners (patent pending)
  - Flowrate and temperature can be controlled individually (patent pending).
  - CAPEX savings and smaller footprint
  - ALGLASS FC upgraded for preheated reactant

# ALGLASS HeatOx solution for small/medium furnaces

## ALGLASS™ HeatOx burner

- Compact and operable with **hot Oxygen** and **hot Natural gas**
- Automatic setting from cold to hot reactants (*patent pending)*
- Constant flame length (~3m)
- Could be operated with Hot Air back up
- NOx level under 200ppm at any given power.





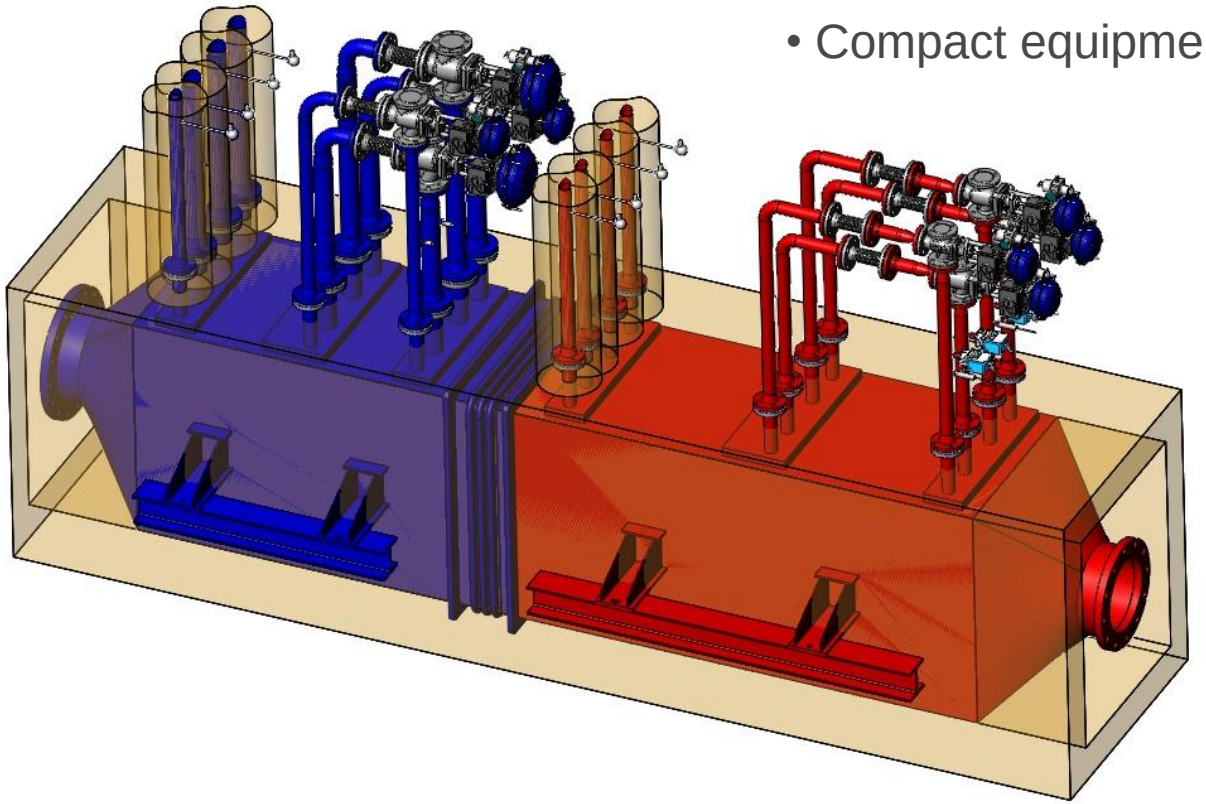


**From 500kW to 4MW - NOx emissions : 0.3kg / t glass -Particulate emissions < 0.2kg / t glass**

# ALGLASS HeatOx solution for small/medium furnaces

## ALGLASS™ HeatOx O2 & NG heaters station

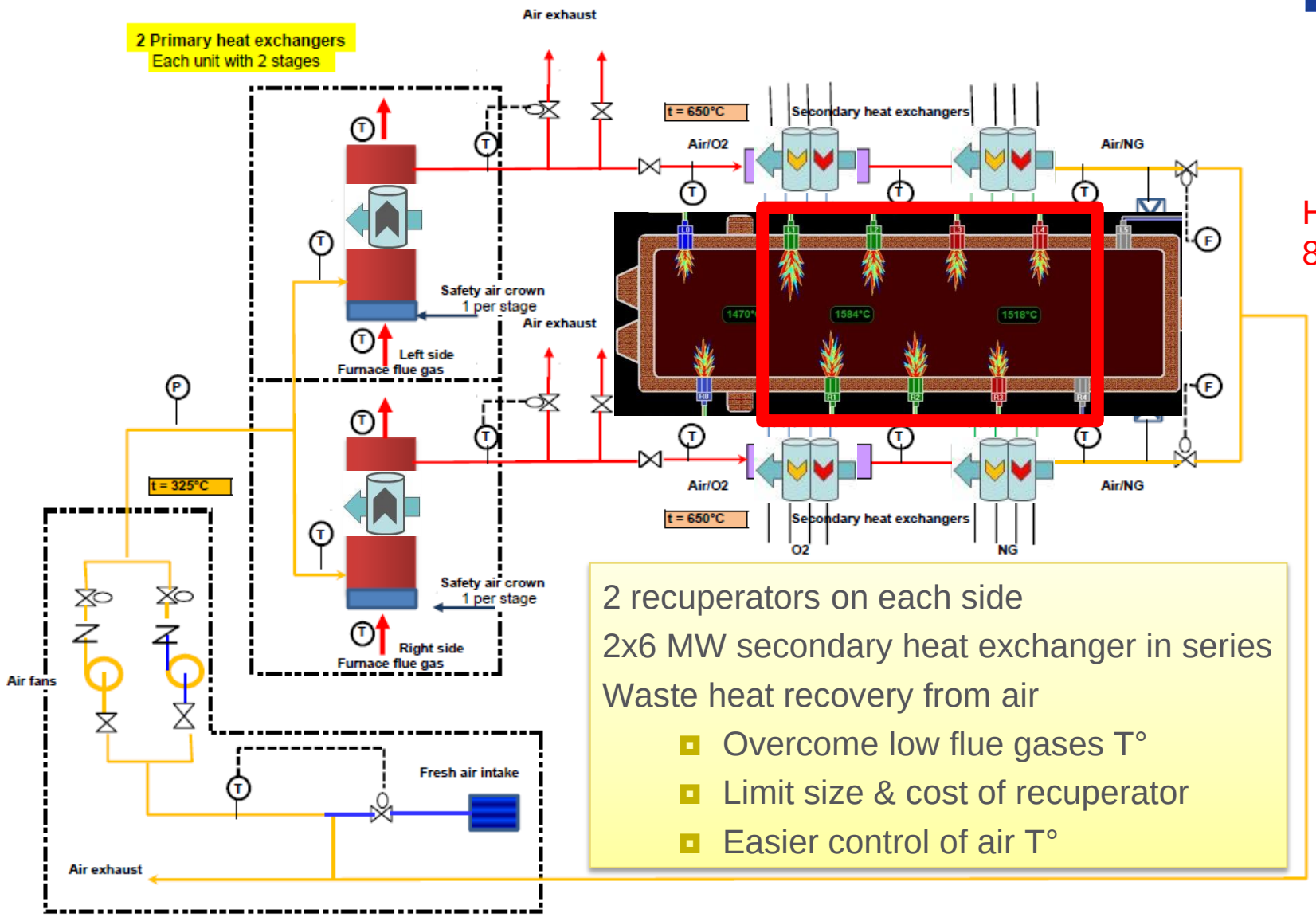
- Independents lines
- Special material for hot reactant
- By-pass valve for NG & O2 outlet T° control
- Instrumentation for process & safety control
- Compact equipment



# LIFE+ Eco-HeatOx ŞIŞECAM

- LIFE+ Eco-HeatOx a project granted by LIFE European commission
- Demonstration of the operation of a full industrial facility with the new Burner and Heat Exchanger at Trakya plant Bulgaria
- Process benefit targets
  - Reduction of GHG emissions linked to tableware glass production: **20% less CO2 and 90% less NOX**
  - Increase of thermal efficiency in tableware glass plants**: 20%**
- Status of project
  - Start-up of furnace (ColdOx) in 2014
  - Detailed design of HeatOx process & heat exchangers done
  - Manufacturing of equipment on-going
  - One HeatOx FC burner already in operation with cold reactant
  - Installation on-fly and start-up in Sept 2015

# LIFE+ HeatOx ŞIŞECAM : Process scheme




HeatOx on
8 burners

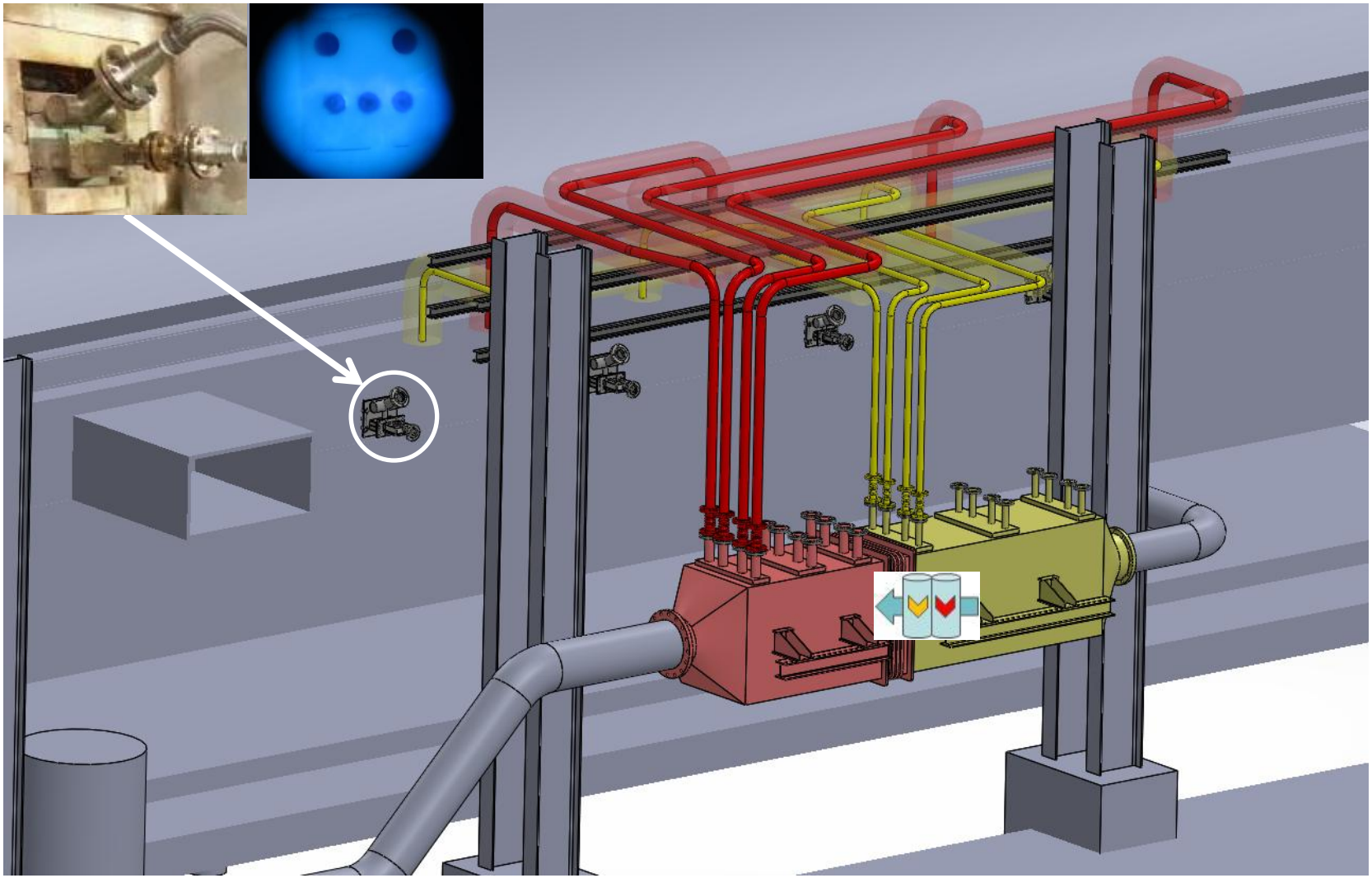
2 recuperators on each side

2x6 MW secondary heat exchanger in series

Waste heat recovery from air

- Overcome low flue gases T°
- Limit size & cost of recuperator
- Easier control of air T°

# LIFE+ HeatOx ŞIŞECAM : Implantation



# Customer benefits

1. Reduction in energy costs:
   - Electric boosting for glass melting, Fuel and Oxygen
2. Flexible energy sourcing
3. Limited additional CAPEX with less than 3 year payback
4. Compliance with new environmental regulations
5. Reliable suppliers capable of offering complete solutions
6. Energy performance commitment

# Thank you

Please visit our website : *www.**ecoheatox**.com*