

# nexelia HEAT-OXYCOMBUSTION

Driving performance to the next level  
ICG Shanghai 2016



# Heat Oxy-Combustion to contribute to COP21

On the occasion of the COP21, **Heat Oxy-combustion** energy-efficient technology was **awarded** at the conference on climate change in Paris.

## 2015 Innovation Award focused on 'Climate Solutions'

The European Commission supports this technology development through the Life+ program.

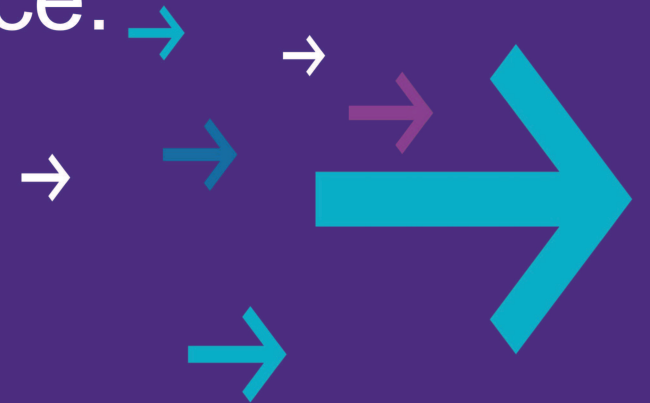


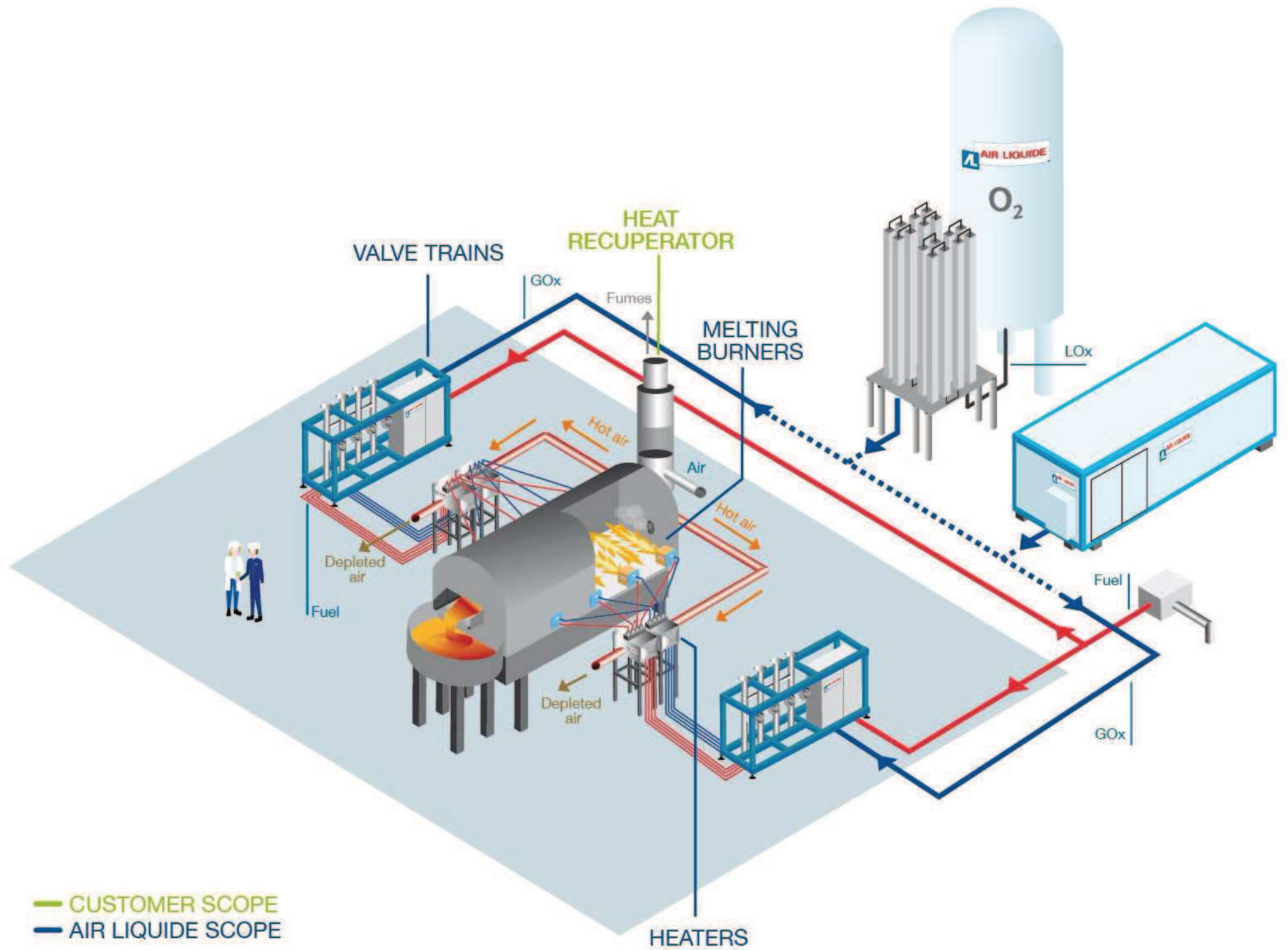
Companies have chosen and contributed to the development of the technology.

# Powerful features behind a simple idea

Recover energy from flue gases to preheat oxygen and fuel

.Add up to 14% additional efficiencies to oxy-combustion performance.



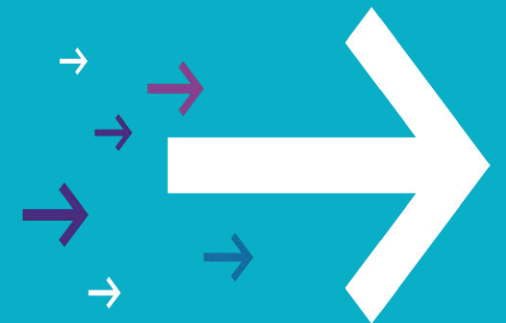


— CUSTOMER SCOPE  
— AIR LIQUIDE SCOPE

## FOR MELTING - HEAT OXY-COMBUSTION

It consists in preheating oxygen and fuel at high temperature thanks to the exhaust fumes generated by the combustion

Through a recuperator, the fumes pass on heat to air flow and then air to the oxygen and fuel



# HeatOx efficiency

Additional Savings vs cold oxy combustion :

- Reactants enthalpy → -6.3 % to -7 %
- Less fumes flow (-7.5% mass flow) → -2.2 % to -2.5 %
- Higher flame emissivity / Fumes T decreasing (-50°C) → -1.5 %
- Discharged hot-air after the oxygen/natural gas heaters used ( fibres drying, heating buildings, electricity production) → -1.5 % to -3%

From curenly 10% to up to 14%

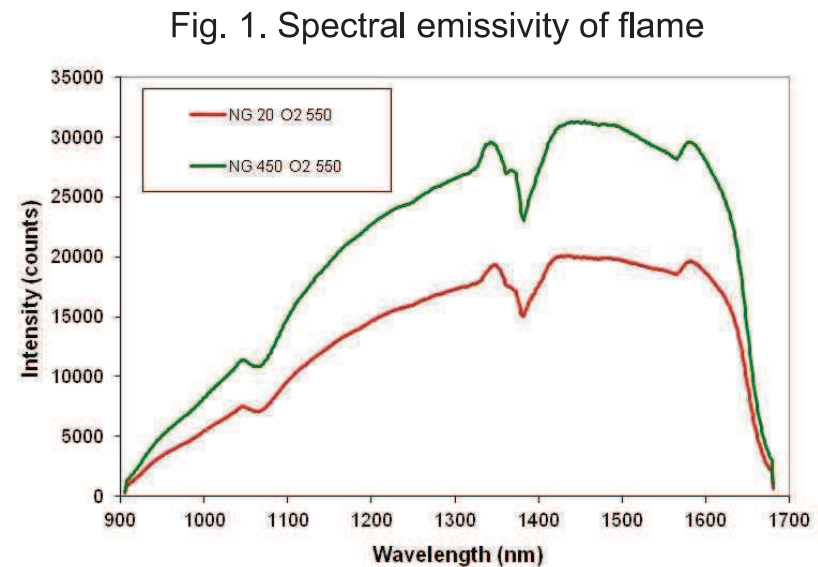
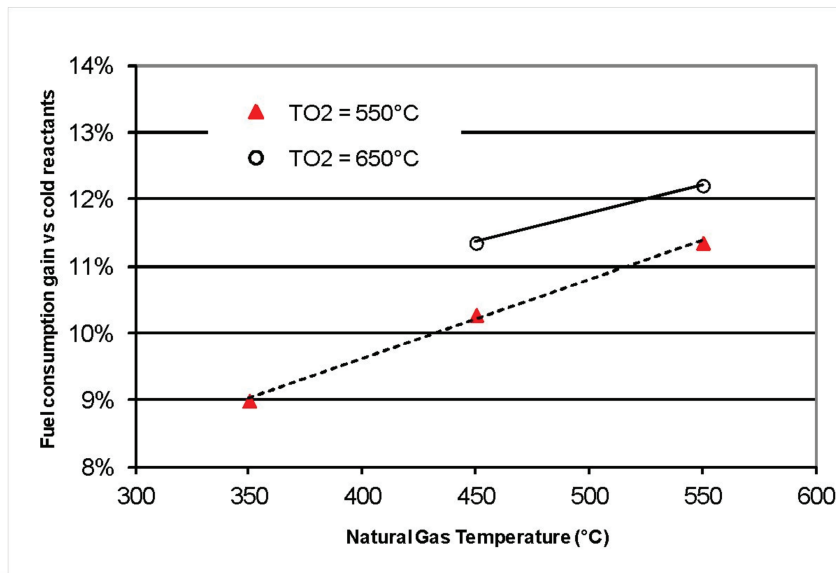


Fig. 1. Spectral emissivity of flame

# Our Commitment for Performance

## BENEFITS

(vs air combustion)

- **Energy:** Up to 40% savings
- **CAPEX:** 10-40% less for furnace construction or refurbishment
- **CO<sub>2</sub>:** Up to 40% less emissions
- **NO<sub>x</sub> :** Up to 90% less emission

## BENEFITS

(vs oxy-combustion)

- **Energy:** 10% additional savings compared to oxy combustion w/o preheating
- **CO<sub>2</sub>:** 10% less emissions
- **NO<sub>x</sub> :** Up to 90% less emissions

# And safety !

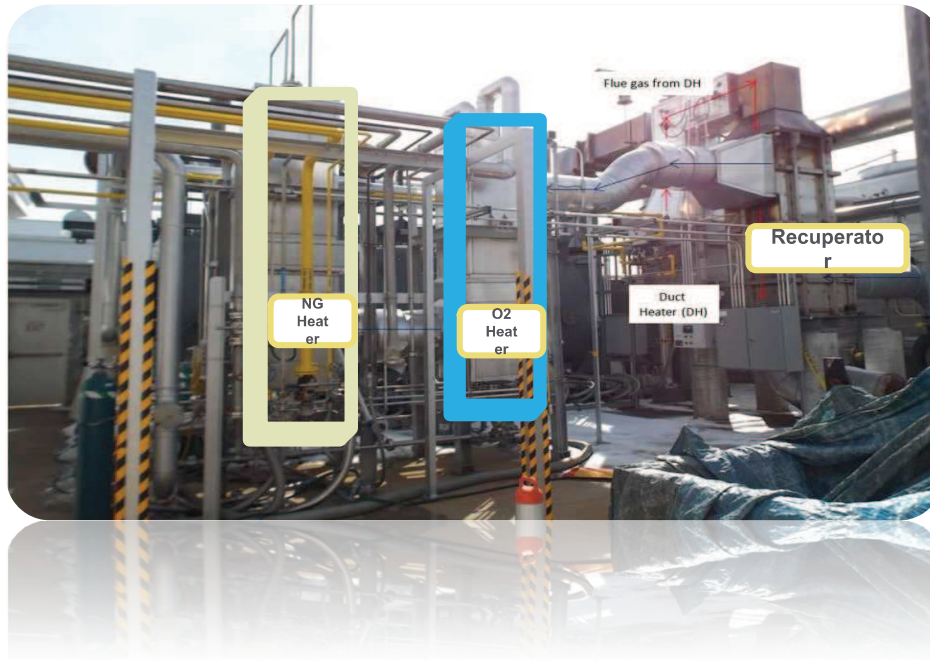
... How to deal with Hot reactants safely?





# Background (Cont.) : 10 years of experience

HeatOX Platform - USA



HeatOX lab - France



- Evaluation of the preheated oxygen/natural gas hazards.

For more than 10 years, various materials had to be tested for cyclic oxidation, ignition and flame propagation with hot oxygen, as there was no industrial standard for hot oxygen-compatible materials (>200°C)

# LIFE+ Eco-HeatOx ŞİŞECAM



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 Pasabashe plant Bulgaria

- Process benefit targets

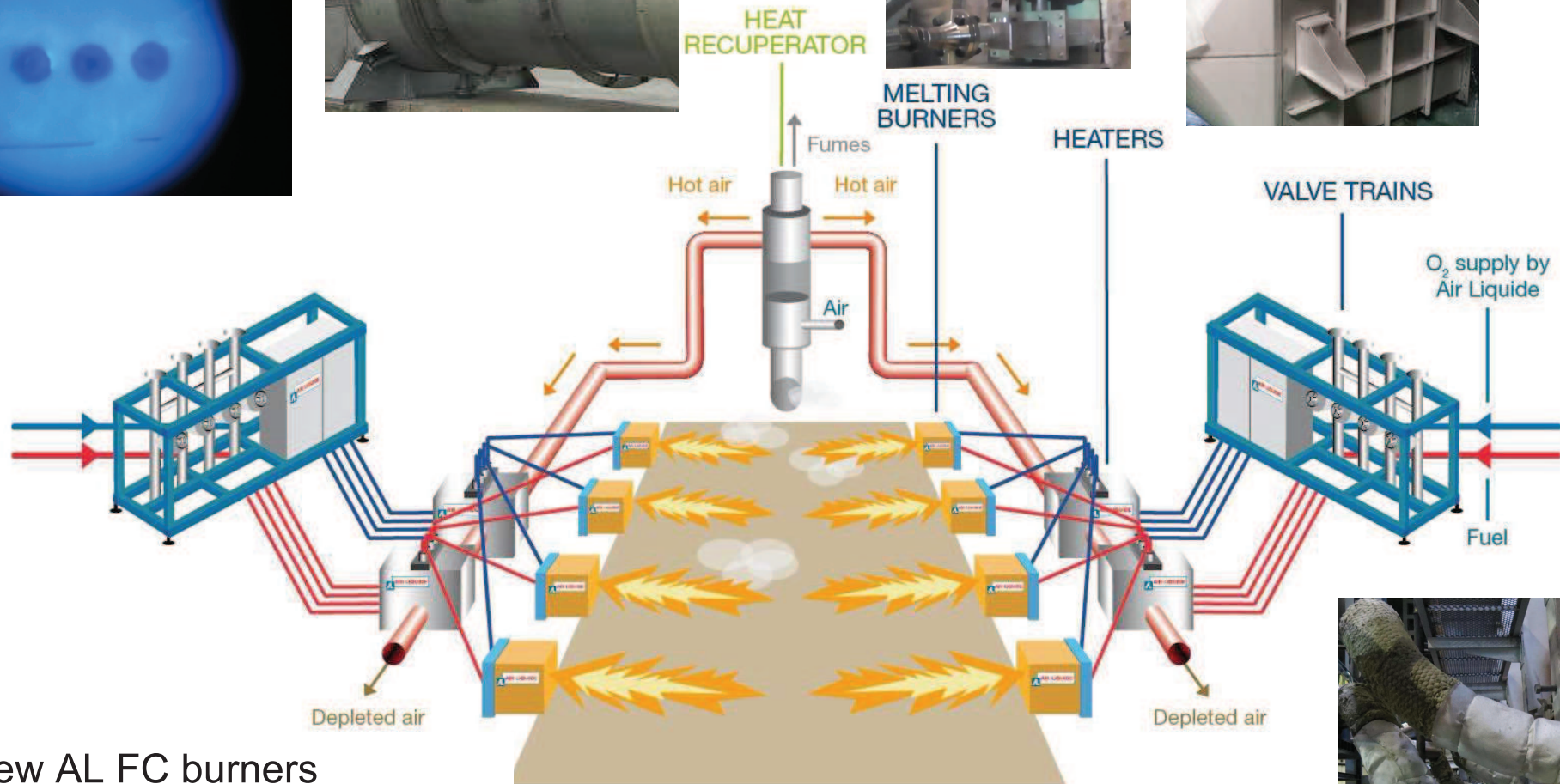
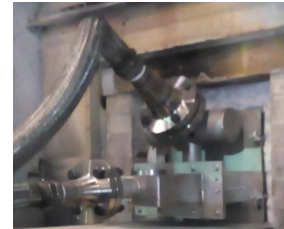
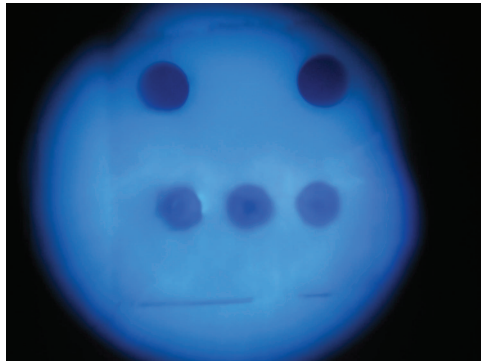
Reduction of GHG emissions linked to tableware glass production:

**20% less CO2 and 90% less NOX**

Increase of thermal efficiency in tableware glass plants: **20%**



# Heat Oxy-combustion solution for glass furnaces

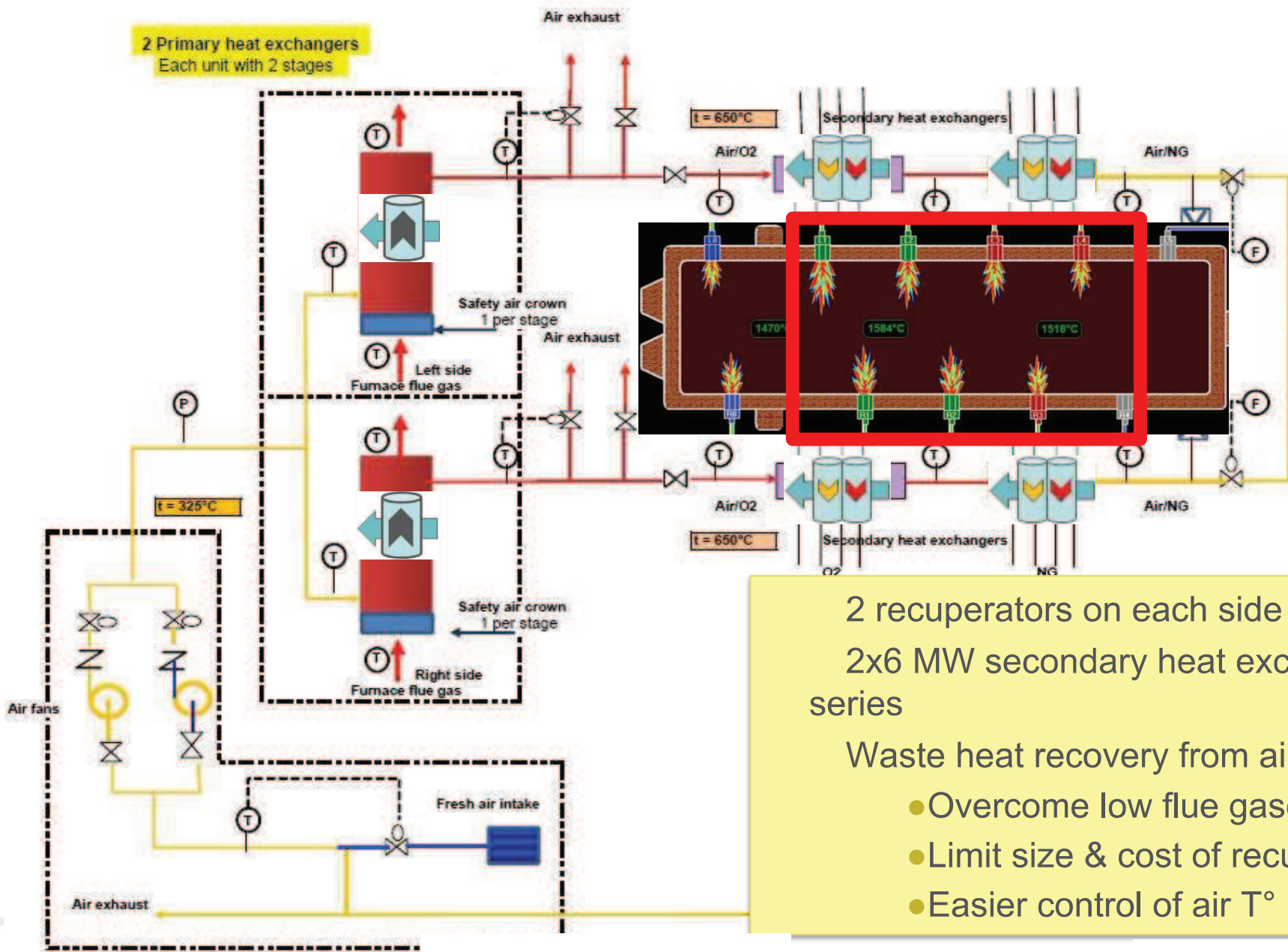


- ✓ New AL FC burners
- ✓ New AL O2 & NG Heaters

# LIFE+ HeatOx ŞİŞECAM : Process scheme



HeatOx on 8 burners



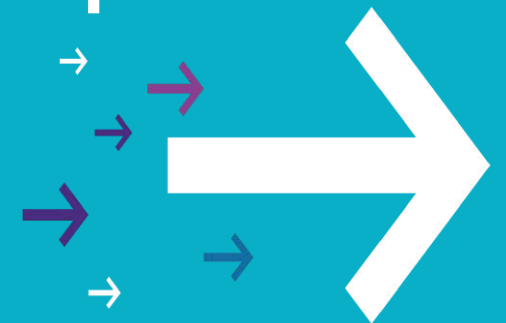
2 recuperators on each side  
 2x6 MW secondary heat exchanger in series  
 Waste heat recovery from air

- Overcome low flue gases  $T^\circ$
- Limit size & cost of recuperator
- Easier control of air  $T^\circ$

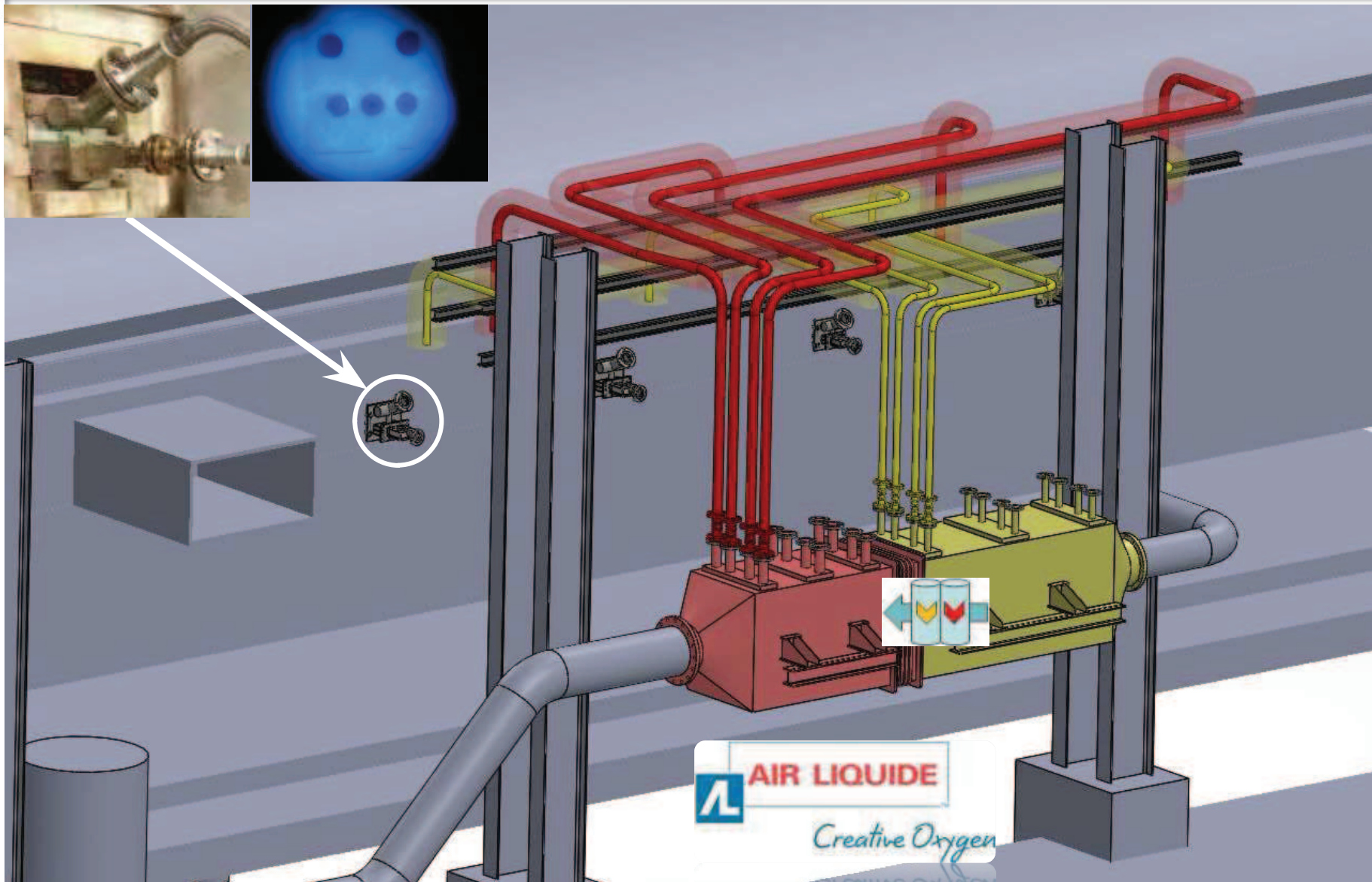
# New patented technology for small/medium furnaces

- **One heat exchanger (O<sub>2</sub>/NG) can accommodate multiple burners**
- **Flowrate and temperature can be controlled individually**
- **New HeatOx FC burner**

 **CAPEX savings and smaller footprint**

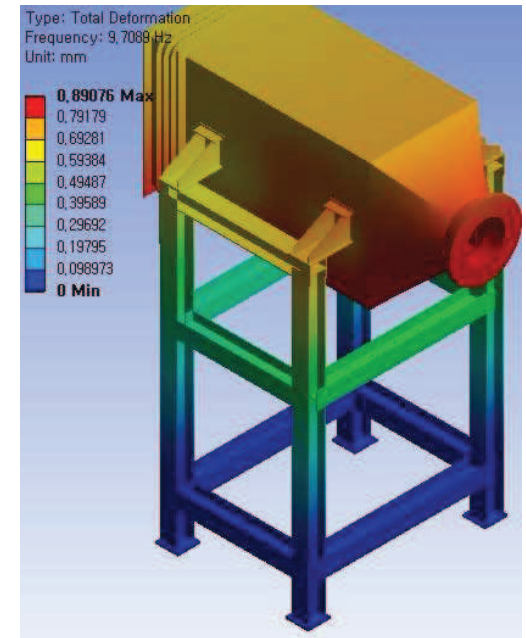
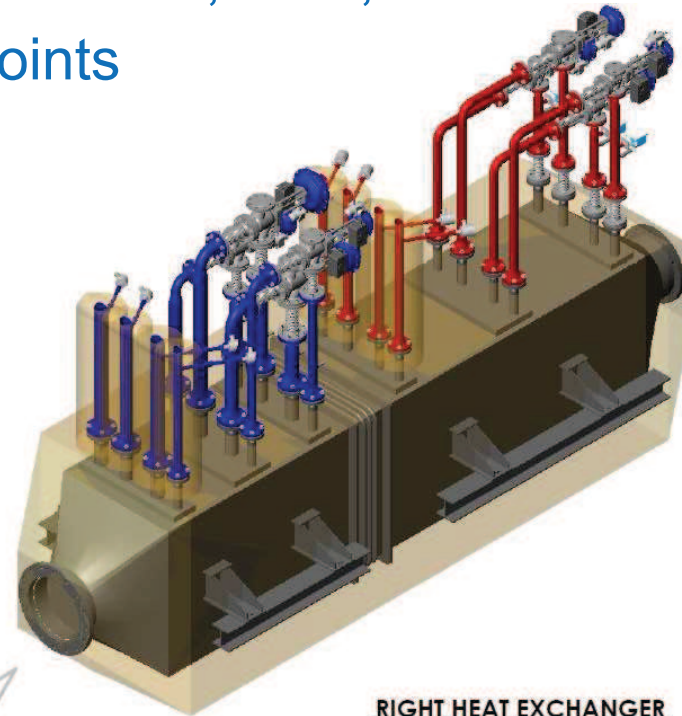


# LIFE+ HeatOx ŞİŞECAM : Implantation



# NG & O2 Heaters

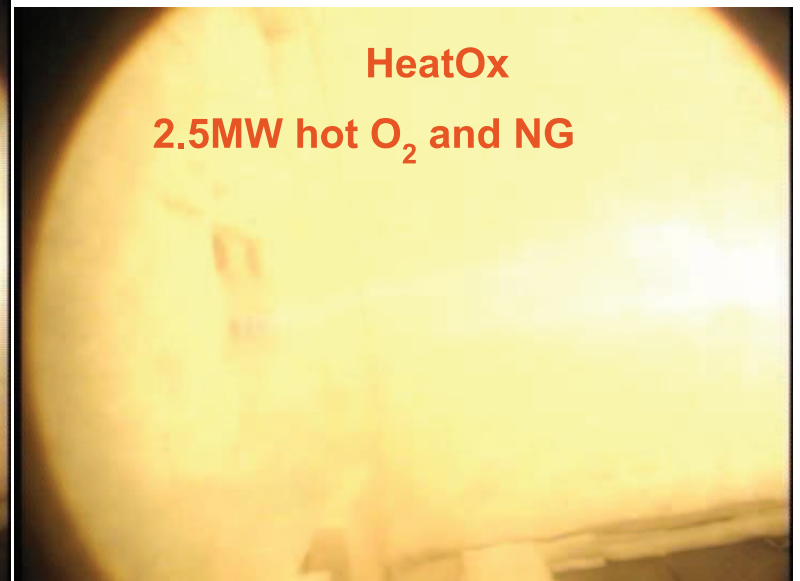
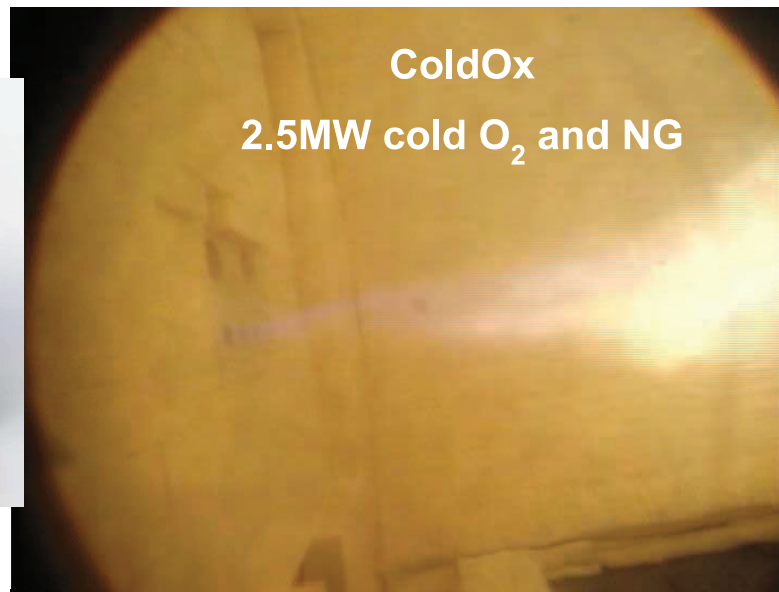
- 2 sets of Heater station by AL
  - Left [O2 & NG] Heaters for 5 burners
  - Right [O2 & NG] Heaters for 4 burners
  - Supporting frame (inc. stress analysis for civil works)
  - 3-way diverting valves for independent T° control by burner
  - Instrumentation: PT, PSH, TC for safety & control
  - Expansion joints



# HeatOx solution for glass furnaces

## HeatOx burner

- Compact and operable with **hot Oxygen** and **hot Natural gas**
- Enable to operate cold reactants too (automatic setting) for safety concern *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



HeatOx - Trakya Glass, August 2015



## Status of the project

Start-up of furnace (ColdOx) in 2014

Start of the implementation of the HeatOx equipment on summer 2015

First Start up end of 2015

Running and optimization Q1-16

Performance qualification and report submission of the port Q2/Q3 16

# Proven today – even better tomorrow

## Three industrial references:

Paşabahçe Bulgaria EAD, AGC France and AGC Czech Republic.

– have validated the concept of preheating oxygen to 550°C and natural gas to 450 °C for oxy-fuel combustion.

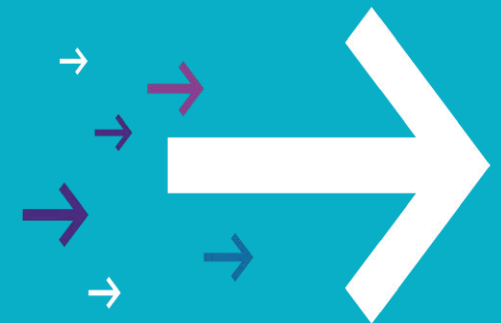
Heat Oxy-Combustion is rapidly improving in both efficiency gains and competitive equipment cost.

Additional energy-recovery systems with discharged hot-air line :

- organic Rankine cycle
- Drying fibres
- heating buildings of the plant and warehouse.

# In conclusion

- Proven technology
- Reduction in fuel and oxygen and 10% in CO<sub>2</sub> compared to traditional oxy-combustion
- Significant reduction in NOx
- To meet the growing needs and challenges of the glass industry



# Thank you

Please visit our website : [www.ecoheatox.com](http://www.ecoheatox.com)

The screenshot shows the Eco-Heatox website interface. At the top left are the AIR LIQUIDE and SISECAM logos. To the right are search and language selection boxes. Below the logos is a banner image of people in a factory setting and various glassware. A blue navigation box on the right lists 'SISECAM' and 'Air Liquide' with their respective website URLs. The main content area is titled 'Welcome to Eco-Heatox' and describes a project funded by the LIFE European Commission. It lists two challenges: decreasing energy consumption and reducing greenhouse gas emissions. A 'Contact' section is visible at the bottom left of the main content area.

**Information ...**

**Eco-heatox**

Project funded by European commission for helping industry to reduce its environmental footprint.

**Contact**

**Welcome to Eco-Heatox :**

**A project granted by LIFE European commission aiming at demonstrating at industrial scale the environmental benefits of an R&D innovation.**

For making glass, two primary materials are necessary : sand and energy. In Europe, tableware and container glass factories are facing two challenges :

- decreasing energy consumption to be more competitive
- reducing greenhouse gas emissions

Traditionally, energy is provided by burning natural gas with air to get a temperature that is able to transform sand into hot glass ready to be moulded. Oxycombustion that uses pure oxygen instead of air (only 21% oxygen) is a proven efficient way to reduce fuel consumption and therefore to lower production costs.

LIFE Eco-Heatox project goes one-step beyond as it uses a part of the fumes heat of the oxycombustion in order to preheat natural gas and oxygen at 450°C. This energy recovery reduces again natural gas consumption and greenhouse gas emissions.