Eco-HeatOx: A Novel Method to Exploit Waste Heat in Oxy/Fuel Furnaces

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- Development of Heat Recovery Technology for Oxy/Tableware Furnace
- Expected Industrial Results

Energy Consumed in Glass Making

	GJ/ton
Container	5-9
Flat	6-10
Tableware	8-15
Fiber	17-25

- Glass melting- energy intensive activity
  - ✓ Consumed energy in a melting furnace- 55-85% of the puchased energy
- CO_2 emmission-in proportion to production rate and the fuel quantity used
  - ✓ decomposition reactions of raw materials(Soda Ash, Dolomite&Lime)-30%
  - ✓ fuel(natural gas)-70%!
- Fuel saving offers an important potential to reduce CO_2 emmission

Waste Heat Potential in Oxy/Combustion

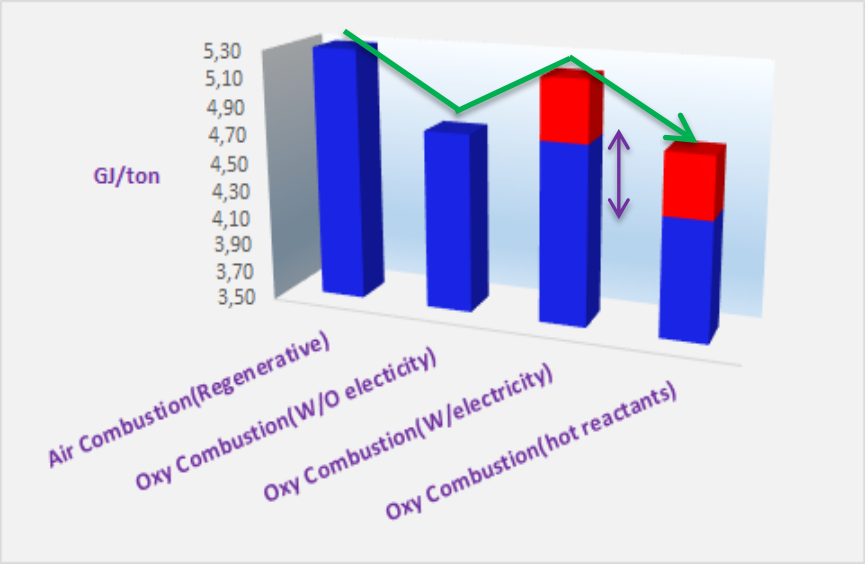
- Oxy/Combustion offers an increase in thermal efficiency over a regenerative melting system-no parasitic nitrogen in oxidant
- It still has a considerable waste heat recovery potential even with the 1/4th of the flue gas volume of a Air/Combustion-higher enthalpy
- High temperature flue gas containes higly radiative tri-atomic CO_2 and H_2O molecules-better heat transfer

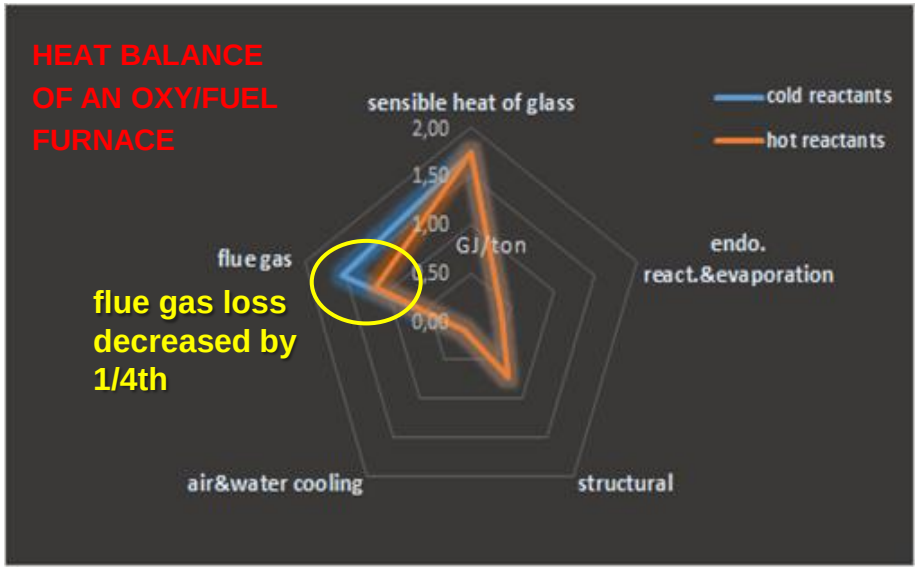
	Available Heat (%)	Flue Gas Temperature (^oC)	Heat Content of Flue Gases (GJ/ton)
Oxy/Combustion	78	1250-1300	~1.3
Air/Combustion	72	400-450	~1.3

Waste Heat Recovery From Flue Gases

- Steam generation
  - ✓ Space heating/electricity generation-cyclic demand and high CAPEX
- Direct preheating of raw materials&cullet
  - ✓ Very high CAPEX
  - ✓ Up to 250-300^{o}C
  - ✓ Up to 15% energy savings
  - ✓ Applications limited to container furnaces
- Termochemical recuperator
  - ✓ Nascent technology for glass furnaces-validation needed!
- Preheating of reactants(natural gas&oxygen)
  - ✓ Successfully applied to an oxy/fuel float

Waste Heat Recovery: Pathway To Low Carbon





- Oxy combustion thermal efficiency is 8-10% higher than air combustion
- Net efficiency gain over a regenerative system is 1.5-2% if electricity used in O_2 production is taken into account-net reduction in CO_2 much less than the thermal efficiency gain!
- Recovering waste heat by preheating the reactants reduces CO_2 in direct proportion to the fuel saved!
- Recovered energy- identical to the energy consumed for O2 production!

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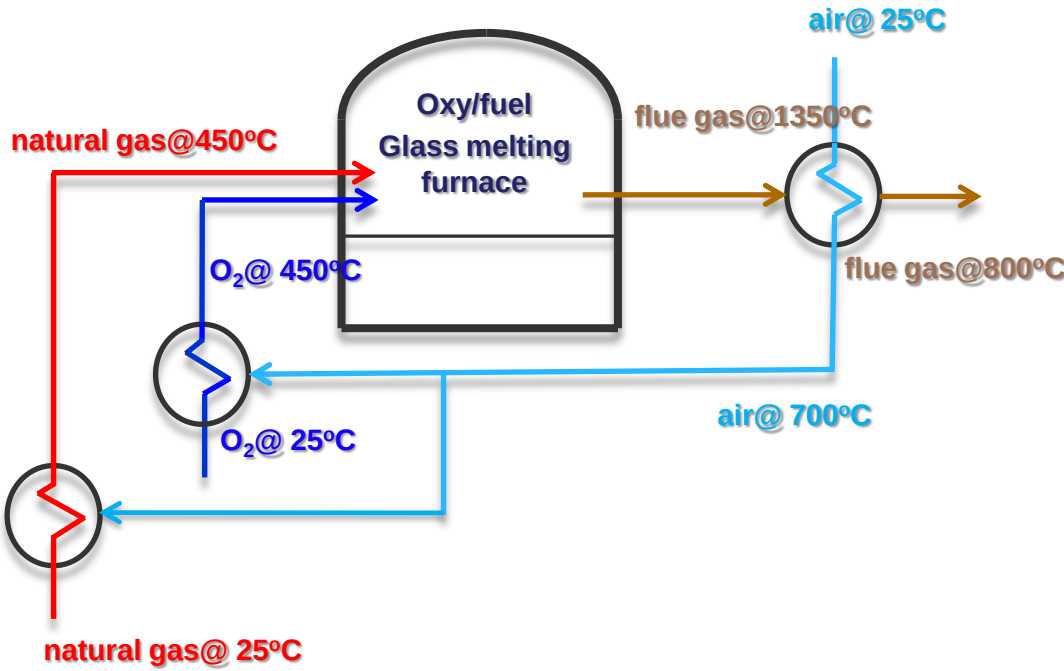
Concept of Heat Recovery in an Oxy-Fired Furnace

- High enthalpy of the flue gas allows air to be heated up to 650-700°C in a metallic recuperator
- Hot air is then used to preheat the natural gas &oxygen up to 450°C in specially developed heat exchangers- safe operation!
- For every 100°C increase in reactant temperature saves 1% energy- 1% less CO_2!



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ALGLASS™

Give sustainability to your performance

Life Eco – HeatOx
LIFE12ENV/BG/000756

Demonstration and validation of a heat recovery packaged solution for decreasing oxy-glass factories' environmental impact

Overview of LIFE+ Eco-HeatOx Project

- **PROJECT LOCATION: TARGOVISHTE (BG)**  **and PARIS (FR)** 

- **BUDGET INFORMATION:**
  Total amount: 4,329,349 €
  EU co-funding: 1,689,986 €

- **DURATION:**
  Start: 01/07/2013 - End: 31/12/2016

- **PROJECT'S IMPLEMENTORS:**
  Coordinating Beneficiary:
  - ✓ Trakya Glass Bulgaria EAD (BG)

  Associated Beneficiary:
  - ✓ Air Liquide S.A. (FR)

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Project Summary

➢ CONTEXT

Oxy-combustion and heating recovery has already allowed a decrease of the environmental impact of the large glass furnaces; lower impact for the environment for small and medium size furnaces can be ensured in terms of:

- Energy efficiency (Treaty of Lisbon, which promotes energy efficiency and saving);
- GHG emissions: (Kyoto Protocol and related Council Decision 2002/358/EC)

➢ PROJECT OBJECTIVES:

« Full Scale » demonstration on a pilot onsite in Targovishte and validation of the efficiency of the innovative technology, which allows recovering energy from flue gases to pre-heat the reactants thanks to innovative heat exchangers and burners for small and medium size furnaces

➢ EXPECTED RESULTS

➢ Reduction of pollutant emissions:

- CO_2: specific emissions reduced by 23% (compared to air comb. using a regenerative heat exchanger)
- NO_x: specific emissions reduced by 90% (NO_x are indirect GHG and are also involved in acid rains)

➢ Reduction of Energy consumption:

- 23% of natural gas saved compared to air combustion (9% compared to cold oxy-combustion)
- 1,052,000 kWh a year saved in oxygen production (54,272 tons of oil equivalent)

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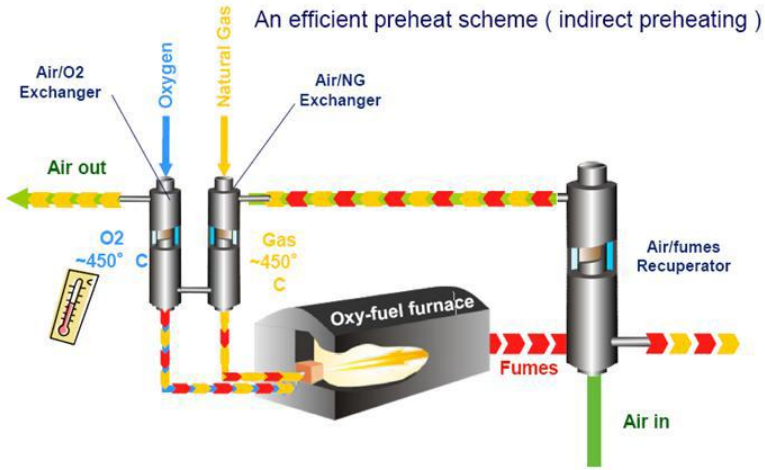
Project Objectives

	Eco-HeatOx vs. Air Combustion	Eco-HeatOx vs. Oxy Combustion
Energy Consumption(GJ/ton)	-23%	-9%
O_2 Consumption(Nm^3/h)	-	-9%
Dust(kg/ton)	-62%	-
NO_x(kg/ton)	-90%	-
CO_2 (kg/ton) combustion	-23%	-9%
CO_2 (kg/ton) raw materials	-	-
Total CO_2 (kg/ton)	-15%	-6%
CO_2 (kg/ton) O_2 prod.	-	-8%
Total CO_2 (kg/ton) process	-12%	-6%



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Project Status

- Installation at Trakya Glass Bulgaria is underway
- Industrial demonstration under LIFE+ will start-up in 2015

Official LIFE+ Board On-site

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