



LIFE Smart Oxy-Boost - LIFE17 CCM/BG/000069

LIFE Smart Oxy-Boost

Smart oxygen boosting for reducing energy consumption and emissions of glass melting furnaces

Layman's Report



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Project Details

PROJECT TITLE: Smart oxygen boosting for reducing energy consumption and emissions of glass melting furnaces

DURATION: 1st July 2018 – 31th December 2021

EU FINANCIAL CONTRIBUTION: 884,693€

SECTOR: Climate Change Mitigation

PROJECT COORDINATOR: Trakya Glass Bulgaria

Partners



With the contribution of the LIFE Programme of the European Union
LIFE Smart Oxy-Boost - LIFE17 CCM/BG/000069

LIFE Smart Oxy-Boost Project

LIFE Smart Oxy-Boost project is led by Trakya Glass Bulgaria EAD, subsidiary of Şişecam Group, in collaboration with Air Liquide. This project, registered as **LIFE17 CCM/BG/000069**, was funded by the European Commission within the LIFE programme. It started on July 1st, 2018 to end in December 31st 2021.

Project Objectives

The project aims to contribute to the implementation of the Industrial Emissions Directive and the Paris Agreement, as well as the possible implementation of a new industrial policy strategy.

Specifically, while increasing productivity by **15%**, it aims to:

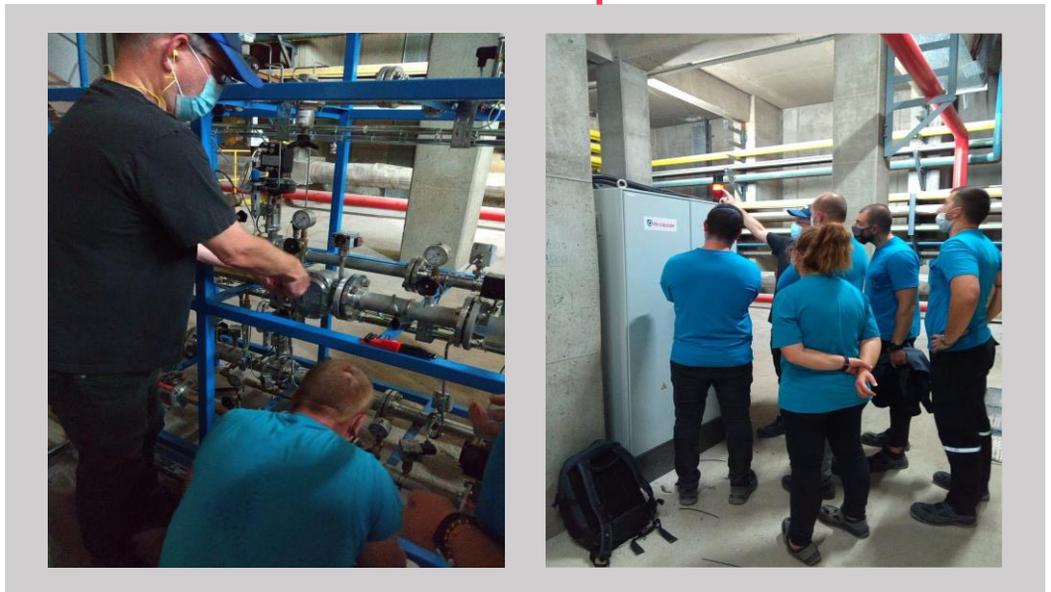
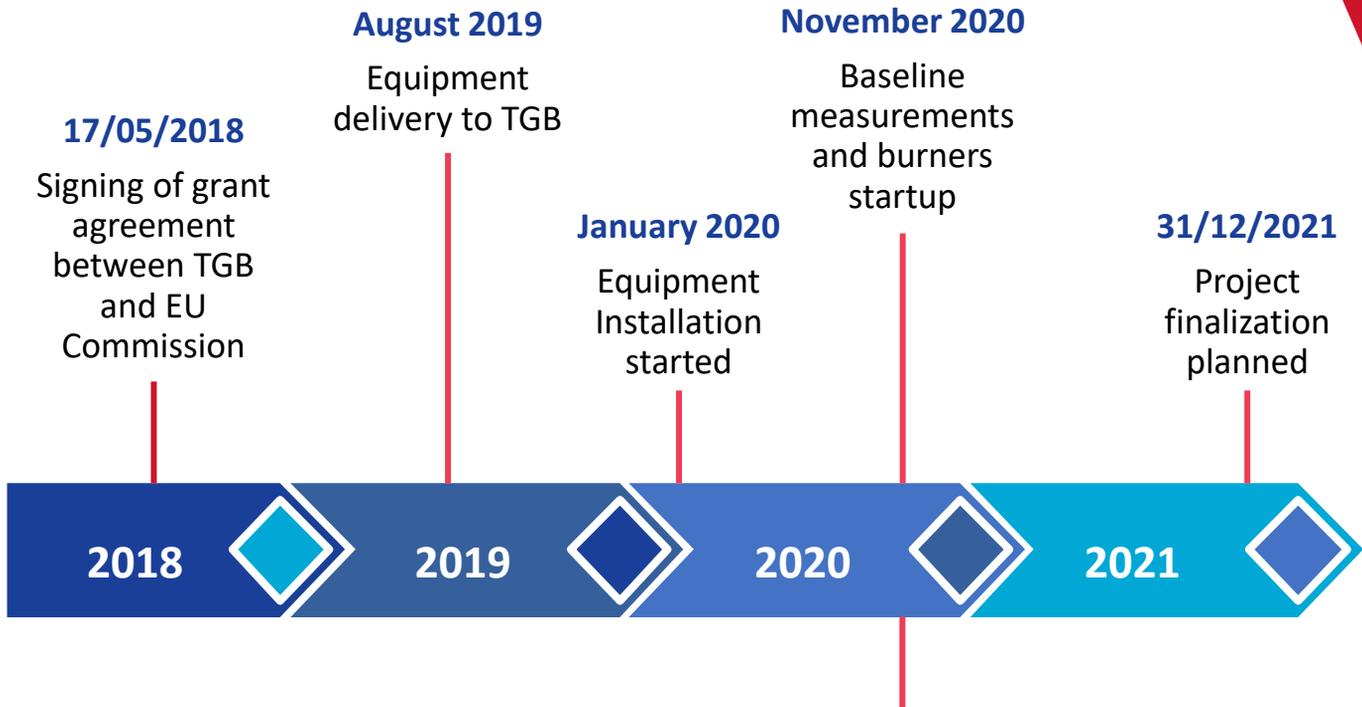
- Reduce specific CO2 emissions from combustion by **4.2%** and total CO2 emissions by **2.8%**
- Reduce specific energy consumption by **4.2%**
- Reduce particulate emissions by **5%**
- Reducing NOX emissions by **10%** (giving rise to a saving of 146 tons of NOx per year)

Context

Observation: As an energy-intensive manufacturing process, it is no surprise that the primary environmental impacts associated to float glass manufacturing are the global warming potential (mainly due to CO₂ emissions from raw materials and fuels use) and primary energy demand (for which the upstream production of energy, in particular natural gas, is the main contribution). Flat glass manufacturing is a significant emitter of greenhouse gases (GHG), particularly carbon dioxide (CO₂). CO₂ in glass manufacturing comes from two sources: the use of fossil fuel to fire furnaces and the carbon contained within and released by raw materials during the melting process.

Area of improvement: One of the main environmental issue associated with flat glass production is that it is a high Nox emissions due to high-energy consumption. Due to the high temperatures in glass furnaces (up to 1650 °C and up to 2500°C in the flame), the major source of NO_x is thermally generated NO_x, arising from the oxidation of nitrogen in the combustion atmosphere at temperatures above 1300 °C. The main sources of the nitrogen is combustion air.

Methodology

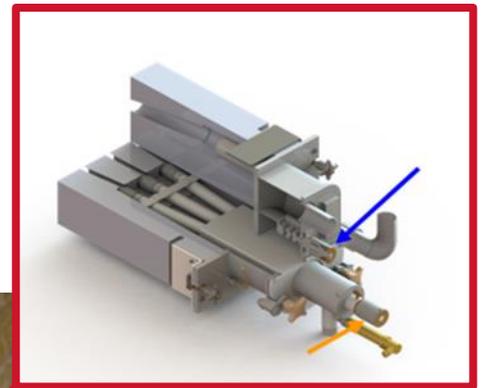


Equipment check and training of TGB team by Air Liquide done before the first trials at November 2020

Technology

The burner is installed in the industrial furnace and is supplied with gas and pure oxygen. The Smart part is that the burner can adjust its consumption according to the energy needed for the process.

Smart Oxy-Boost burner

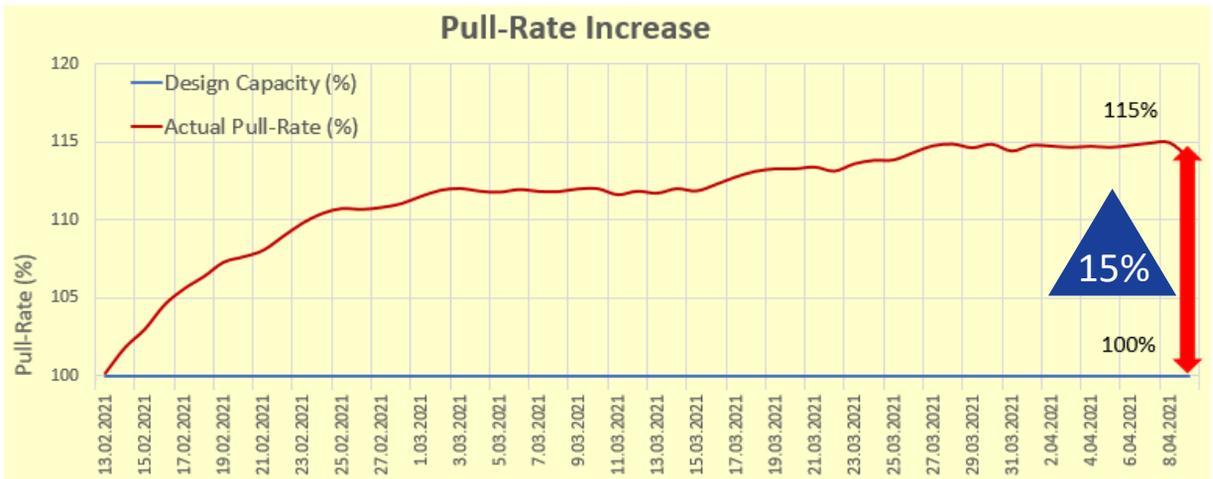


Industrial glass furnace

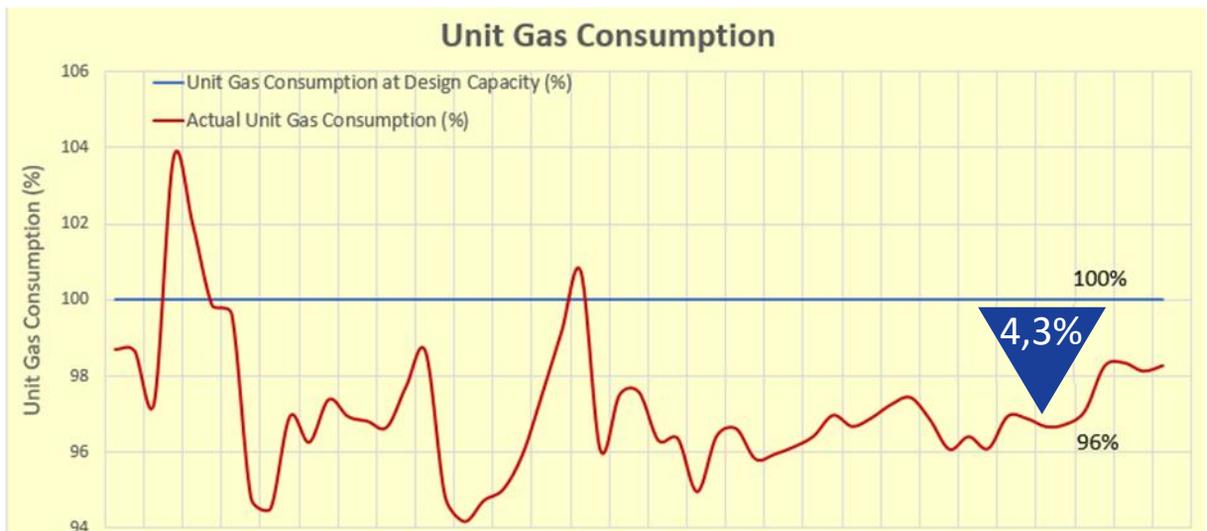


Results

Production: Using Smart Oxy-Boost, TGB managed to increase production by 15% above the design capacity, which was one of the goals of the project.



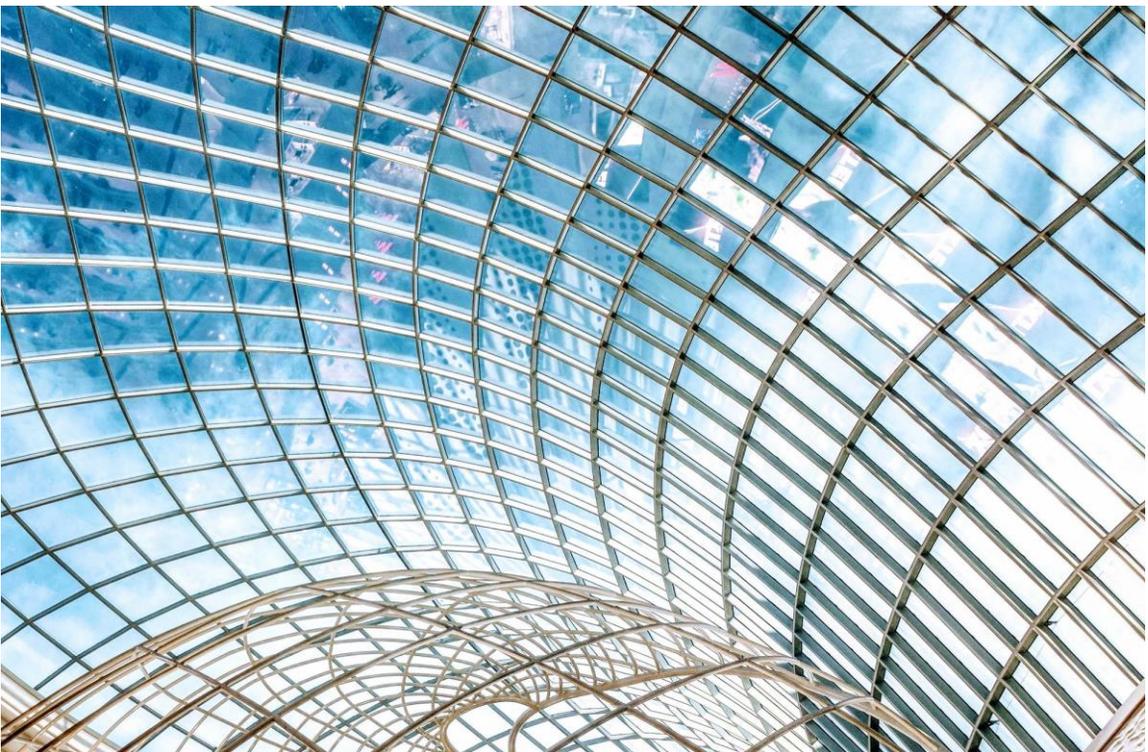
Consumption: Energy consumption is also decreased by 4,3%.



Results

Reliability: During this high production period, manually measured temperatures between Oxy-burner and Port 0 have been stable. Compared to design capacity, as expected temperatures in this area were manageable.

Quality: The glass quality was the same as the base case.



Results

Environmental impact: The main objective of the project, and the LIFE programme, is to reduce the human impact on nature.

All the environmental indicators results are in the following table :

Environmental indicators results			
	Baseline	Performance Test	Final Test
Pull (ton/day)	750	850	860
Energy Consumption (kwh/Ton of glass)	1677	1623 (3.2%)	1604 (4.3%)
CO2 - Combustion (kg/Ton of glass)	356	345	341
CO2 - batch (kg/Ton of glass)	182	182	182
Total direct CO2 (kg/Ton of glass)	539	527	523
Total indirect CO2 (kg/Ton of glass)	71.1	77.0	76.1
Total CO2 (kg/Ton of glass)	609.8	604.3 (0.8%)	599.4 (1.7%)
Total NOx (NO + NO2) (kg/Ton of glass)	8.1	7.4 (8.5%)	

Summary of results



Production



Consumption



Quality



CO2 emissions



NOx emissions

Replicability

Smart Oxy-Boost enables the glass industry to comply with and go further current climate regulations thanks to the reduction in fuel and oxygen and in CO₂ compared to widespread air combustion. It is in line with the EU climate policy on energy and greenhouse gas intensive industrial production and can lead to the development of stricter Union policy and legislation.

Consequently, besides GHG savings, economic viability of the proposed innovative technology is key to contribute to EU climate objectives through wide replication after demonstration. Hence the contribution of the project to the development and demonstration of an innovative climate change mitigation technology suitable for being replicated and transferred to other energy intensive industries.

Today, about 35 furnaces are operating with oxy-combustion in EU, for fiberglass and technical glass production mainly. Tank capacity in container and float glass production, represent both nearly 82% of glass production in tonnage. Those account for 293 units and can be potentially converted to Smart Oxy-Boost. e.Burner could be implemented with all of these furnaces when rebuilt, since it could work with any type of glass and every fuel type.

Transferability

At the end of a furnace's usual lifetime (7 to 12 years), when investment decision is made to renovate, oxy-combustion with e.burner can possibly be implemented. Then, in 15 years, major part of air glass furnaces could be converted to oxy-combustion with e.burner. With further development to adapt the e.Burner design, it will be extended to other manufacturing «high temperatures» processes such as melting and heat treatment, for steel and non-ferrous metals, foundries and non-ferrous recycling processes as well, but also for cement and other 'Basic mineral non-metallic Materials'. On this industry, potential CO₂ and energy savings will depend on fumes temperature and process characteristics resulted in an average estimated reduction about 50% of CO₂ coming from direct combustion in the process.

The knowledge and data acquired during the LIFE Smart Oxy-Boost project is very valuable for other glass furnaces as well as steel, cement, enamel, frit or any other industry requiring the use of high quantities of energy for melting purposes in small or medium size furnaces. Therefore, some R&D activities (pilot scale) would be necessary in a first step in order to adapt the technology bricks (smart burners) to the particularities of other targeted furnaces (batch cycle, special pollutant in fumes, etc.). Then an industrial demonstration would be implemented with partners to validate the transferability and launch the deployment.

Dissemination and networking actions

The project improve the knowledge base for the implementation of effective climate change mitigation actions. This knowledge will be disseminated in order to be applied in practice.

In the frame of networking and dissemination activities Project partners made contact with other LIFE projects, presented LIFE Smart Oxy-boost project at different seminars and conferences.

1st action: TGB made contact with two project coordinators The Prime Glass project (www.primeglass.it) and LIFE SUGAR (Sustainable Glass: Architecture of a furnace heat recovery system including a steam Reformer). The first contact was made in June 2020. Projects were presented mutually through e-mail correspondence and on-line meetings.

2nd action: ICG (International Commission on Glass): ICG is an organization that seeks to generate value by leveraging its know-how and network to bring academia and industry together while constantly striving to attract young talent to invest in a sustainable glass society. ICG organization has sub-committees named TC, which are specialized in their field, and Şişecam plays an active role in these committees.

Technical Committee on Energy Efficiency TC09, mainly focus on glass melting since this contributes on average about 60-65 % to the total energy consumption in glass production. The aim of this committee is to identify the major process steps with energy efficiency improvement potentials, to select suitable technologies, to test or develop tools that supports energy efficiency investigations such as energy balance models, protocols for energy management, energy audits and finally to define research activities for developing energy saving glass production methods. The LIFE Smart Oxy-Boost project was presented on 07 April 2021 Video Conference to the TC9 Energy Efficiency committee members. In particular, flat glass manufacturers were closely interested in Smart Oxy-boost results, LIFE grant opportunities, and LIFE's general procedures all necessary information has been explained to them.

3rd action: 36th Glass Symposium, 12 November 2021: LIFE Smart Oxy-boost project is represented by TGB at operational excellence session of 36th Glass Symposium. More than 750 participants from 40 countries participated in this on-line symposium and the LIFE Smart Oxy-boost project was presented at this on-line meeting. It was understood from the questions after the presentation that the interest was high.

4th action: In the frame of Smart Oxy-Boost project AL made a presentation called “Clear Efficiency”. ICG international Congress in Boston, USA in 2019.

Contact

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LIFE Smart Oxy-Boost Project LIFE 17 CCM/BG/000069

Smart Oxygen Boosting for Reducing Energy Consumption and Emissions of Glass Melting Furnaces

Facilitating the wide spread use of partial oxy-fuel conversion in air-fuel float glass furnaces with an innovative combination of smart burners equipped with sensors and wireless communication means in communication with the process changes in the furnace.

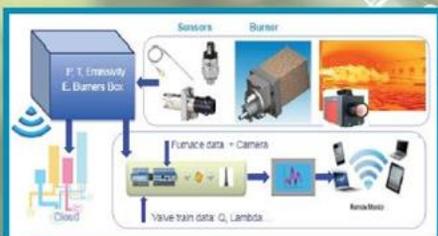
Total Budget : 1,990,591 Euro
EU Contribution : 884,693 Euro
Project duration : from 01-JUL-2018 to 31-DEC-2021

Smart Oxygen Boosting for Reducing Energy Consumption and Emissions of Glass Melting Furnaces

Reduce specific GHG emissions (2,8% less CO₂ and 10% less NO_x) compared to side fired (air-fuel) furnace by only using -10% of O₂ and <10% of CAPEX required for typical full oxy-fuel furnace conversion.

Reduce specific Energy consumption by 4,2% while increasing Production by 15,4% compared to side-fired regenerative (air-fuel) furnace.

Reduce Particulate emissions by 5%



Trakya Glass Bulgaria EAD Flat Glass Plant