

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

Business plan

With the contribution of the LIFE financial instrument of the European Community

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Introduction

The objective of action C.5 is to ensure long-term sustainability of project results and to prepare replication of the technology and transfer the results to other industries. This action is essential to ensure the replication of the technology in Europe and Worldwide by preparing specific business plans.

Methodology

Business model

Trakya Glass Bulgaria sees sustainability as the focal point of their operations and a core element of their business model. To that end, Şişecam, which is the main company of TGB, plans and carries out all their investment decisions as well as product and process development activities in consideration of social and environmental impacts. Şişecam aims to disseminate a sustainability vision to include all our stakeholders in every aspect.

Şişecam business model consists of 3 scopes which is shown in Figure.1. Considering the aims of LIFE project, it shows parallelism with scope 1 defined in 2020 Şişecam Sustainability Report. Furnace technology change has been achieved thanks to Smart Oxy-Boost. As a result of the project, energy consumption and therefore CO₂ emission has been reduced by 4%.

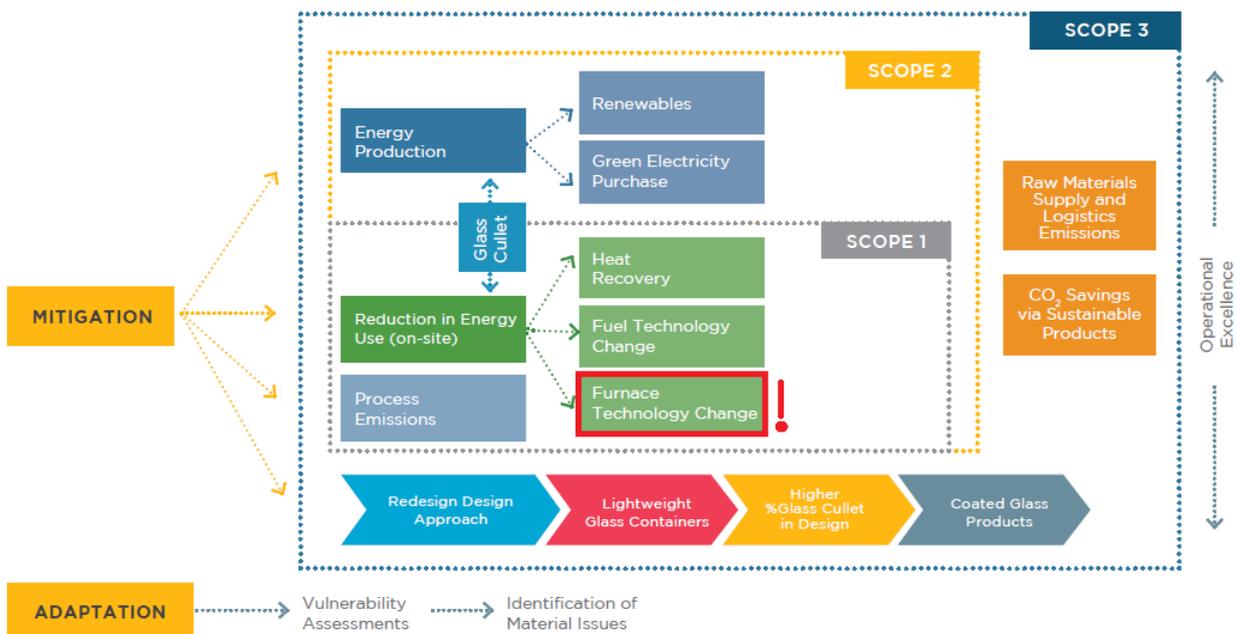


Figure.1 Şişecam Group Business Model (*2020 Şişecam Sustainability Report)

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Stakeholders are defined as Şişecam Group, public authorities and glass industry. Şişecam Group is in charge of validating the technology provided by Air Liquide in the pilot furnace and of transferring and replicating the technology to its other furnaces worldwide. Stakeholders should agree with environmental regulations implemented by public authorities. Other glass producers are pressured to carry out similar technologies to coordinate with the new environmental norms set by the project. They should get involved through targeted dissemination and replication actions.

Glass industry and other industries using combustion in their processes (steel, cement manufacturers, etc.) can be considered as targeted groups for replication and transfer of results in order to keep pace with innovation of the process for environmental reasons.

Stakeholders aim to replicate and transfer this technology to the following furnaces, respectively.

- Application of this technology in other Şişecam flat glass furnaces
- Application of this technology in other companies' flat glass furnaces in Europe and worldwide
- Application of this technology in other types of glass furnaces (container etc.)
- Application of this technology in other sectors (steel, non ferrous, cement etc.)

Based on the business plan and the dissemination activities performed by the partners during and after the project, Şişecam would replicate the process in other float furnaces of the Şişecam Group.

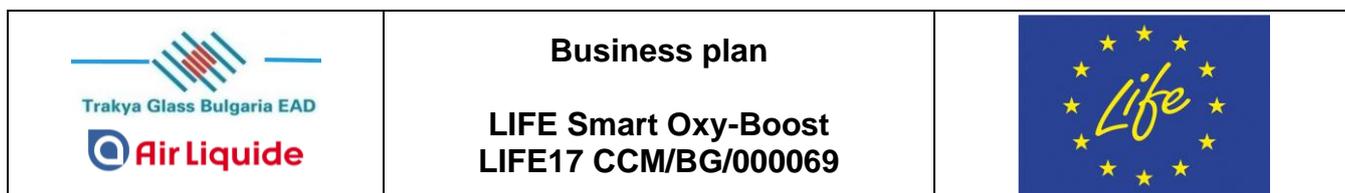
The Smart Oxy-Boost process has been specifically designed for flat glass furnaces. Besides Şişecam Group, the other glass companies may benefit from the know-how generated in this project. For instance, companies such as Saint Gobain (60 production sites), O+I (37 production sites), Vetropack Group (7 production sites in Europe), Vidrala (6 production sites in Europe) Wiegand- Glas (5 production sites in Europe) and Arc International (4 production sites) may be interested. In addition, the knowledge and data acquired during the LIFE Smart Oxy-Boost project are very valuable for other types of glass furnaces.

Besides the glass sector, the developed technology can be transferred to other sectors having high temperature processes (such as steel, cement, non-ferrous metals etc.) with similar or slightly different configurations in terms of burner layout. They should be interested in implementing the technology in order to reduce their activities' environmental impact.

These replication and transfer projects will be ensured by financial viability of the technology demonstrated through the LIFE Smart Oxy-Boost project due to the low CAPEX.

Market Research

The objective within this step will be to carefully analyze the size of the markets that will be addressed in case of transfer of the project results but also to analyze the competition in order to further estimate the potential breakthrough.



It is estimated that 628 furnaces are operating in Europe with 43 M tons production capacity per year for every kind of glass. 490 furnaces of them are regenerative or recuperative, which uses liquid or gaseous fossil fuel for combustion. Today, about 35 furnaces are operating with oxy-combustion in EU, for fiberglass and technical glass production mainly.

Table.1 Number of EU glass furnaces

Type of glass	Estimated number of EU-27 glass furnaces	Melting capacity (TPD)
Flat glass (float glass)*	58	500-1000
Container glass*	175	200-600
Domestic glass (tableware)	300	10-200
Technical and fiberglass and others	95	20-250
Total*	628	n/a

*Source: Best Available Techniques (BAT)

Container and float glass division is 82% of glass production in tonnage, which means Smart oxy-boost technology can be implemented to nearly 293 units. Flat glass industry has a turnover of 15 billion with 60 installations in 12 countries in Europe. Annual growth in flat glass output is in the order of 2-3% on average because of growth in the automotive and construction industries. There is a great potential in the flat glass sector to apply this technology to other furnaces. Dissemination of this technology to other glass furnaces will provide a significant contribution to reducing energy consumption and emissions. Considering furnaces in Europe, it is possible to increase production capacity to 35-50 M tons per year with existing furnaces.

Şişecam Group has 50 furnaces operating in Turkey and abroad with total 4.9 M tons production per year in 2020. 46 of 50 furnaces are regenerative and 4 of them are oxy-fuel. 28 furnaces are operating in Turkey, others in foreign countries namely Russia, Bulgaria, Italy, India and Egypt.

Table.2 Number of Sisecam Glass Furnaces

	Float	Packaging	Tableware	E-Glass
Turkey	9	12	6	1
Abroad	6	12	4	-

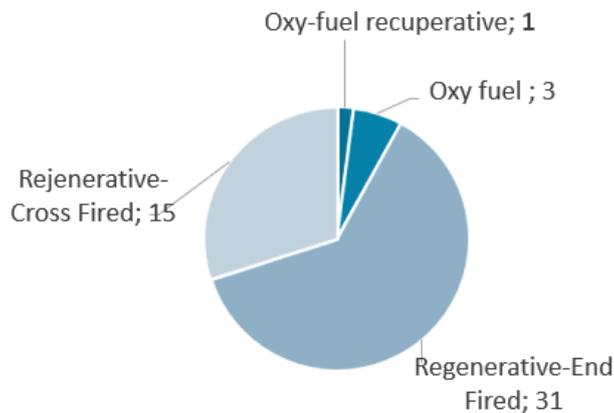


Figure.2 Şişecam furnaces' types

Profitability study

Sisecam also carried out a study on the profitability of the smart oxy-boost technology based on expenditure and profit generated. This profitability is an estimate and will of course depend on the evolution of the various expenditure items.

Due to market conditions and thin glass production, the furnace will not produce at high capacity throughout the year. Therefore, the system will not be used all year. 3 alternatives were evaluated as optimistic, normal and pessimistic scenario. In the optimistic scenario, it is assumed that the system will be used **90%** throughout the year. It is assumed that it will be used **70%** in the normal scenario and **50%** in the pessimistic scenario.

Table.3 Estimating the cost-effectiveness of a use case of Smart Oxy-Boost Technology (in €)

		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
CAPEX (EURO)	Investment in the technology	250.000					
	Maintenance			10.000	10.000	10.000	10.000
	Personnel training	10.000	5.000				
OPEX (EURO)	Energy consumption saving		1.000.000	1.000.000	1.000.000	1.000.000	1.000.000
	O2 consumption		901.000	901.000	901.000	901.000	901.000
	Increasing pull rate profit		80.000	80.000	80.000	80.000	80.000
	Other expenditure (external assistance, performance tests etc)		10.000	5.000	5.000	5.000	5.000
Financial savings - optimistic		-260.000	146.100	146.100	146.100	146.100	146.100
Financial savings - normal		-260.000	110.300	110.300	110.300	110.300	110.300
Financial savings - pessimistic		-260.000	74.500	74.500	74.500	74.500	74.500
Payback	optimistic	1,8					
	normal	2,4					
	pessimistic	3,5					

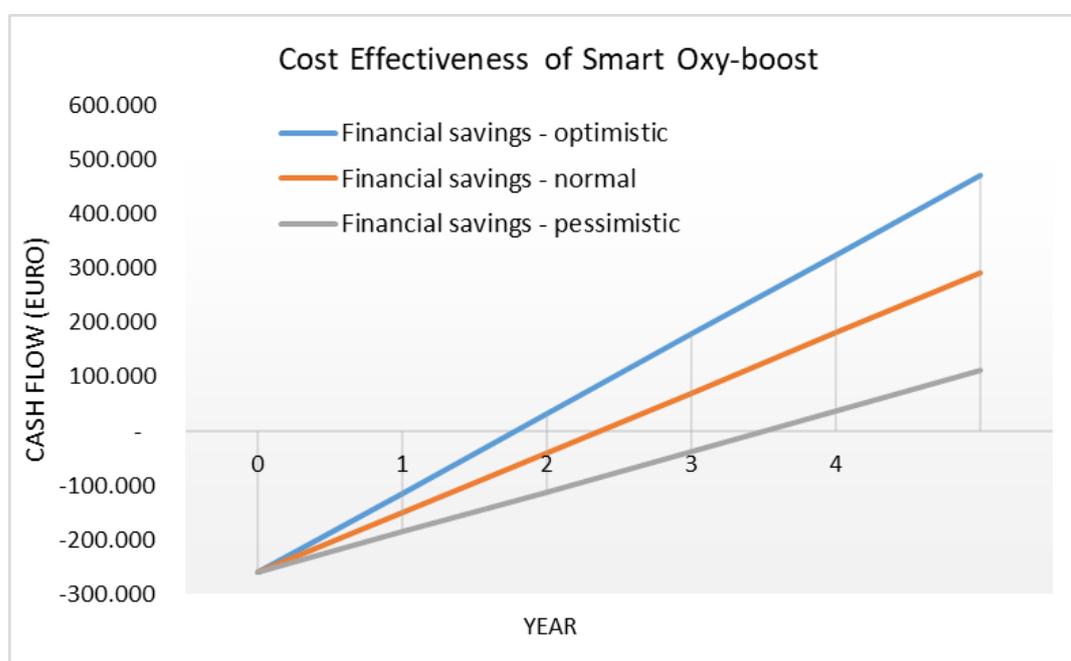


Figure.3 Smart Oxy-Boost profitability scenarios

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During alternative scenarios evaluation, energy savings, pull rate increasing profit and O₂ consumption cash flows are multiplied by these ratios. For example in the optimistic scenario Energy consumption saving is calculated $1.000.000 \times 0,9 = 900.000$ EUR .

As shown in the table and graph, using Smart Oxy-Boost is profitable after 2,4 year according to normal scenario.

Results

Firstly, the main objective of the project is to reduce greenhouse gas emissions (4,2% CO₂ savings from combustion and 10% NO_x savings) compared to the air combustion process what will ensure a low-carbon economy in the glass industry.

Secondly, another main project objective is to increase thermal efficiency in glass plants by reducing natural gas (NG) use for the glass melting process by 4,2% which highly contributes to a resource efficient economy.

The Smart oxy-boost technology has achieved 15 % capacity increase with 4 % decrease in energy consumption in TGB and 4% reduction in CO₂ emissions from combustion and 2.8% reduction in total specific CO₂ emissions in an air-fuel float glass furnace. In Europe, CO₂ emission of glass industry is around 21.7MT per year. After implementation of Smart oxy-boost to air-fired furnaces, the potential yearly CO₂ saving will be about 0.146 MT per year.

Conclusion

Based on the business plan performed during the project and also based on the intensive dissemination and networking activities performed by the partners during and after the project, TGB might replicate the process in other float furnaces of the Siseçam Group. Besides the glass sector, the developed technology can be transferred to other sectors having high temperature processes (such as steel, cement, non-ferrous metals etc.) with similar or slightly different configurations in terms of burner layout. They should be interested in implementing the technology in order to reduce their activities' environmental impact.

The promotion of Smart Oxy-Boost and its environmental and financial benefits will be continued through fairs, exhibitions, and conferences. During these events, TGB and AL will distribute the documents to targeted groups such as glass industries, glass industry clients, public authorities and the general public.