Oxycombustion

An innovative solution to help industry reduce its environmental footprint

R&D driving Air Liquide’s innovation

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Energy challenges:
at the heart of the worldwide economic and political debate today…
Fossil fuels will remain the largest source for the foreseeable future but their combustion generates a large amount of CO₂.

Oxycombustion
is a promising solution for capturing and storing CO₂ emissions from power plants and industrial activities.

Using oxygen offers two major advantages:
- improving combustion efficiency
- producing concentrated CO₂ flue gases, ready for capture, storage or direct use
Developing combustion technologies with specific burners, suitable for oxygen use. Flame temperature with oxygen is actually significantly higher (2200 °C - 2700 °C) than for air combustion (1900 °C).

Test capabilities

2 MW (7 MBtu/h) ALICE furnace used to design prototype burners for various processes (glass, steel...) at Claude-Delorme Research Center (CRCD), France, one of the Air Liquide research centers.

Oxycombustion in boilers

1 MW pilot boiler to optimize and test oxyburner designs (flame geometry and stability), CRCD, France

Developing the technology bricks to enable a safe and efficient CO₂ capture and storage. The recirculation of flue gases allows to decrease oxycombustion flame temperatures. Purification of the flue gases provides the quality required for geological storage.

Test bench (Floxyinator™) to simulate O₂ injection in flue gases at Delaware Research and Technology Center (DRTC), US, Air Liquide facility

Producing oxygen through higher efficiency cryogenic Air Separation Units (ASU). Integrations with the power plant can offer further benefits. Air Liquide offer includes oxygen supply by pipelines, on site generators or liquid storage tanks.

Providing modeling studies to simulate all phases of the oxycombustion process and to optimize furnace efficiency. Modeling allows analysis understanding of all physical phenomena as well as prediction of industrial configuration behavior.
Oxygen to reduce CO2 emissions

Total - Air Liquide collaboration

Total and Air Liquide collaborate to demonstrate the full chain of capturing and storing CO2 towards clean power production. Air Liquide provides proprietary oxyburners and oxygen from an on-site unit.

The technology developed by Air Liquide enables safe heat transfers to the boiler while providing a very high concentration of CO2. The CO2 rich flue gas will be then cleaned and compressed. The resulting CO2 will be conveyed via pipeline to a depleted gas field to be injected into a deep carbonate reservoir.

Air Liquide partner of ULCOS project coordinated by ArcelorMittal

Mefos, Luleå - Sweden

Within the context of the European ULCOS project (Ultra Low CO2 Steelmaking), Air Liquide has developed, built and tested a pilot plant in Luleå, Sweden.

The CO2 is separated from blast furnace gases, while the residual gases are recycled.

Babcock & Wilcox - Air Liquide collaboration

Clean Environment Development Facility, Ohio - US

Babcock & Wilcox PGG (B&W PGG) and Air Liquide successfully operated a 30 MW coal fired boiler unit in full oxy-combustion mode (a world record thus far). Further plant design improvements are being tested for oxycombustion of different types of coal.

Air Liquide and B&W PGG intend to implement the technology at a larger demonstration plant where more than one million tonnes of CO2 could be captured in a single year.

Oxycombustion to increase industrial plant efficiency

Oxycombustion brings numerous advantages to our customers’ processes:

- increase of thermal efficiency
- 20 to 60% reduction of energy consumption
- increase of productivity
- improvement of product quality
- possibility to burn low grade fuels
- reduction of flue gas volume
- reduction of pollutant emissions (NOx) and associated treatment cost

40% technical glass furnaces converted to oxycombustion

More than 800 patents in this field
With more than 40,000 employees in 75 countries, Air Liquide is the world leader in industrial and medical gases and related services. The Group offers innovative solutions based on constantly enhanced technologies and produces air gases (oxygen, nitrogen, argon, rare gases...) and many other gases including hydrogen. The Group contributes to the manufacturing of many everyday products: bubbles in sparkling beverages, protective atmosphere for packed foods, oxygen for hospitals and homecare patients, ultra-pure gases for the semiconductor industry, hydrogen to desulfurize fuels...
HOT OXYgen for Float furnace: a sustainable technology

Heat recovery for oxy-fuel furnaces
- Fuel savings more than 25%
- Significant pollutant reduction (CO₂, NOx, SOx)

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