

## Pre-feasibility study of a CO<sub>2</sub> capture system at Comilog Dunkirk

Janv.  
2024



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### Comilog Dunkerque

The industrial site of Comilog Dunkirk (a subsidiary of the Eramet group), built in 1978, is located in the town of Gravelines. Dedicated to the manufacture of a silico-manganese alloy (SiMn) for the steel industry, it produces about 80,000 tSiMn per year.

Manganese alloys are produced by reducing manganese ore, at a temperature of about 1,600 °C. This operation is carried out by adding carbon (in the form of coke) to an electric furnace. Mainly used in the steel sector for the manufacture of carbon steel (90% of the need for alloys), manganese alloys make it possible to improve the mechanical characteristics of steels (hardness, abrasion resistance, elasticity and surface finish when rolled) as well as to reduce their sulphur or oxygen content during metallurgical treatments. Manganese is, as an alloying element, non-substitutable by other non-ferrous metals.

The main source of CO<sub>2</sub> emissions (scope 1) is the use of carbon in the form of coke and is derived from the reduction of ore. It accounts for 99% of the site's greenhouse gas emissions (scope 1). The site also consumes diesel for the operation of handling equipment, but the associated emissions are marginal.

The site emits between 100,000 t and 120,000 t of CO<sub>2</sub> per year. As the Comilog Dunkirk furnace is a "semi-closed" furnace, its gases are diluted by fresh air before passing through the flue gas treatment circuit. The CO<sub>2</sub> concentration of the gas is therefore very low (less than 5%).



### Decarbonization roadmap

Comilog Dunkirk's decarbonisation trajectory provides for the achievement of negative emissions by 2035 by combining the substitution of coke with bioreducers, the implementation of a solution for capturing and storing part of the CO<sub>2</sub> emitted and better control of the process.

## Objectives of the study

The main objective was to study the possibility of capturing the CO<sub>2</sub> contained in a highly dilute gas such as that from the Comilog Dunkirk furnace and to evaluate the technical and economic performance (design, investment and operational costs, footprint, energy efficiency, etc.) of the process involved. Only amine technology was studied given the low CO<sub>2</sub> concentration of the gas, which precludes the use of a membrane solution. Two different concentrations were studied (1.5% and 3.7%).

This pre-feasibility study was carried out as part of the ZiBaC phase I programme and will contribute to the development of the decarbonisation trajectory of the Comilog Dunkirk site and, more broadly, that of its territory.

## Results

The main result of the study was to confirm the applicability of the amine technology to a gas with a low CO<sub>2</sub> concentration, such as that from the Comilog Dunkirk furnace. To treat such a concentration, the supplier of the technology in question had to modify certain elements of the treatment process. The efficiency of the capture rate remains very good: 90% for a concentration of 1.5% and 95% for a concentration of 3.7%.

For each scenario, a set of preliminary information was provided, such as a mass balance, process flowsheets, list and quantities of consumables, an implementation schedule, and an estimate of the investment costs (Class V). The specific energy consumption (steam and electricity) is between 1.1 and 1.3 MWh per tonne of CO<sub>2</sub>. The investment cost exceeds 100 million euros.

The findings will be used to conduct various studies as part of Phase 2 of the ZiBaC project.



## RÉSUMÉ

As part of the **ZiBaC – Phase I** program, Comilog Dunkirk (Eramet Group) launched a pre-feasibility study to assess the implementation of a CO<sub>2</sub> capture system at its Gravelines site. The plant, which produces approximately 80,000 tonnes of silico-manganese per year, emits between 100,000 and 120,000 tonnes of CO<sub>2</sub> annually, mainly from the reduction of manganese ore using coke in an electric furnace.

A key challenge lies in the very low CO<sub>2</sub> concentration in the flue gases (1.5% to 3.7%, below 5%), due to the semi-closed design of the furnace. This constraint rules out membrane technologies and led to the selection of amine-based absorption technology for the study.

The results confirm the technical feasibility of capturing CO<sub>2</sub> from highly diluted gas streams, achieving capture rates of 90% at 1.5% concentration and 95% at 3.7%, subject to process adaptations. The specific energy consumption is estimated between 1.1 and 1.3 MWh per tonne of CO<sub>2</sub> captured, with total investment costs exceeding €100 million.

This study represents a key milestone in the site's decarbonization roadmap, which aims to achieve negative emissions by 2035 through a combination of coke substitution with bio-reducers, carbon capture and storage (CCS), and process optimization.

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