

# ESTEP 2025 Annual Event

28-30 October 2025  
Udine (ITALY)

How decarbonisation, digitisation  
and circular solutions forge the  
sustainable European steel future?

Jean BORLEE  
CRM Group  
Unit Manager

## Operation of a 1 tpd mobile CO<sub>2</sub> capture unit based on cryogenic desublimation in heavy industry plants in Belgium

Luis LOPEZ DE LEON, Jean BORLEE, Victor DEVEEN (*CRM Group*)  
Charles ROBIN, Alex AUBERT (*CARMEUSE Technologies*)  
Ethan BEVER (*Chart Industries [NYSE: GTLS]*)



DIGIMET



DANIELI AUTOMATION



UNIVERSITÀ  
DEGLI STUDI  
DI UDINE  
HIC SUNT FUTURA

# HECO<sub>2</sub> in Wallonia (Belgium)

## Towards a Low CO<sub>2</sub>-emitting heavy Industry:

### **HECO<sub>2</sub>** (Hydrogen, Electrification, CO<sub>2</sub> capture)



#### Technological solutions:

- Substitution of fossil energy sources by:
  - **Electrification** of production processes
  - Production of green **Hydrogen**
- **Development of CCUS-solutions** to deal with hard-to-abate CO<sub>2</sub> emissions from production processes



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# HECO2 in Wallonia (Belgium)

24 % of CO2 emissions of industry in Wallonia  
6.000 jobs, 3 billion € of turnover

LE

SME

R&D&I



# HECO2 SATURN : CCUS as ultimate step



**Industrial sectors :**  
**Stainless steel, Glass, Chemistry (phosphates) and Lime**

aperam

AGC



CARMEUSE

- **Tackle “fatal” or “hard-to-abate” industrial emissions by CCUS and (if needed) process retrofit**
  - Assess feasibility and costs of end-of-pipe capture
- **Select, implement and optimise capture technologies in the specific industrial applications of project partners**

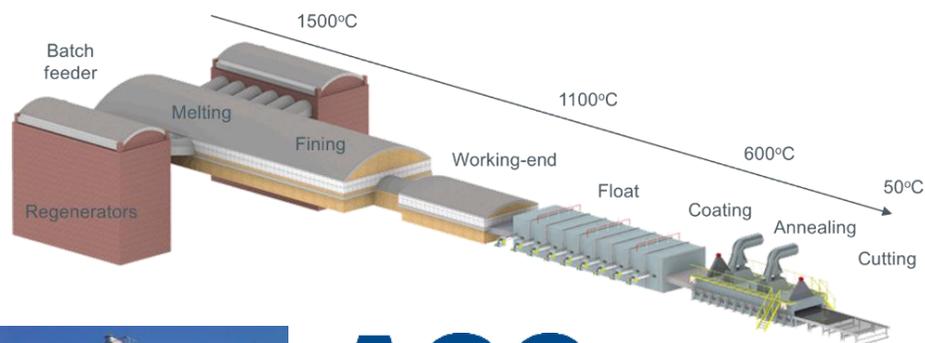
# Characterisation of industrial emissions



# Industrial emissions

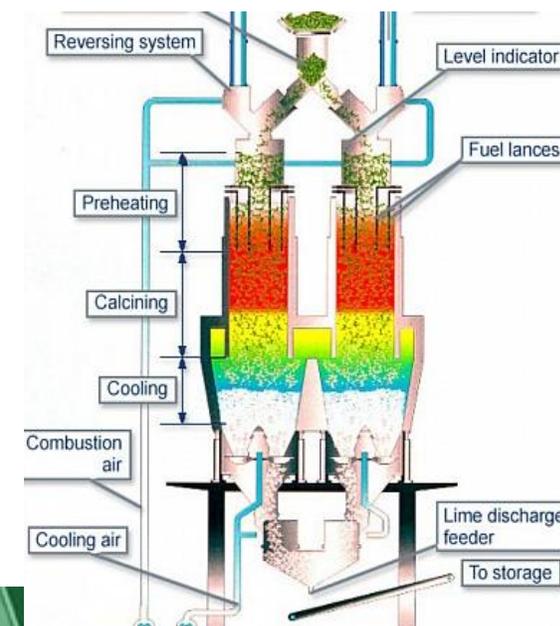
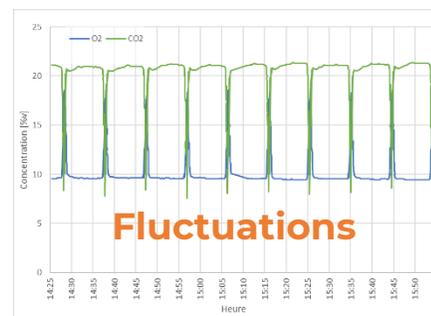
## Glass and Lime plants

- One CO<sub>2</sub> emission point (stack) on each production line
- CO<sub>2</sub> to be captured end-of-pipe, after gas cleaning
- Fluctuating flow and composition (heating reversals)



**AGC**

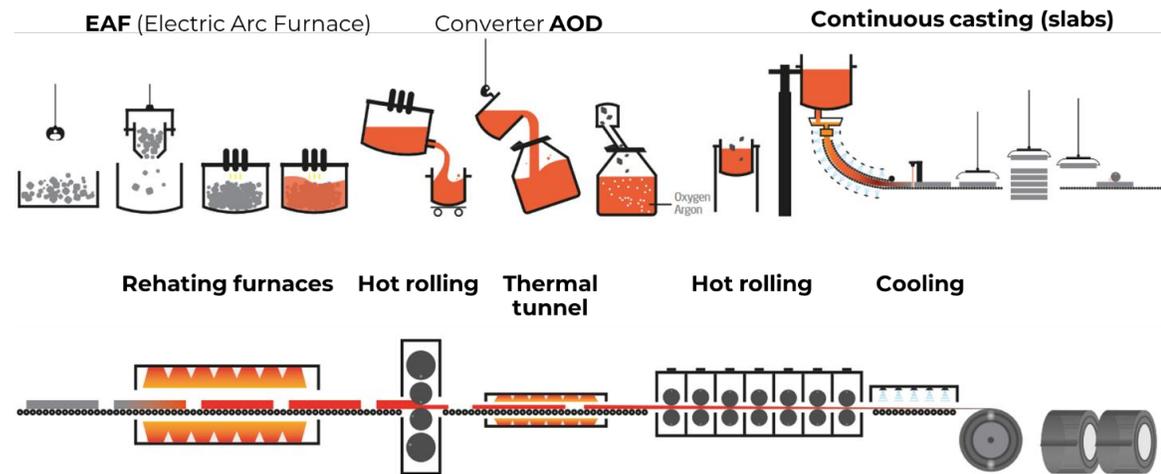
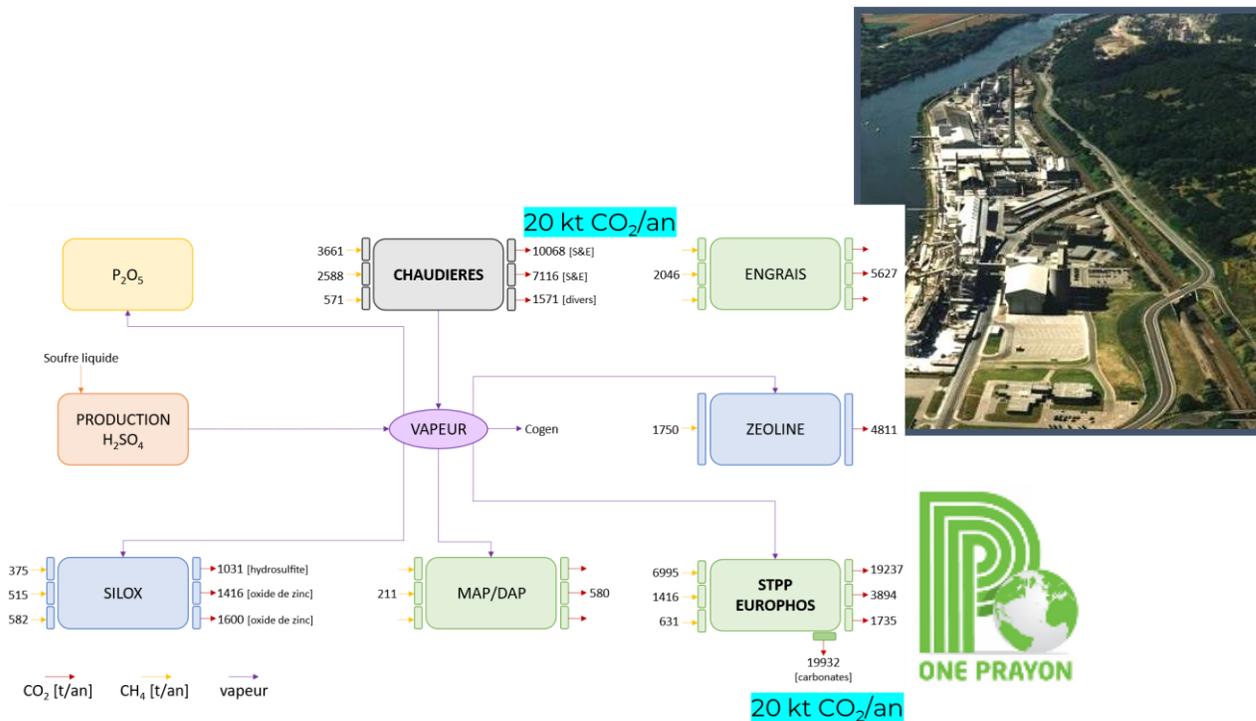
**CARMEUSE**



# Industrial emissions

## Steel and Chemical plants

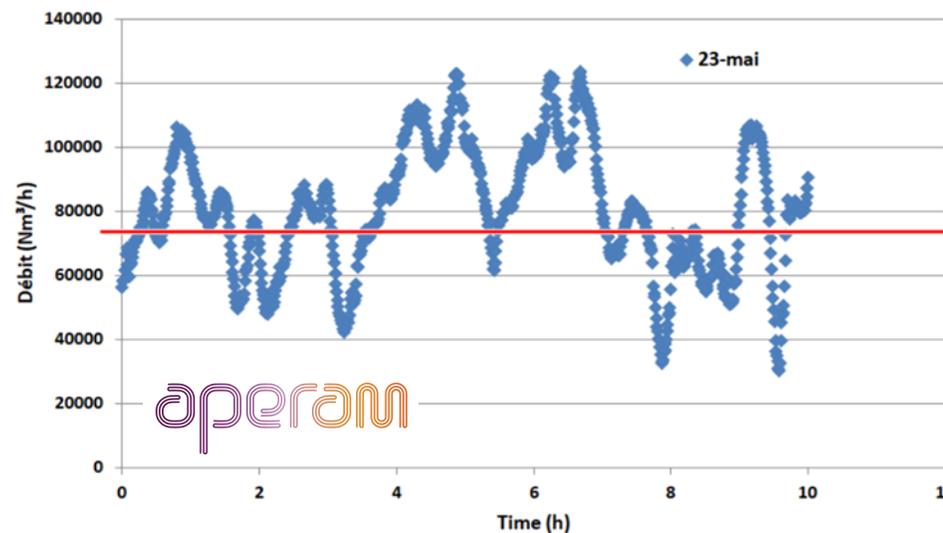
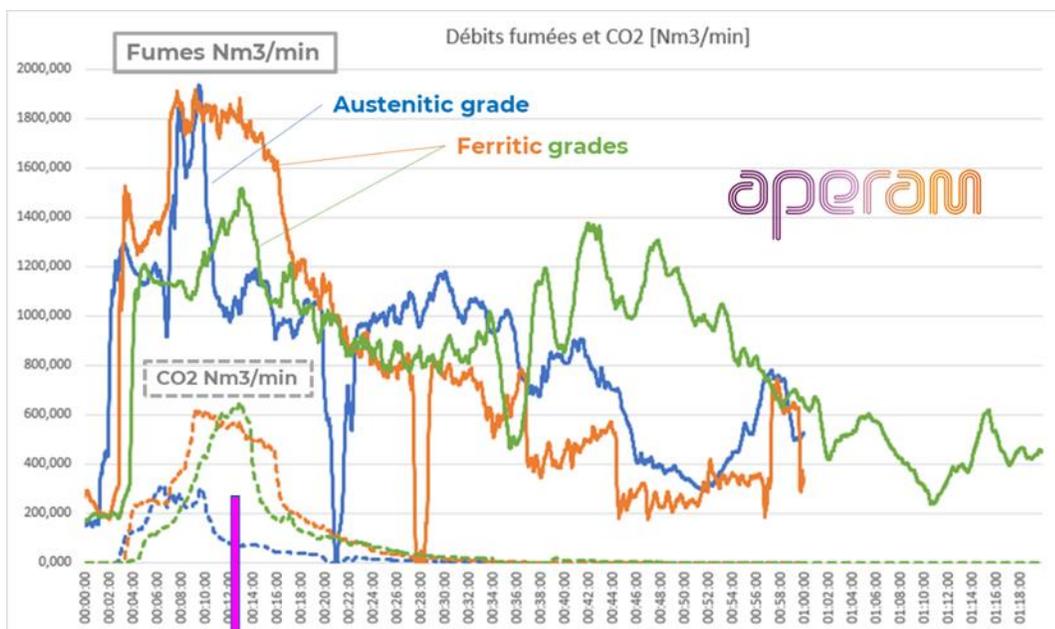
- Many CO<sub>2</sub> emission points, with specific constraints (flow, composition, fluctuations, etc) : selection required



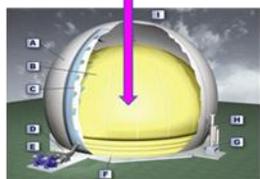
# Source fluctuations require process adaptations or specific developments ...

**Source 1** : highly fluctuating source  
 → buffering system required

**Source 2** : flow also quite fluctuating to follow production schedule  
 → design capture process on base load

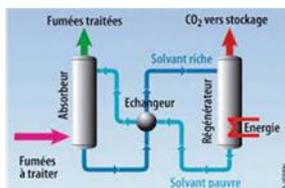


Blower 5-20 min



8 to 20 000 Nm3/h  
 Continuous

Compressor



# Pilot testing of CC

# CC technology selection

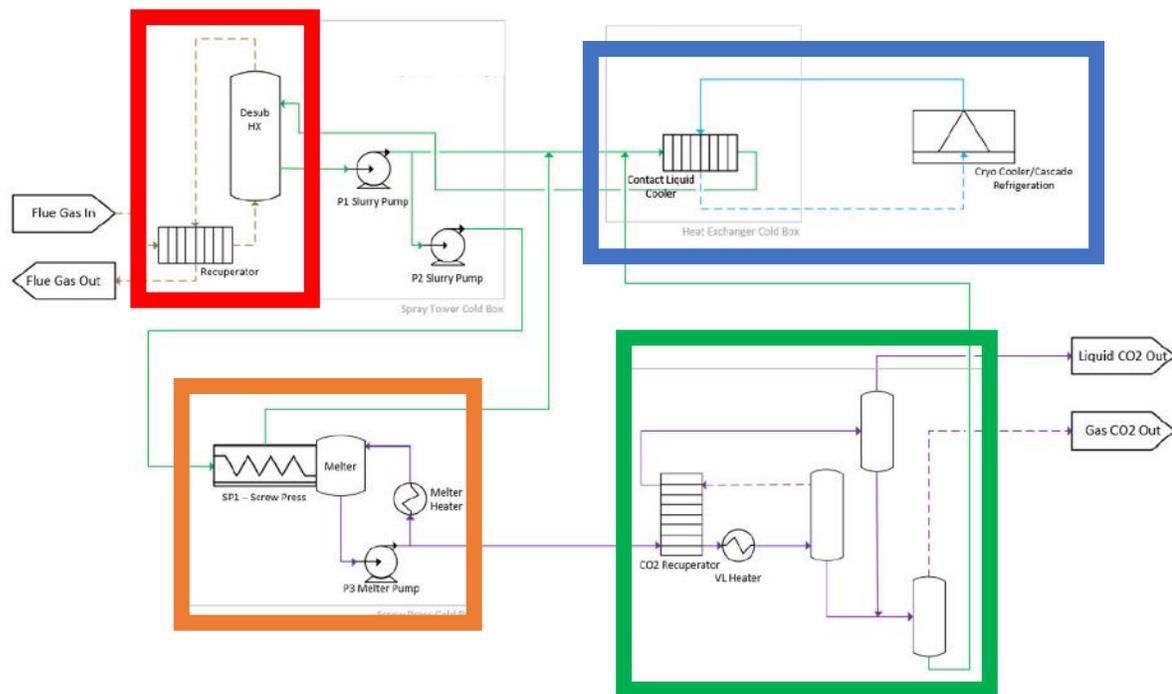
Consortium, led by industrial partners:

- Review of technologies available at pilot scale (TRL 5-6)
- Discussions with technology suppliers and review of offers
  - Test of **conventional amine absorption technique** at CRM, on a pilot unit able to reproduce industrial off-gas streams
  - Construction of a **mobile pilot unit** to be tested in each industrial plant based on Chart-SES technology (**desublimation cryogenic process**)



# Chart-SES technology

## Desublimation cryogenic process



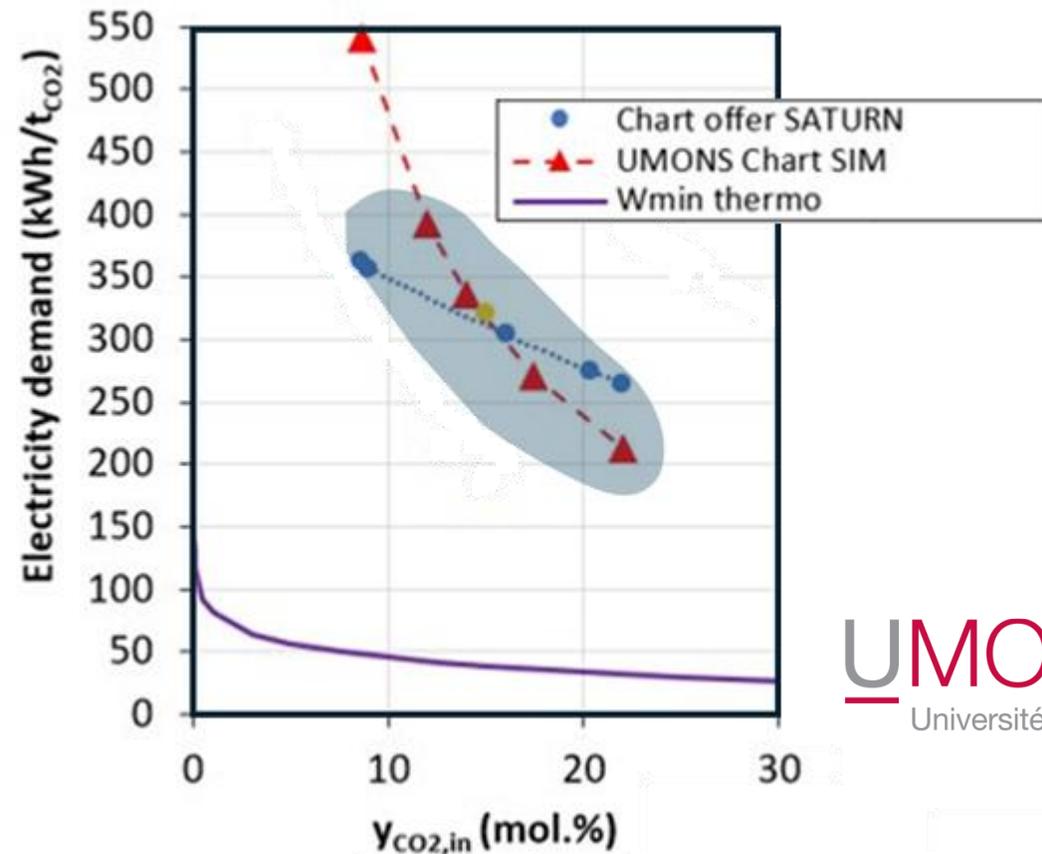
- Fumes are cooled and CO<sub>2</sub> desublimates (direct contact with cryogenic liquid)
- Solid CO<sub>2</sub> is separated from contact liquid
- CO<sub>2</sub> is separated from traces of contact liquid
- Cooling system



# Chart-SES technology

## Desublimation cryogenic process

- produces pure liquid CO<sub>2</sub> in one step
- only consumes electricity
- targets reasonable power consumption (200-300 kWh/t), even at low CO<sub>2</sub> content (10-20%)
- can also be operated as de-SO<sub>x</sub> & de-NO<sub>x</sub> technology



# Chart-SES technology

## Status of development in the USA



- Skid **1 tpd**, tested in Wyoming on power plant fumes
- New DOE project for scale-up at **30 tdp** size: under commissioning at Sugar Creek Cement Plant near Kansas City, Missouri



# Mobile capture unit

## Status

- Fabrication, pre-testing & delivery of 1 tpd pilot unit have been ordered by CRM to Chart Industries

→ **Delivered in Belgium early august 2025, commissioning completed**

- **Plant tests** (operated by CRM) in 4 industrial plants in Wallonia :
  - **CARMEUSE** Aisemont (09-10 2025)
  - **AGC** Moustier (11 2025 - 01 2026)
  - **APERAM** Châtelet (02 - 03 2026)
  - **PRAYON** Engis (04 - 05 2026)
- Late 2026, mobile capture unit will be available for testing in other industries / contexts



# Mobile capture unit

## First test results in CARMUSE

- Runs**

Total runs	Total time of flue gas processing
9	35 hours

- Flue gas**

Flue gas source	Fuel
Mix from 2 Kilns	Lignite and wood

- Process conditions**

CO <sub>2</sub> inlet	CO <sub>2</sub> outlet	Capture yield
22-25%	0,5-1%	95-98 %



**This work is carried-out in the frame of  
the HECO2-SATURN project:**



**SATURN**

**Supported by :**



**Funded by the  
European Union**  
NextGenerationEU



# THANK YOU

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[BDServices@crmgroup.be](mailto:BDServices@crmgroup.be)

For a better future

# CO<sub>2</sub> CAPTURE TECHNOLOGIES available at CRM Group

## ABSORPTION



## MOBILE CRYOGENIC UNIT

## ADSORPTION

