

For a better future



Revamping and operation of a CO₂ capture pilot by amine absorption in simulated industrial conditions at CRM group

Romain CLOSE,
Jean BORLEE, Luis LOPEZ DE LEON

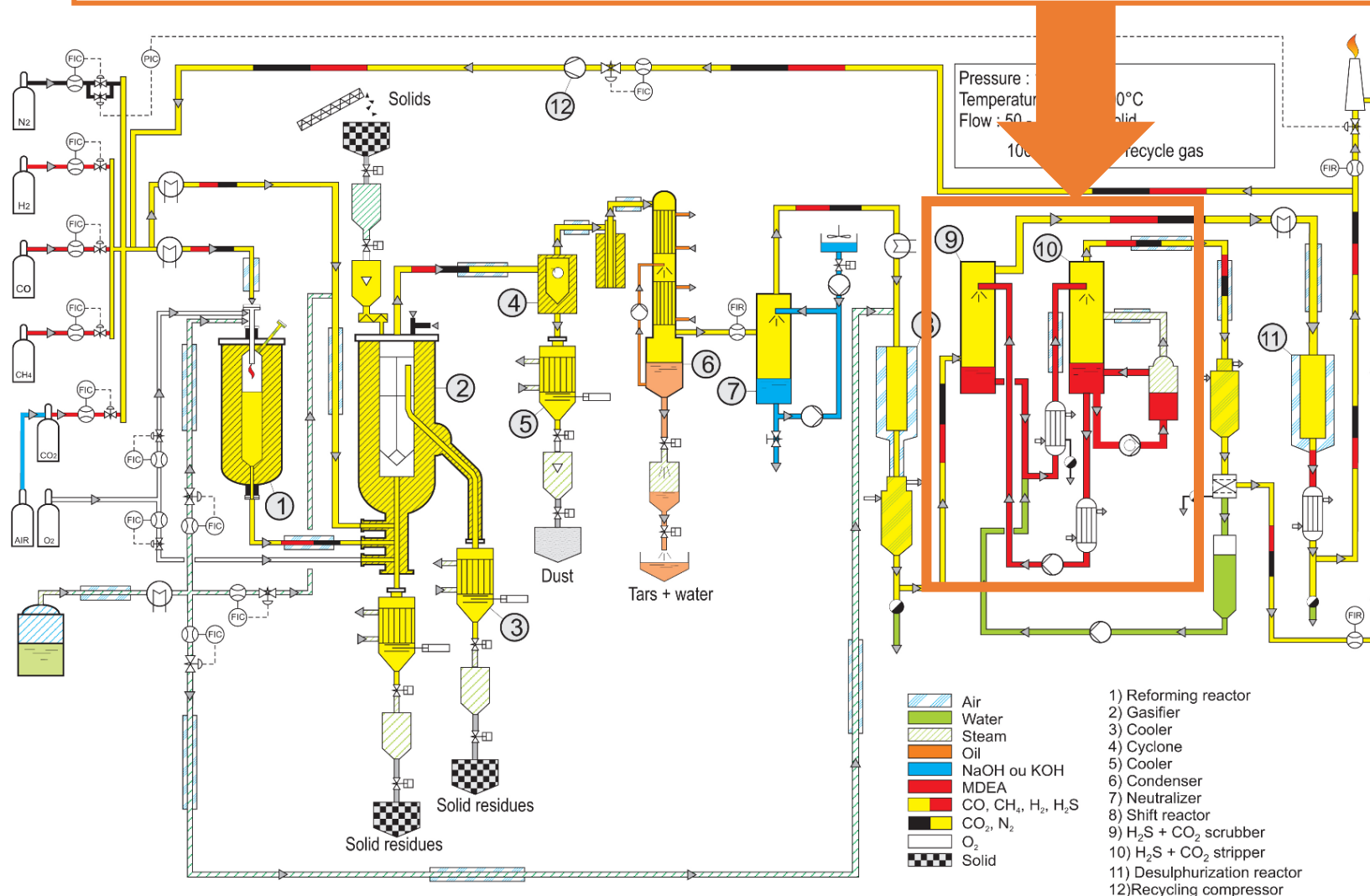
Energy and Low Impact Industry department



IEAGHG 8th Post Combustion Capture Conference
Marseille, 18th september 2025

The starting point ...

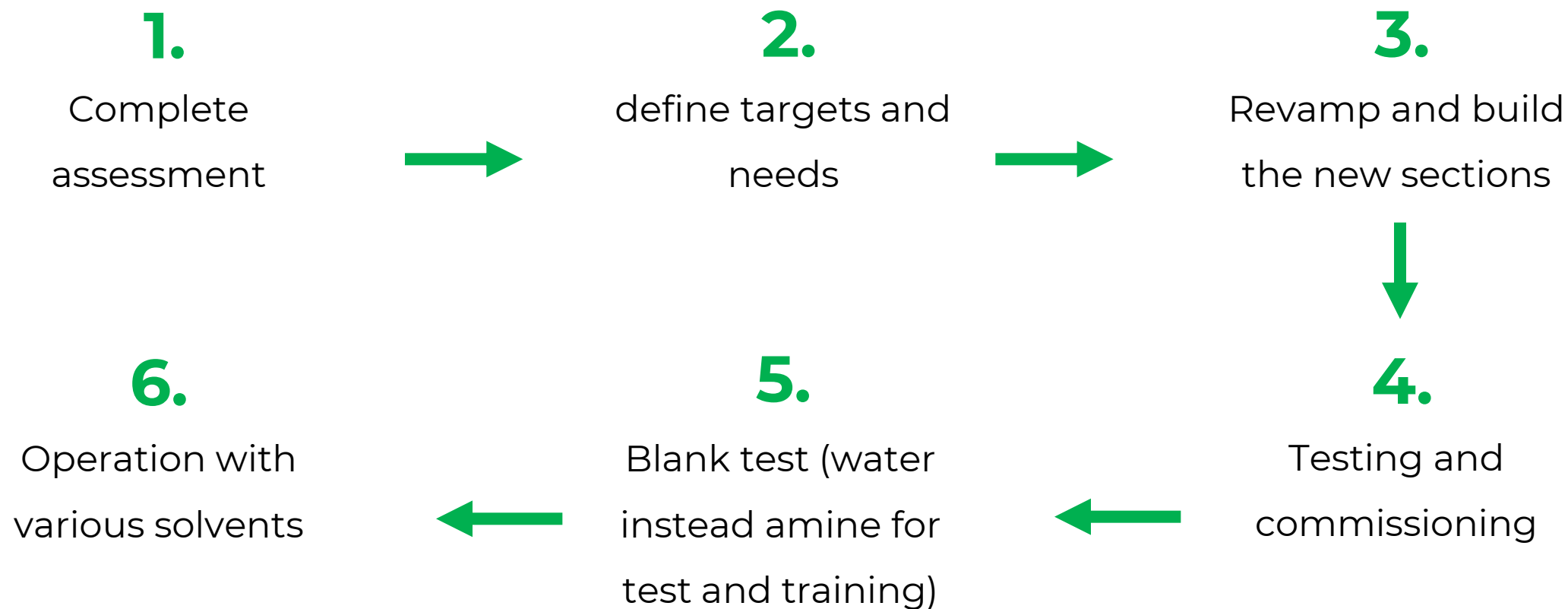
Former capture plant : integrated in a coal liquefaction plant



Dated from the end of the 1980's

- H₂S and CO₂ capture
- High pressure : up to 50 barg
- MDEA25%w solvent
- With limited sensors and automation

Revamping : the process



Revamping : targets



Modern pilot, fully
automated and controlled



Flexibility regarding the
amine-based solvent



Suited to simulate many
industrial applications



Suited to the needs of current
and future industry partners in
CO2 capture development



Independent of solvent or
technology suppliers

Revamping : targets



Modern pilot, fully automated and controlled



Flexibility regarding the amine-based solvent



Suited to simulate many industrial applications



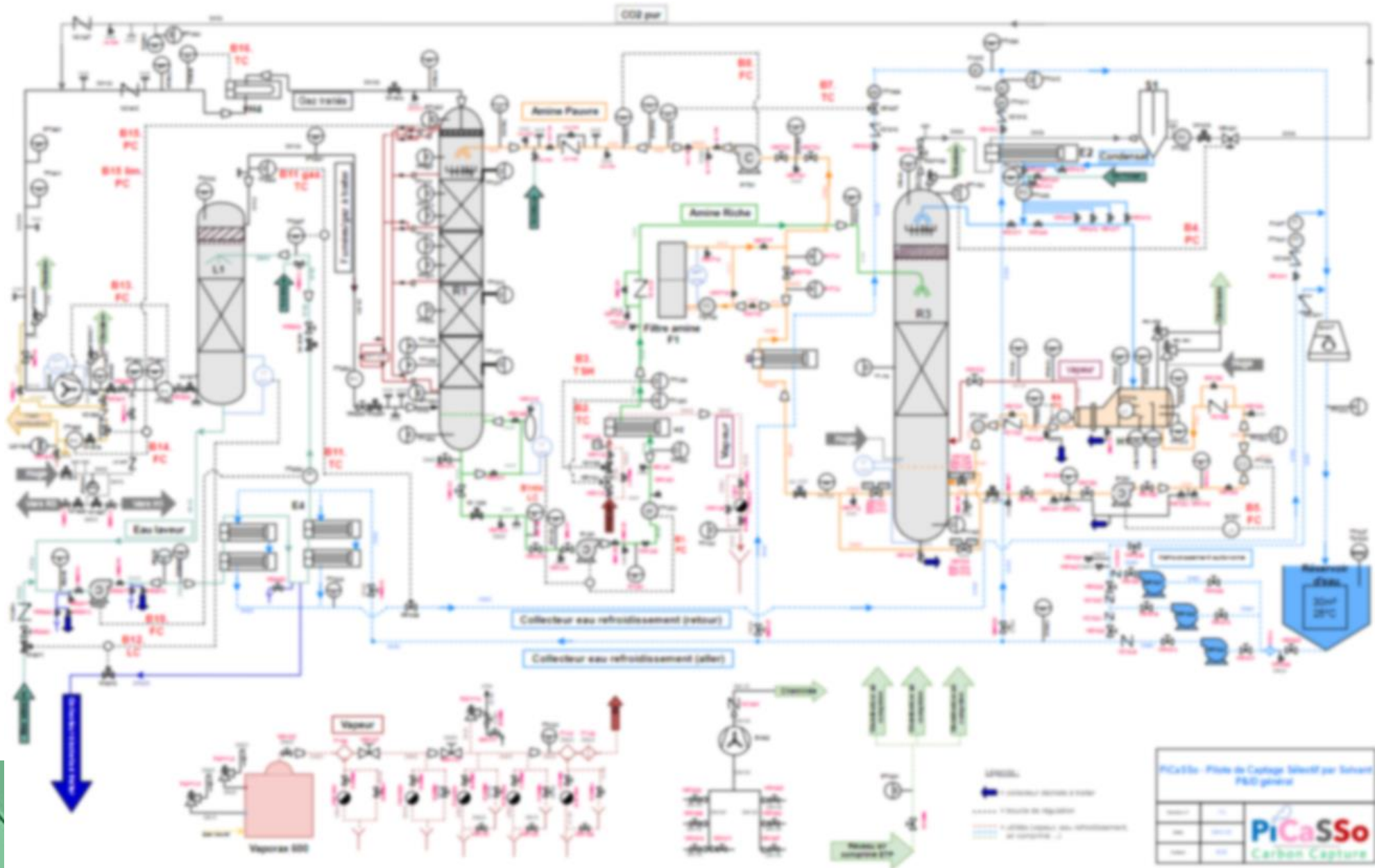
Suited to the needs of current and future industry partners in CO₂ capture development

Unique feature : tailor- made production of the inlet gas stream, which is assembled by mixing pure gases (CO₂, CO, H₂, CH₄, N₂, O₂, ...), then by adjusting pressure, temperature and moisture.

Allows to test CO₂ capture on:

- literally any type of industrial fumes
- on pressurized pre-combustion gases (e.g. syngas from gasification plants)
- On industrial gases (e.g. blast furnace gas)

In the real world ...

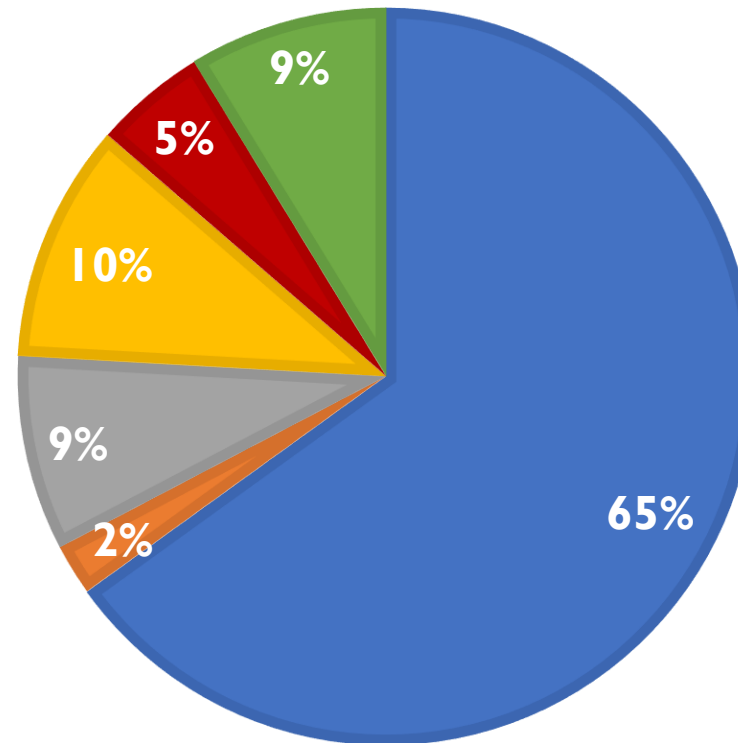


Revamping costs

REVAMPING BUDGET

- Workforce/ internal staff
- external staff
- piping
- equipment/mecanic
- sensors and automatic valves
- electricity and automation

**Total revamping
costs ~ 1.4M€**



Pilot characteristics

- **50 to 200 kg/h CO₂ captured (1 to 5 tpd)**
- **inlet gas of tailor-made composition**
 - obtained by mixing pure gases (can simulate fumes or pre-combustion gases, e.g. steel plant gases)
 - possible addition of ppm range pollutants (NH₃, SO_x, NO_x, etc)
- **Solvent** : Designed to be operated with various amine-based solvents (MEA, aMDEA, CESAR-1, etc)
- **Absorber** :
 - Pressure : 0 – 6 barg
 - Packing height : 6.2 m (structured)
 - 400 – 800 Nm³/h inlet gas
 - Solvent flowrate : 0.5 to 3 t/h
- **Stripper** :
 - Pressure : 0 – 3 barg
 - Packing height : 1.7 m (random)
 - Electric reboiler : 185 kW



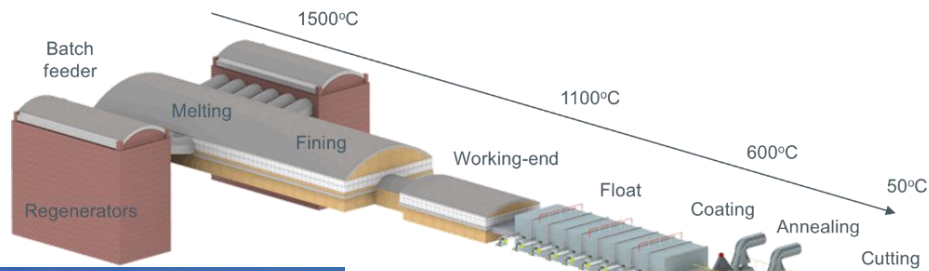
Industrial capture conditions

Industrial sectors :

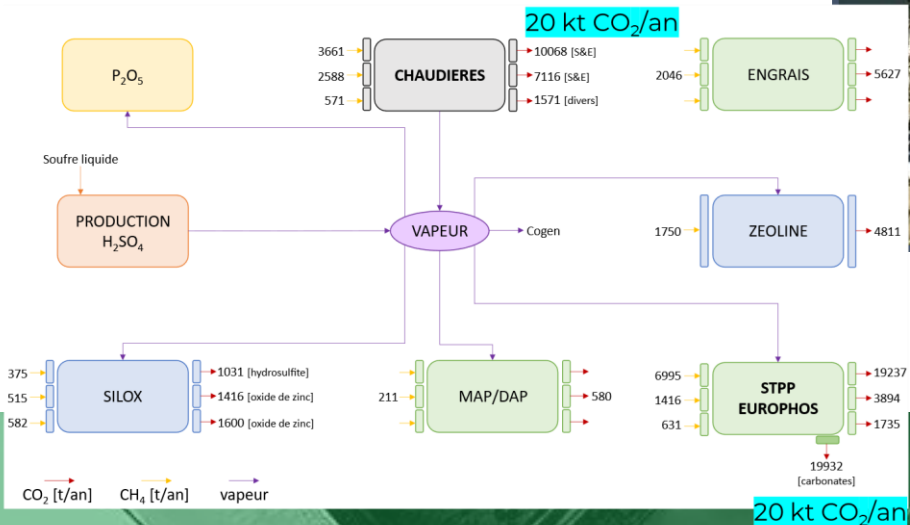
Stainless steel, Glass, Chemistry (phosphates) and Lime



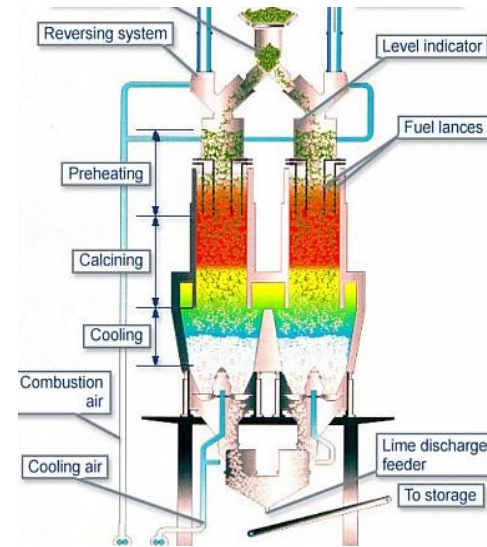
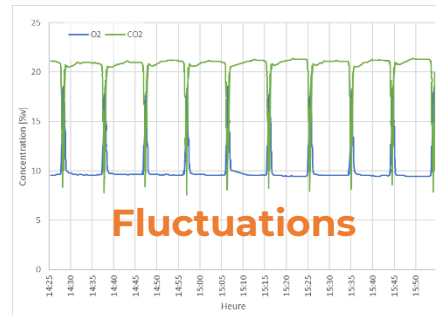
- **Tackle “fatal” or “hard-to-abate” industrial emissions by CCUS and (if needed) process retrofit**
 - Assess feasibility and costs of end-of-pipe capture
- **Select, implement and optimise capture technologies in the specific industrial applications of project partners**



AGC



CARMEUSE



EAF (Electric Arc Furnace)

Converter AOD

Continuous casting (slabs)



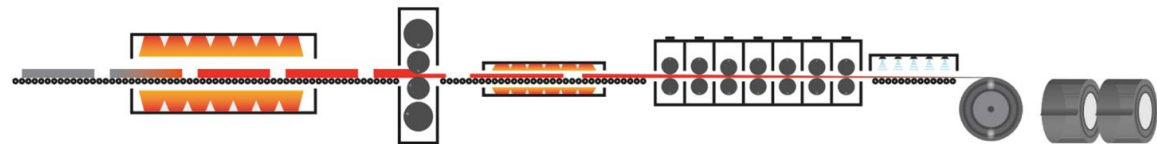
Reheating furnaces

Hot rolling

Thermal tunnel

Hot rolling

Cooling



aperam

Operation of the capture plant

Started in April 2025

11 operating points already tested

Solvents (interchangeable) :

1. MEA30% (currently used)
2. Cesar-1 (AMP/PZ)
3. MDEA activated
4. Others (following demand)

Analysis :

Solvent : loading rate Online & lab measure

Gas : 6 sampling points with μ GC

Quick switch between operating point (max 1h)

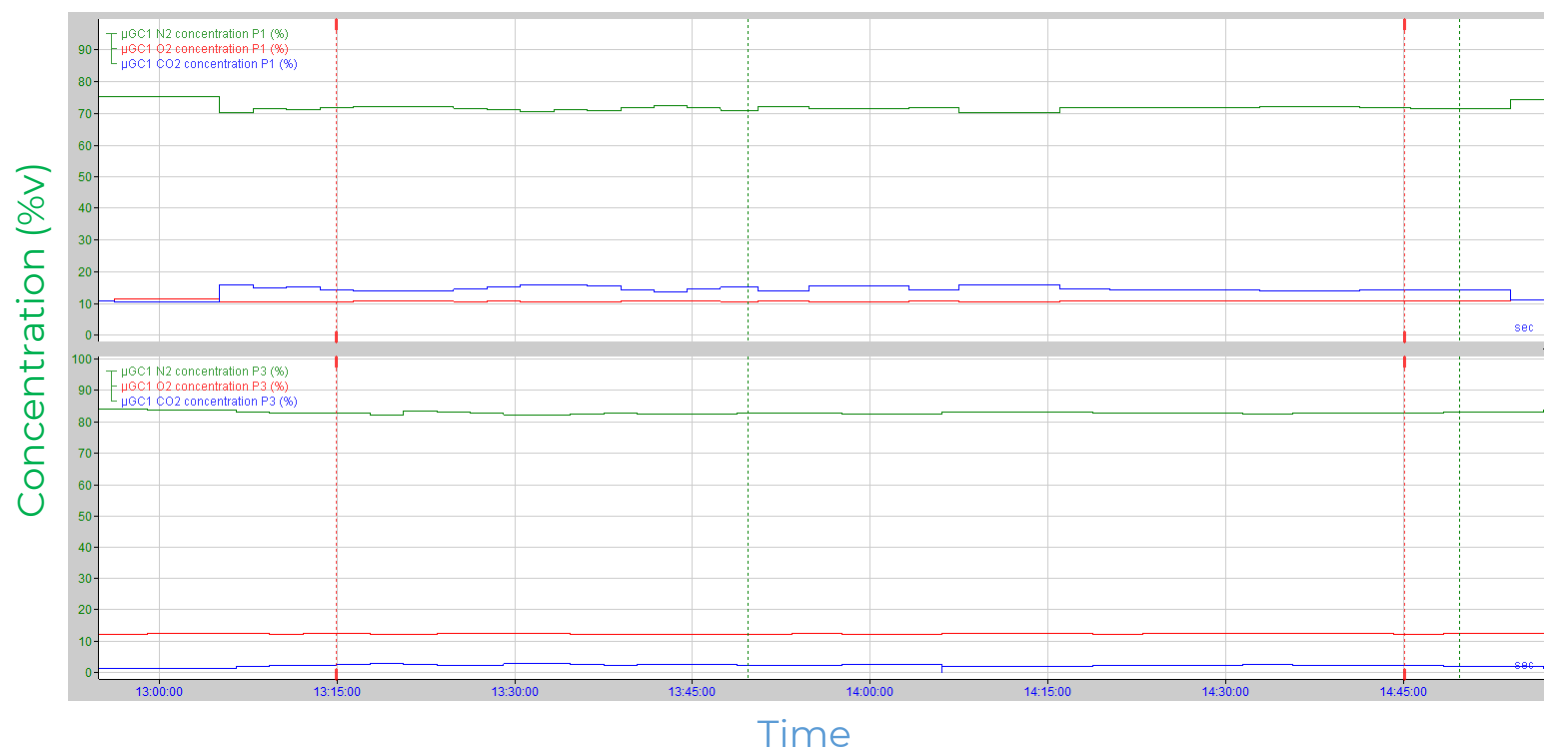
→ Operating points chosen following gas conditions of our partners helped by simulation from University of Liège



Operation : results

Results for gas composition with 15%v CO₂ - 440Nm³/h (Stainless industry – AOD Furnace)

Capture rate : 80 – 90%



Blue = CO₂

Red = O₂

Green = N₂



Figure : Gas analysis μGC P1 = inlet absorber, P3 = outlet absorber, blue = CO₂, green = N₂, red = O₂

Gas composition at absorber inlet : **stable** and with recirculation loop (**>95%**)

For a better future

Operation : results

Results for gas composition with 15%v CO₂ - 440Nm³/h (Stainless industry – AOD Furnace)

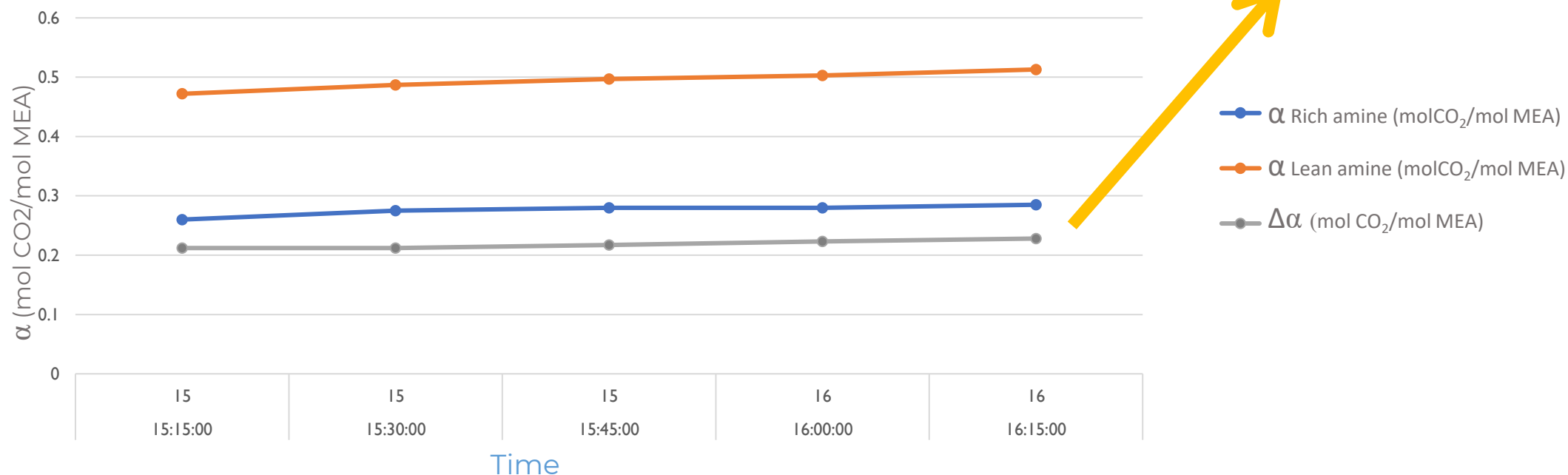
Loading rate (α) :

Rich amine ~0.50 molCO₂/mol MEA

Lean amine ~0.27 molCO₂/mol MEA

→ $\Delta\alpha$ ~0.23 molCO₂/mol MEA

stable



Next steps

Under contract with partners (lime, glass, stainless steel and chemical industries) until June 2026



PRAYON

→ Starting June 2026 available for private trials

- solvent of your choice
- Gas composition tailor-made from pure gas (CO_2 , N_2 , O_2 with possibilities of CO , CH_4 , H_2 , ...)

Conclusions

- Pilot operationnal
 - Tailor made flue gas supply
 - Solvent interchangeable
 - Capture rate : 80 – 90%
 - $\rightarrow \Delta\alpha \sim 0.23 \text{ molCO}_2/\text{mol MEA}$
- 1 to 5 tpd CO_2
- In operation for 4 industrials partners
- Available from june 2026 for trials



This pilot plant was designed and constructed in the frame of :



SATURN

Supported by :



**Funded by the
European Union**
NextGenerationEU



THANK YOU

www.crmgroup.be

BDServices@crmgroup.be

For a better future