

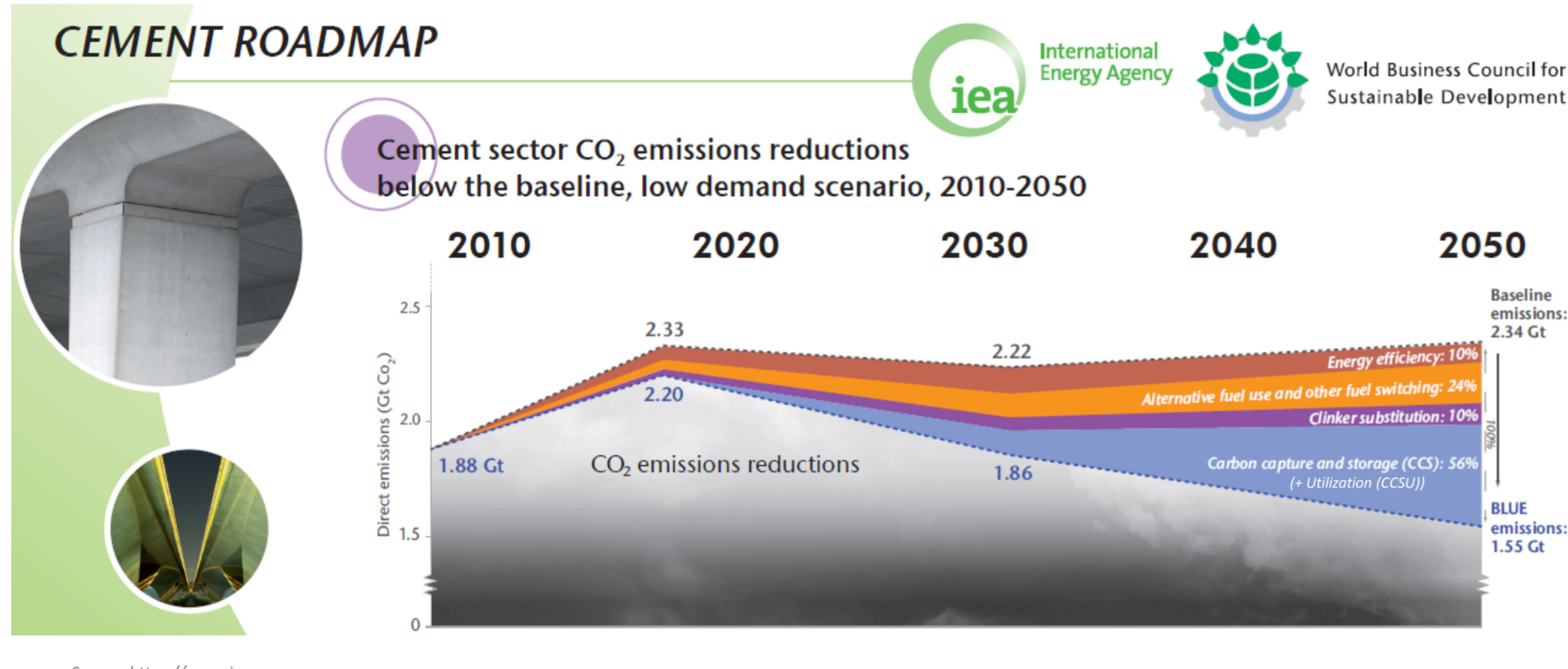
ECRA ACADEMIC CHAIR "FROM CO₂ TO ENERGY" AT THE UNIVERSITY OF MONS: CO₂ CAPTURE & REUSE IN THE CEMENT INDUSTRY

Lionel DUBOIS, Sinda LARIBI, Seloua MOUHOUBI, Nicolas MEUNIER, Remi CHAUVY, Guy DE WEIRELD and Diane THOMAS*
Chemical & Biochemical Process Engineering and Thermodynamics Units, Faculty of Engineering,
University of Mons, 20 Place du Parc, 7000 Mons - Belgium - *diane.thomas@umons.ac.be

CEMENT INDUSTRY CONTEXT

Cement plants ≈ 30% of the industrial CO₂ emissions

CO₂ emissions reductions



44% thanks to:

- Energy efficiency
- Alternative fuel
- Clinker substitution

56% thanks to:
Carbon Capture Storage & Utilization (CCSU)

The reduction of the CO₂ emissions from different industries (power plants, cement plants, etc.) at world scale requires the implementation of **Carbon Capture, Storage and Utilization (CCSU) processes**. The application of CCSU to power plants flue gases (CO₂ contents from 5% to 15%) has already been considered in many studies but there is still a lack of data concerning its specific application to the **cement industry** (y_{CO₂} > 15%).

Regarding the capture phase, two technologies are adapted to the cement industry, namely:

- the **post-combustion CO₂ capture** (currently tested at pilot scale in the cement industry), where the CO₂ in the pretreated flue gas (containing from 20% to 30% CO₂) is conventionally captured thanks to an absorption-regeneration process where it is absorbed in a solvent (such as monoethanolamine 30 wt.%) which is then regenerated requiring energy;
- the **oxy-fuel combustion CO₂ capture** (the selection of a cement plant for pilot tests is undergoing), where the combustion is performed with pure oxygen leading to flue gases highly concentrated in CO₂ (>80%) which need to be purified (de-SO_x, de-NO_x, etc.) prior to conversion into valuable products such as methanol.

Another option envisaged by the cement industry is the "**partial oxy-fuel combustion CO₂ capture**" which corresponds to a hybrid process which combines the combustion with O₂-enriched air (CO₂ contents in the flue gas between 40% and 60%) and post-combustion CO₂ capture by the absorption-regeneration process.

In this context, the **ECRA (European Cement Research Academy) Academic Chair** was established at UMONS in 2013, focusing on the CO₂ capture and reuse applied to the cement industry. Initially scheduled for a first period of 3 years, the ECRA Academic Chair has been recently prolonged until mid-2019!

April 2013: Important scientific agreement between **ECRA (European Cement Research Academy)** and **UMONS (University of Mons)**

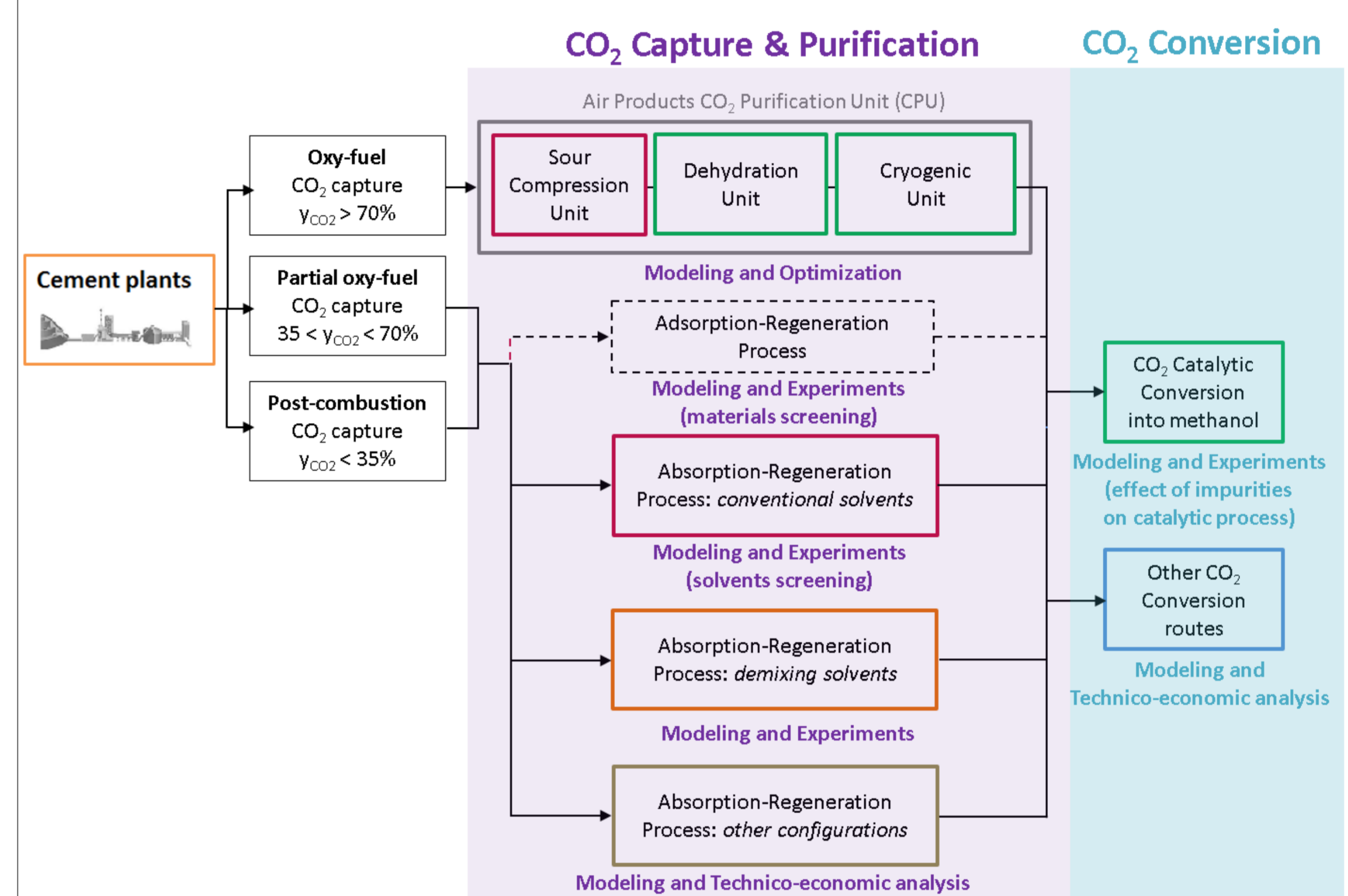


Centre of scientific expertise in the specific field of "carbon capture in cement production and its re-use"

Promotion of research and innovation through:

- PhD theses + Post-Doc
- Projects for under-graduated students + ECRA Award
- External communications
- Technical/scientific Events
- Visits of professors & experts

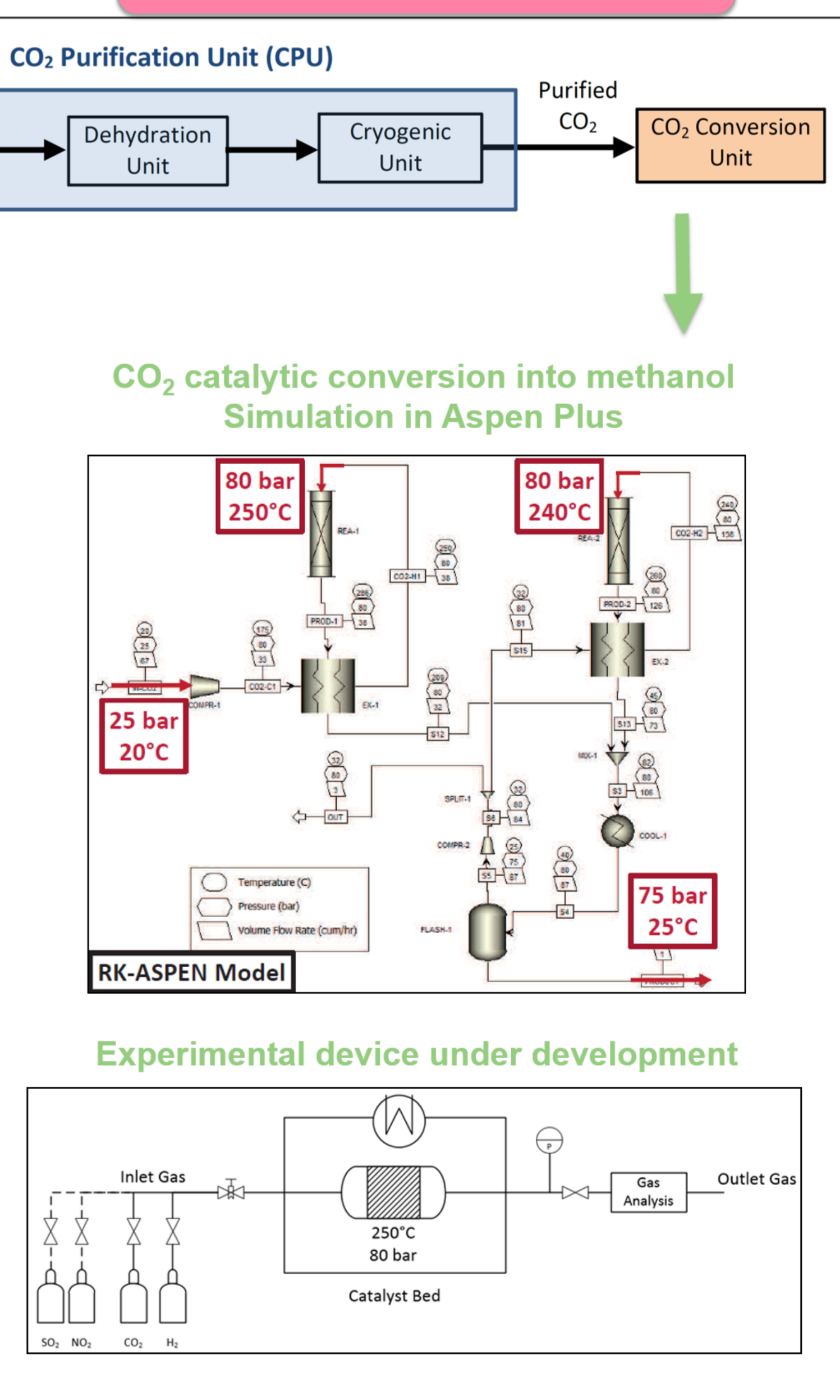
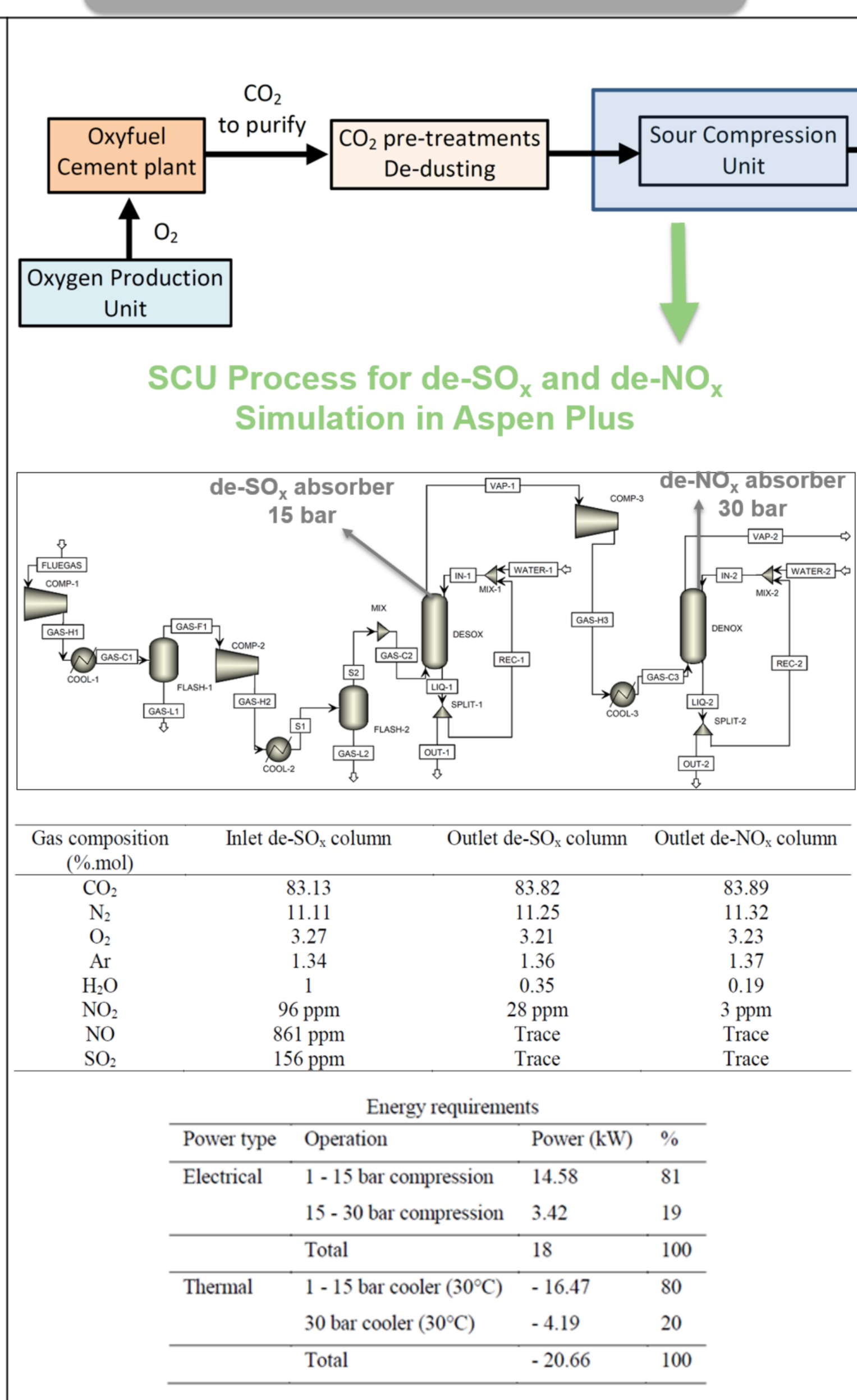
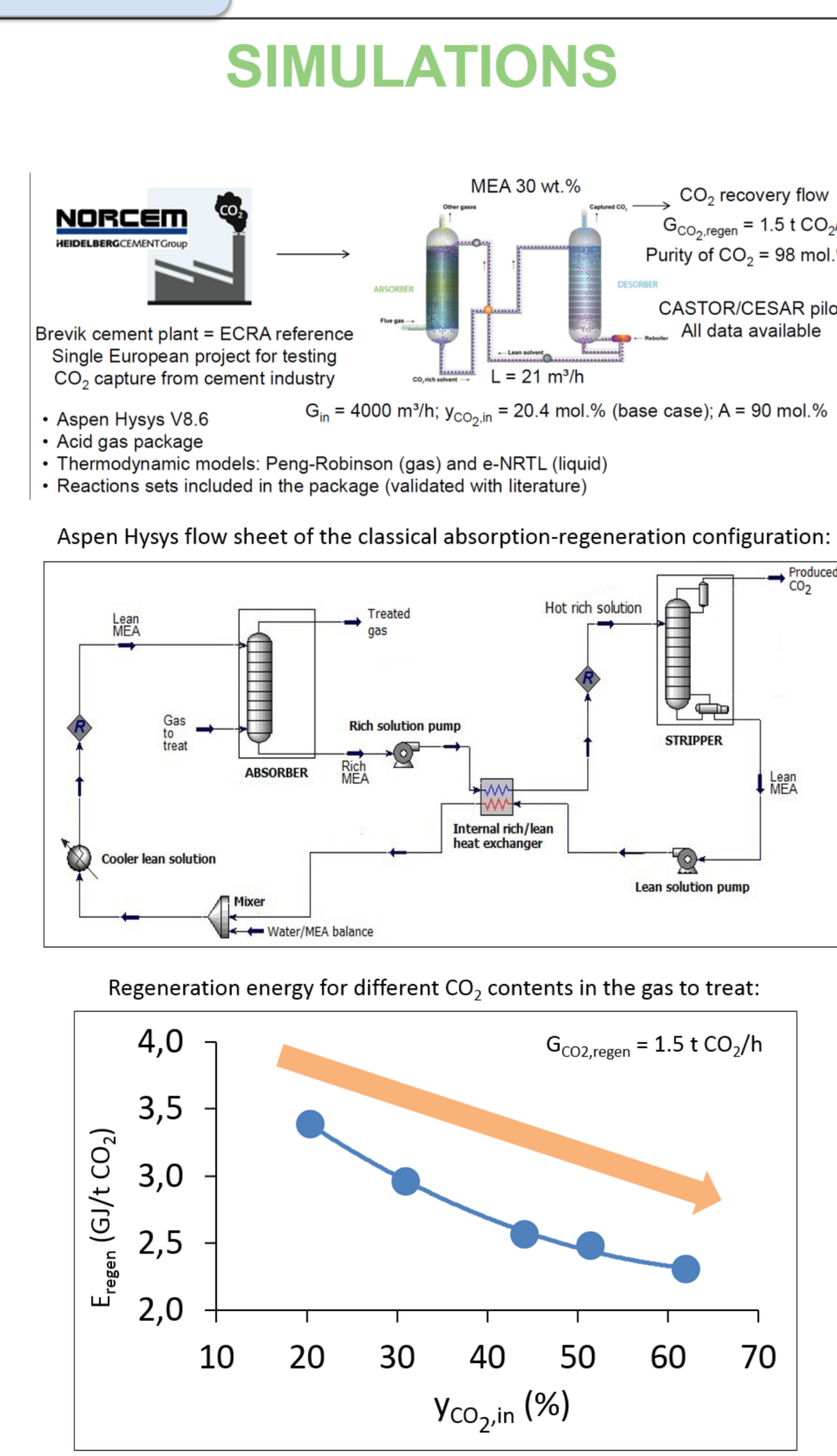
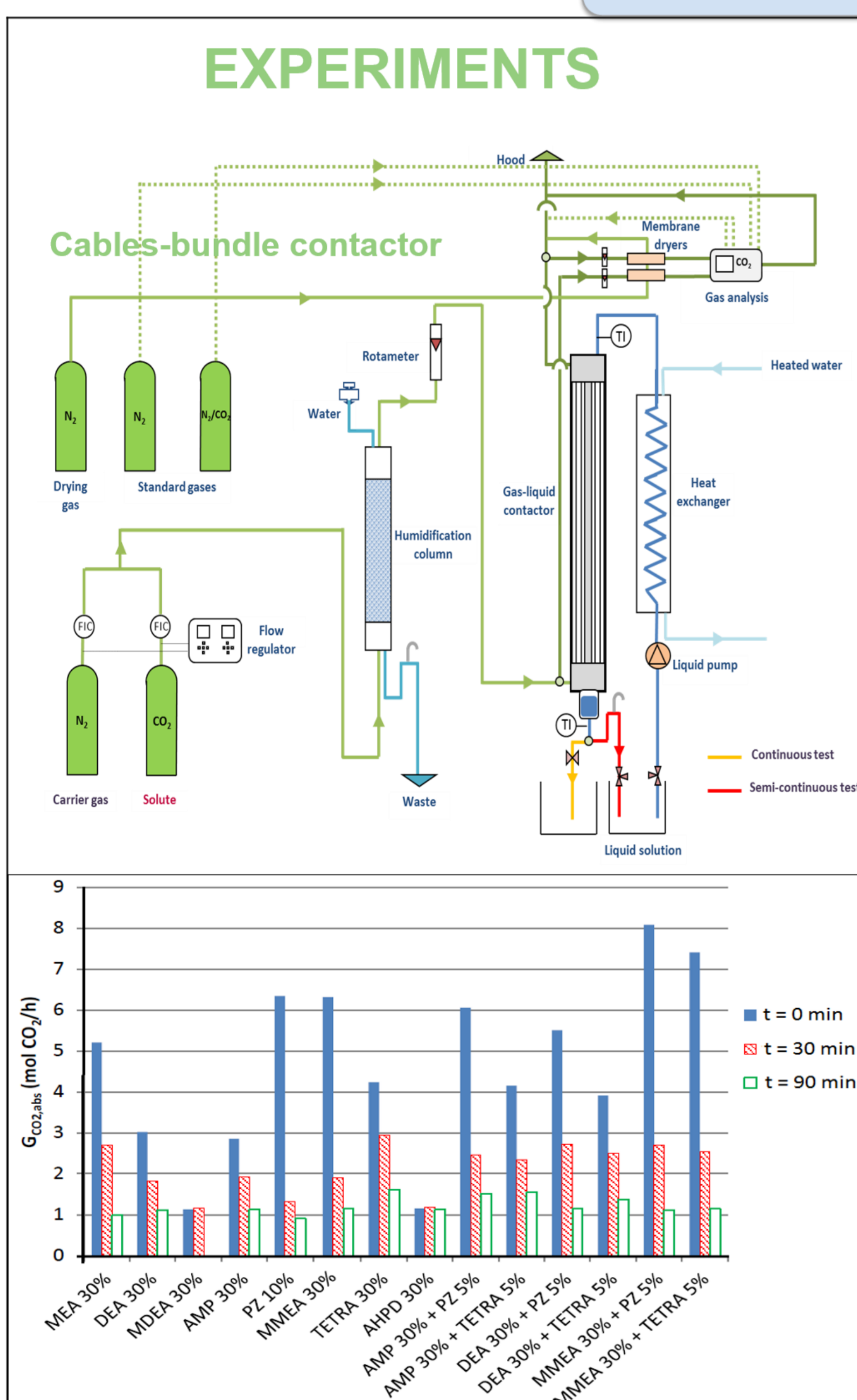
ECRA Academic Chair Framework



CO₂ CAPTURE

CO₂ PURIFICATION

CO₂ CONVERSION



European Cement Research Academy (ECRA) and HeidelbergCement are acknowledged for the technical and financial supports accorded to the ECRA Academic Chair.

ECRA Academic Chair references:

Meunier N., Laribi S., Dubois L., De Weireld G., Thomas D., CO₂ capture in cement production and re-use: first step for the optimization of the overall process, Energy Procedia 63, 6492, 2014.

Laribi S., Dubois L., Thomas D., Post-combustion CO₂ capture applied to cement plant flue gases: screening tests of innovative solvents for the absorption-regeneration process, 10th European Congress of Chemical Engineering (ECCE 10), Nice, France, 2015.

Meunier N., Laribi S., Dubois L., Thomas D., De Weireld G., CO₂ capture and re-use from oxyfuel cement kilns: Process simulation of the CO₂ purification and catalytic conversion into methanol, International Conference on Carbon Dioxide Utilization (ICCDU XIII), Singapore, 2015.

Dubois L., Laribi S., Meunier N., De Weireld G., Thomas D., Global optimization of the CO₂ capture and reuse applied in the cement industry, Brussels sustainable Development Summit 2015, Belgium, 2015.



More information about the ECRA Academic Chair activities on:
<http://hosting.umons.ac.be/html/ecrachair>

Second ECRA Chair Scientific Event, Mons, November 2016