Introduction to Aalborg Portland's cement production

Cementir Holding

Key figures

Annual sales: € 1.2 billion

Employees: 3.042

White cement market share: 20%

Plants

Cement plants: 11

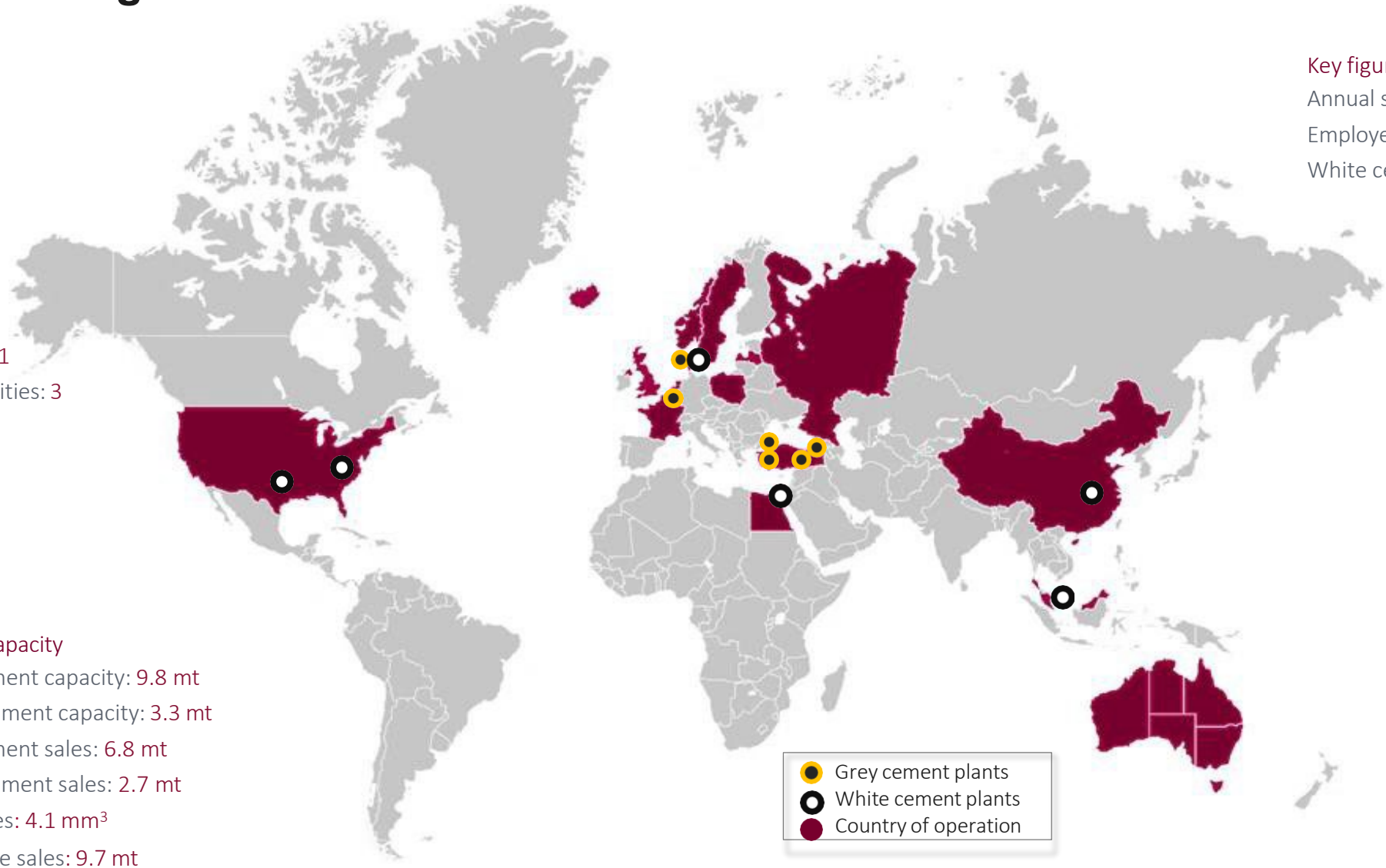
Terminals: 30

RMC plants: 100

Quarries: 11

Precast products plants: 1

Waste management facilities: 3



Sales / Capacity

Grey cement capacity: 9.8 mt

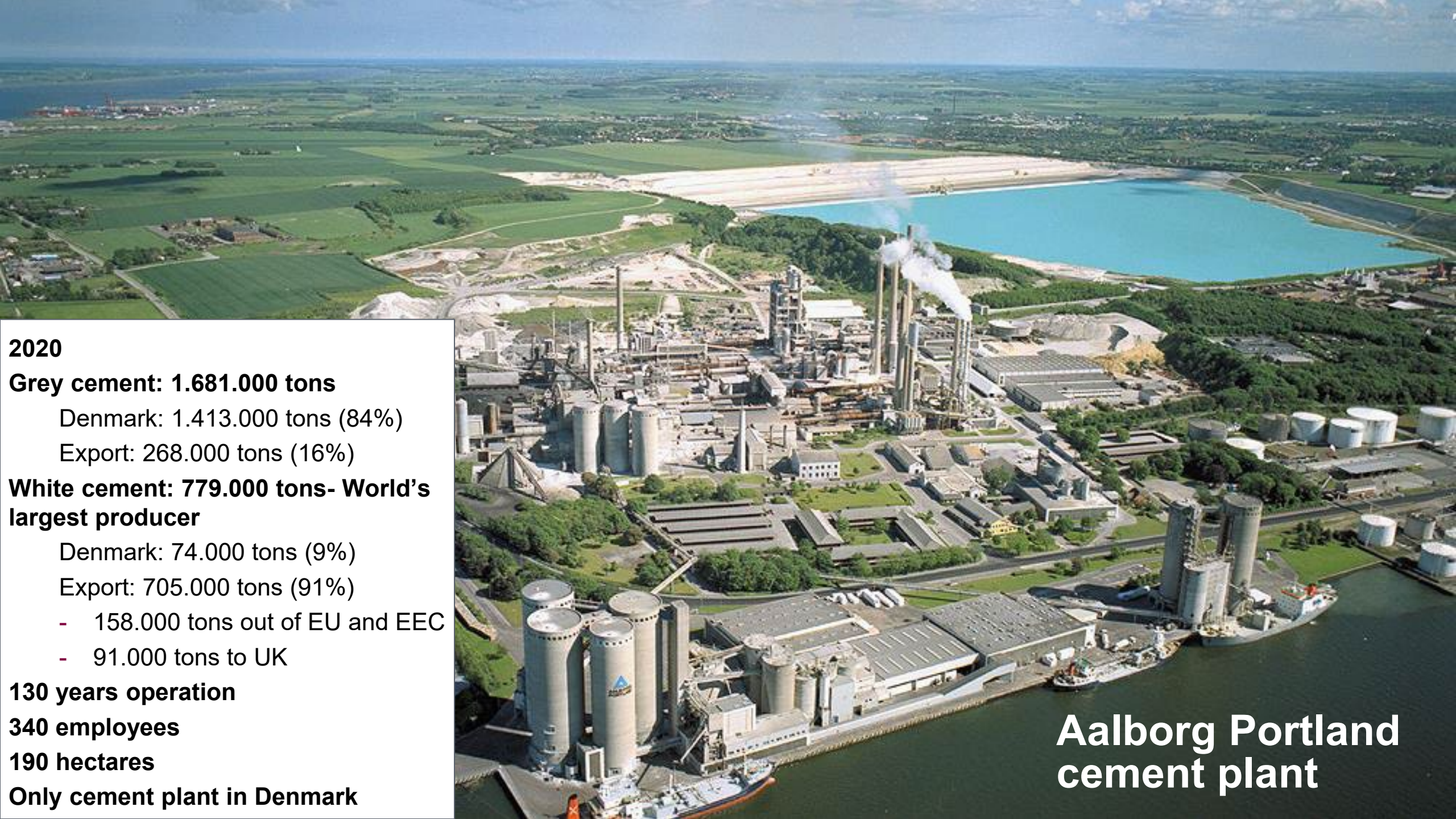
White cement capacity: 3.3 mt

Grey cement sales: 6.8 mt

White cement sales: 2.7 mt

RMC sales: 4.1 mm^3

Aggregate sales: 9.7 mt



2020

Grey cement: 1.681.000 tons

Denmark: 1.413.000 tons (84%)

Export: 268.000 tons (16%)

White cement: 779.000 tons- World's largest producer

Denmark: 74.000 tons (9%)

Export: 705.000 tons (91%)

- 158.000 tons out of EU and EEC
- 91.000 tons to UK

130 years operation

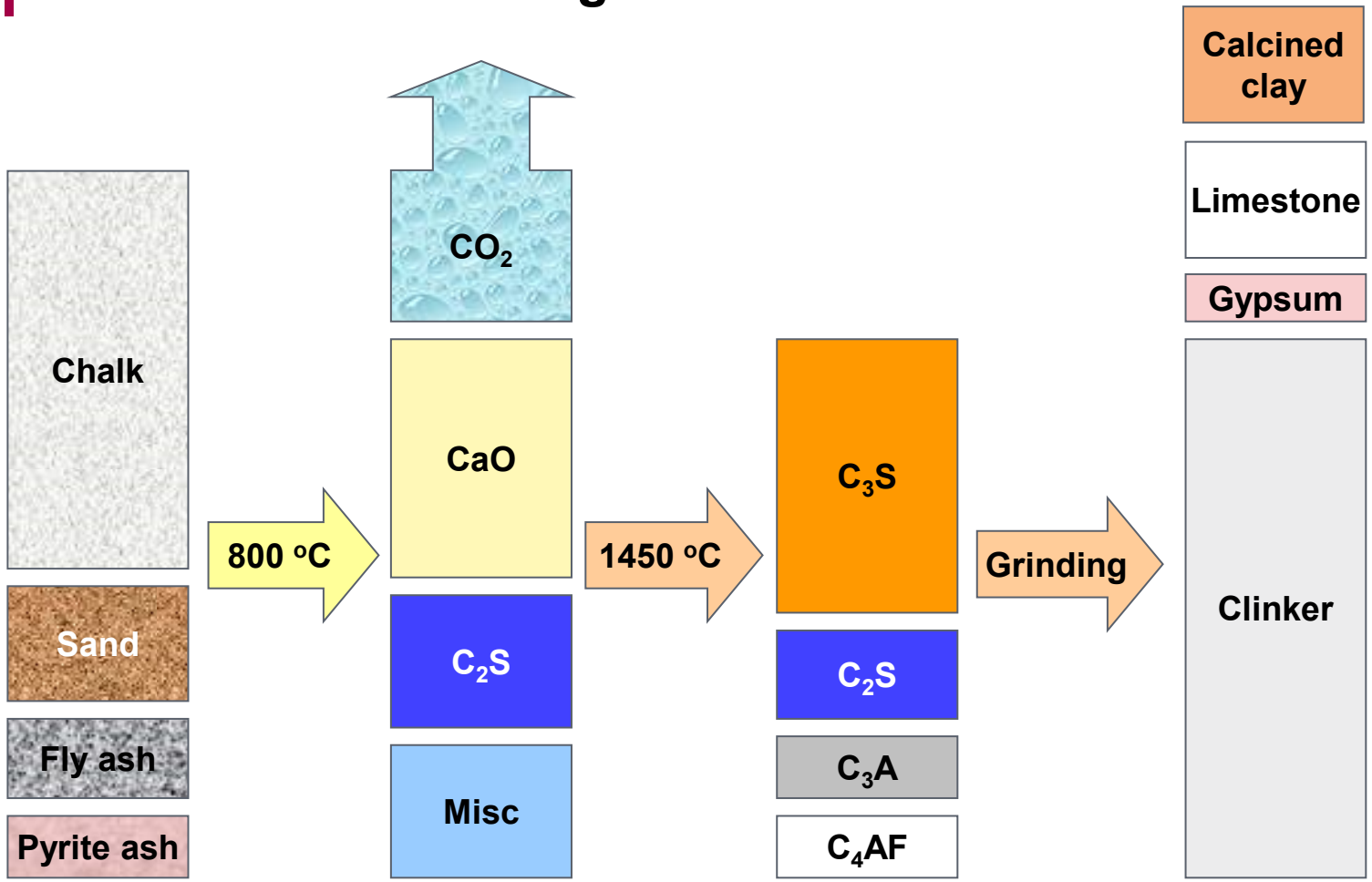
340 employees

190 hectares

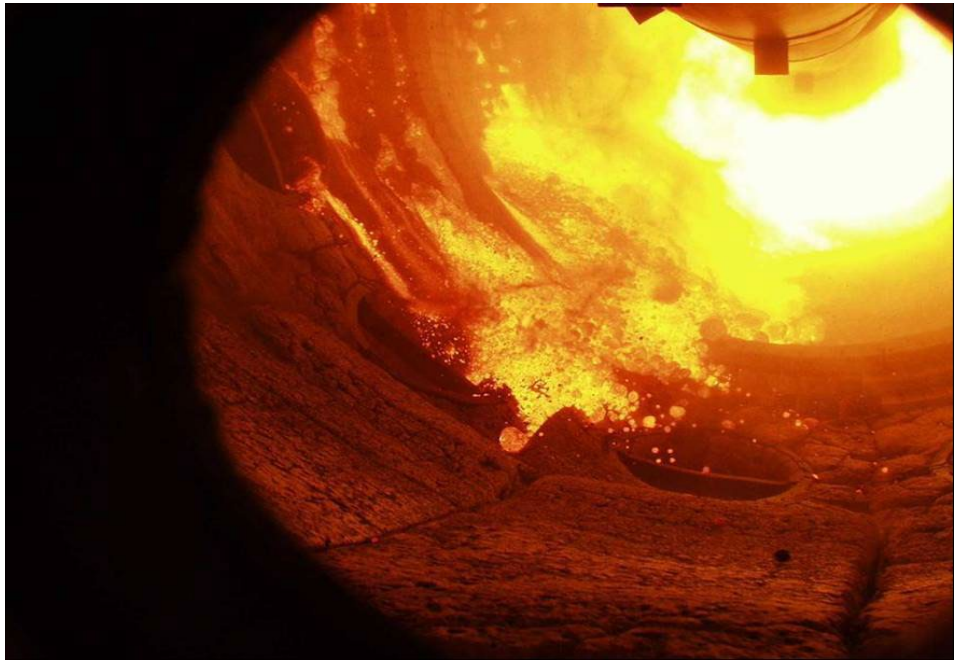
Only cement plant in Denmark

Aalborg Portland cement plant

Cement manufacturing



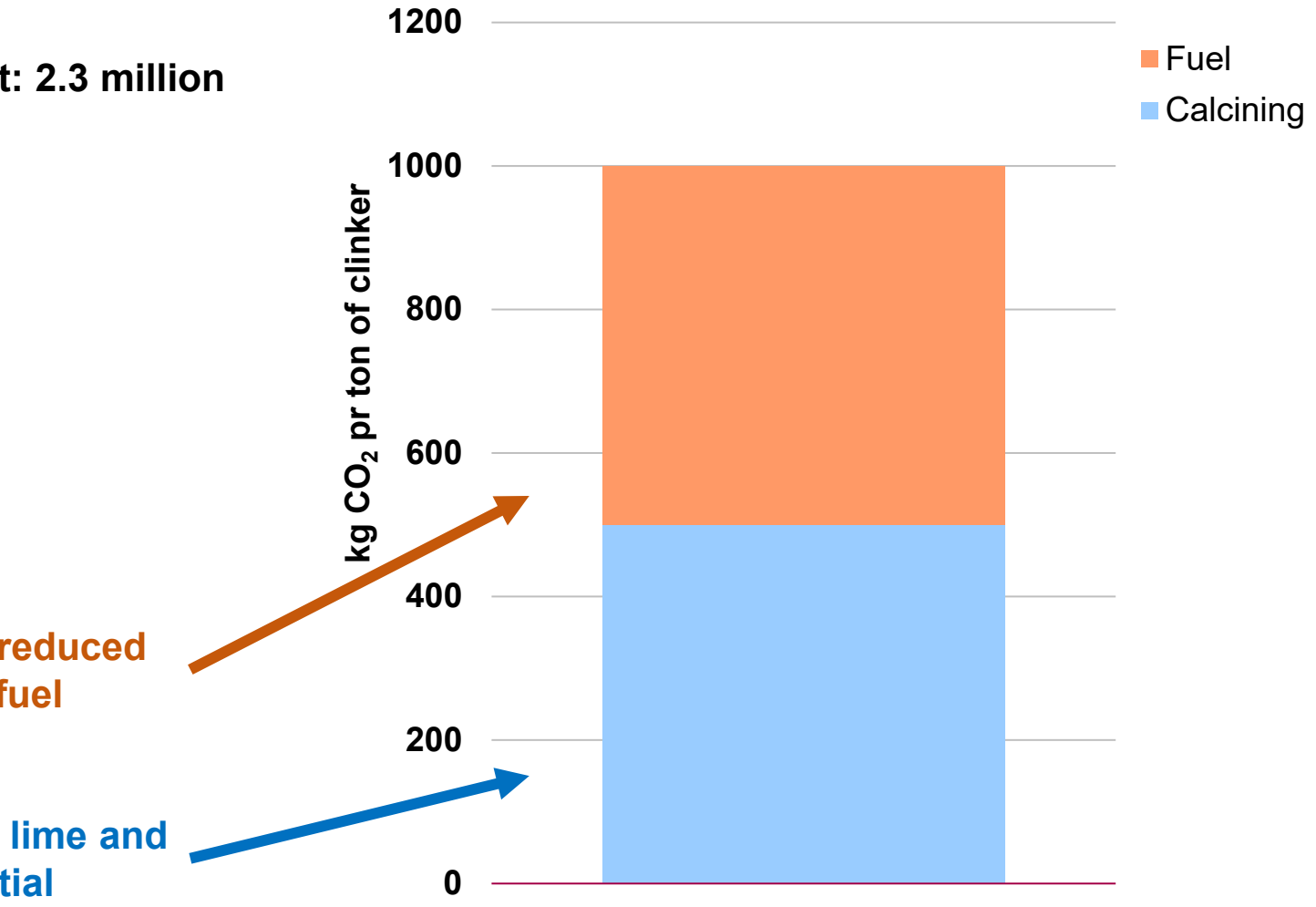
Ca_3SiO_5	$= 3CaO.SiO_2$	$= C_3S$
Ca_2SiO_4	$= 2CaO.SiO_2$	$= C_2S$
$Ca_3Al_2O_6$	$= 3CaO.Al_2O_3$	$= C_3A$
$Ca_4Al_2Fe_2O_{10}$	$= 4CaO.Al_2O_3.Fe_2O_3$	$= C_4AF$



CO_2 and cement

CO_2 emission from production of cement: 2.3 million tons

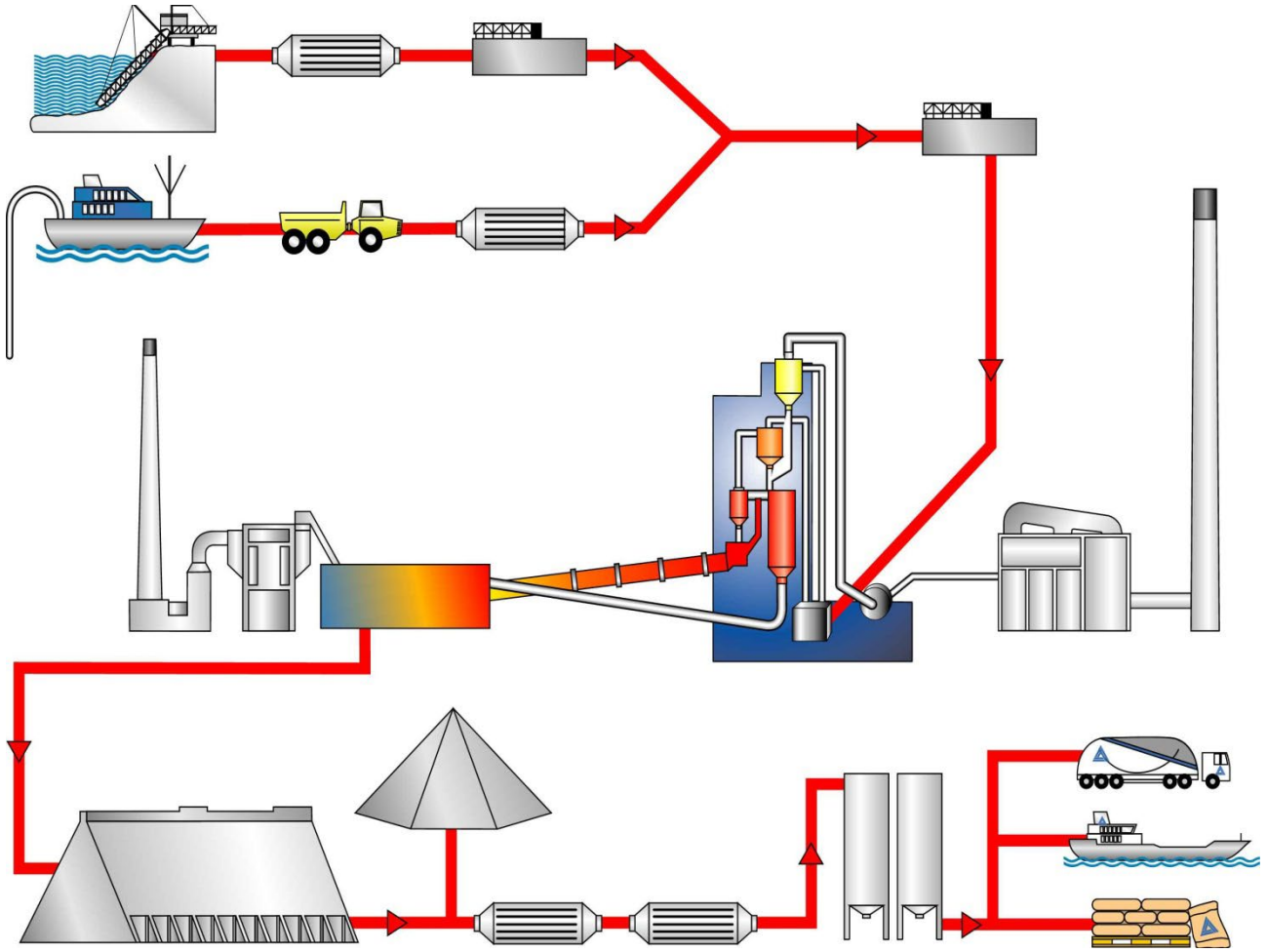
- 2.6% of Danish emissions



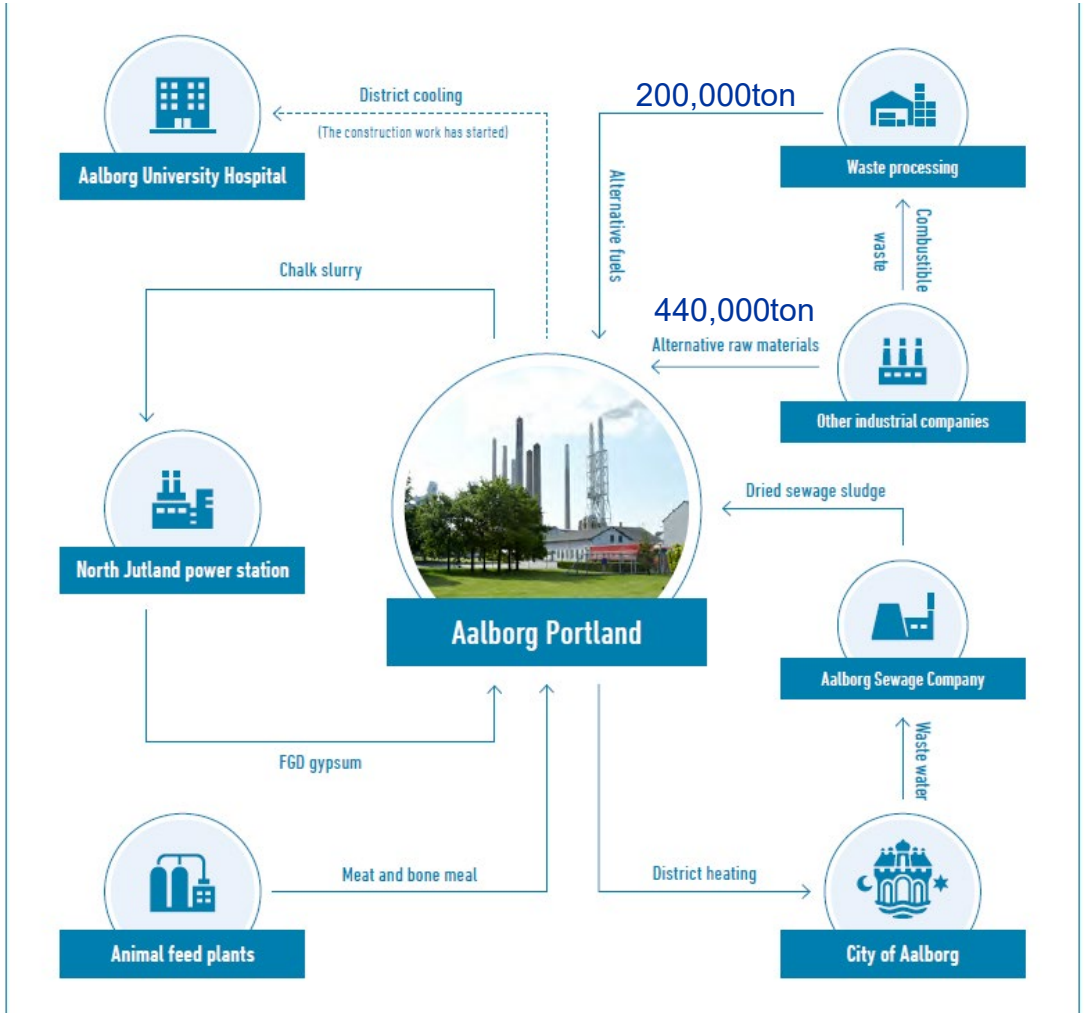
CO_2 from fuel can be reduced by using biomass as fuel

Limestone is decomposed to free lime and CO_2. Very limited reduction potential

Grey cement manufacturing process at Aalborg Portland

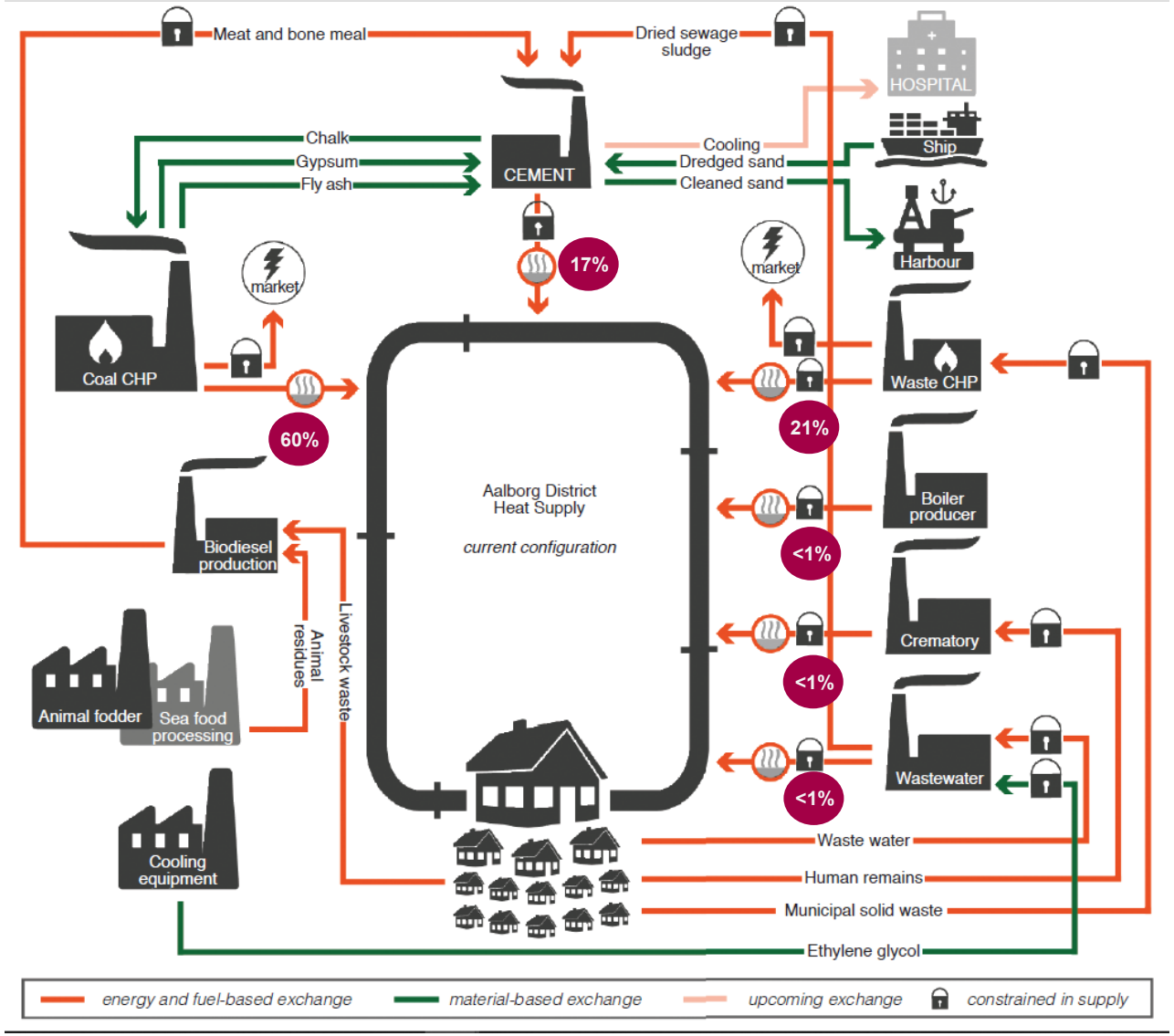


Industrial Symbiosis at Aalborg Portland

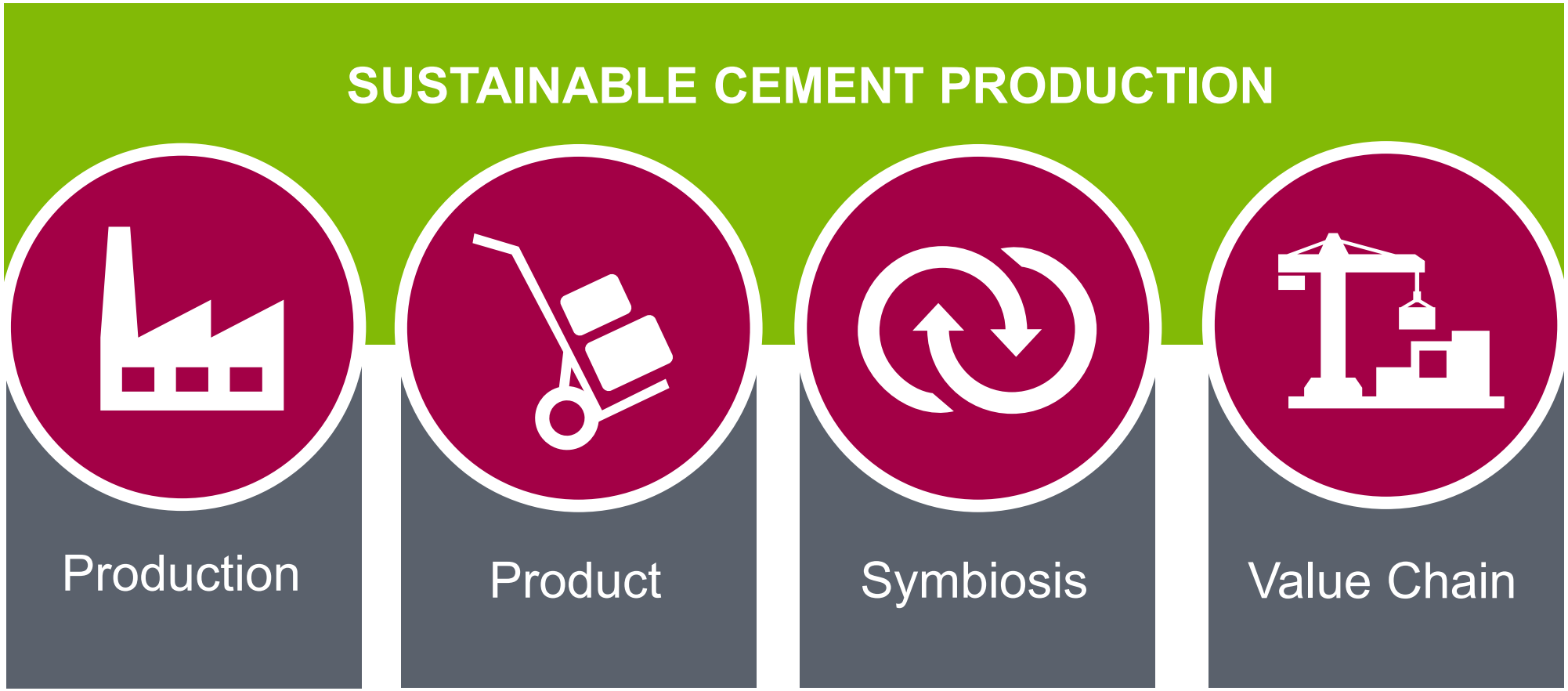


- Troldtekt boards for cement manufacturing 3.000tones
- Oxition: 68.116tones
- Dried sewage sludge from WTW: 3.000tones
- Mussel shells: 3.000 tones

Industrial Symbiosis for District Heting



Roadmap for reducing emissions by 2030



Production

1990-2019

- Partial use of alternative fuels
- Energy efficiency

2019-2025

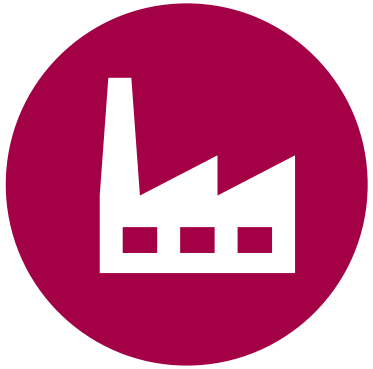
- Increased use of alternative fuels or gas
- Increased energy efficiency
- Possibility for test facility for CO_2-capturing

2025 - 2030

- 100% use of alternative fuels, gas or CO_2-neutral fuels
- Possibility for CO_2-capturing facility

2030 - 2050?

- 100% CO_2-neutral fuels
- Large scale CO_2-capturing
- Partial electrification



Product

1990-2019

- Focus on strong cement types (CEM I)

2019-2025

- Launch of FutureCem with 30% CO_2-reduction
- Portfolio change with focus on FutureCem (blended cement, CEM II)

2025 - 2030

- Launch of FutureCem with 50% CO_2-reduction
- Full portfolio implementation of FutureCem

2030 - 2050?

- Leading low carbon cement producer

Symbiosis

1990-2019

- CO_2-neutral district heating to 25,000 households

2019-2025

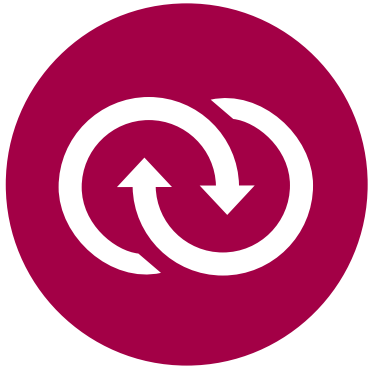
- CO_2-neutral district heating to 30,000 households
- District cooling to new hospital
- Green electricity from own wind turbines

2025 - 2030

- CO_2-neutral district heating to +50,000 households
- More district cooling

2030 - 2050?

- The symbiosis as international showcase



Value chain

1990-2019

- Marine transport
- High quality products to customers

2019-2025

- CO_2-uptake through carbonation included in IPCC and national carbon footprint inventory
- Sustainable Concrete Initiative: 50% CO_2-reduction in 2030
- New ships with 55% fuel reduction. Delivery with train. Bio-fuels for trucks

2025 - 2030

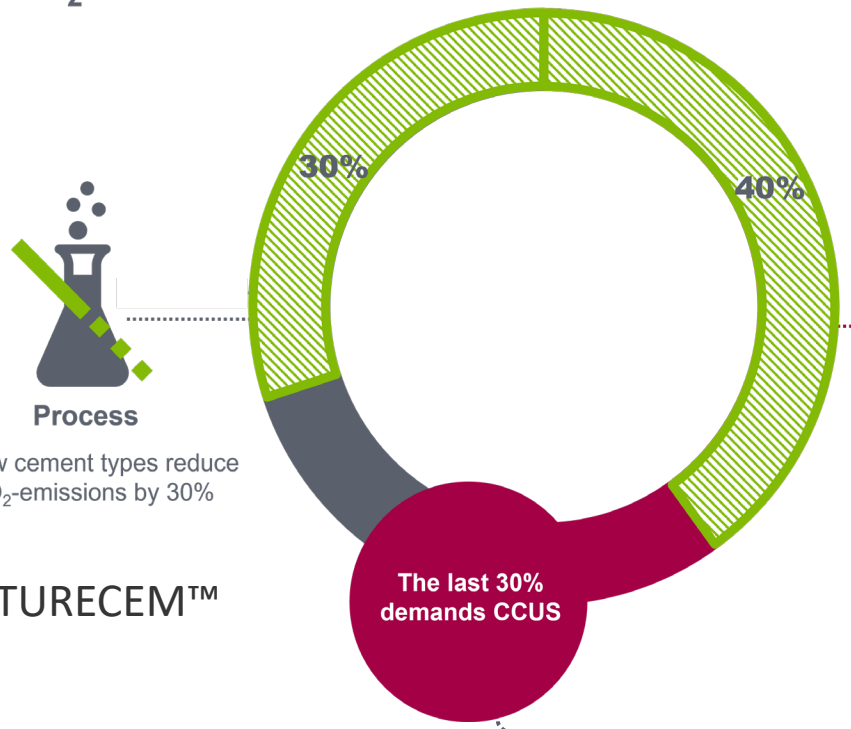
- Concrete buildings and constructions with 50% lower CO_2-footprint
- Increased CO_2-reduction in transport

2030 - 2050?

- CO_2-neutral concrete constructions
- CO_2-neutral transport

Roadmap for reducing emissions by 2050

70-100% CO_2-reduction



Process

More new cement types reduce the CO_2-emissions by 30%

FUTURECEM™

Fuels

CO_2-neutral and alternative fuels reduce 40% of the CO_2-emissions

Cement = Clinker + gypsum

Clinkers = calcination of Limestone

$CaCO3 \rightarrow CaO + CO_2$

50% of AP emissions come from the clinker production process and the release of CO_2 is inevitable

GreenCem

https://greencem.dk/

2. Power to MeOH Process Flow Diagram by AAU

1. Concept study for capture plant by COWI

- Demo: 200.000tCO_2/y
- Large scale: 1MtCO_2/y

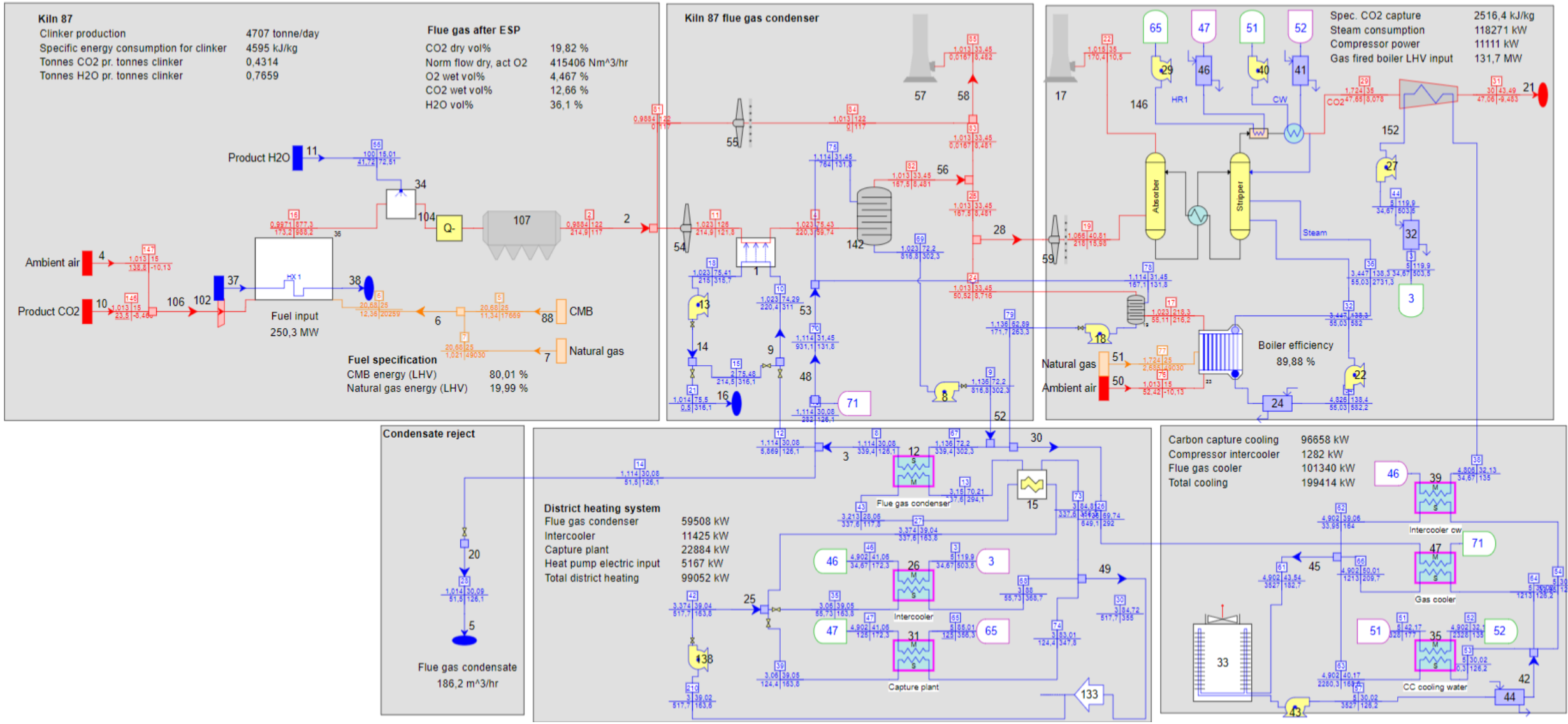
Technology:
Amine Scrubbing

Energy demand
2.3-3.8 GJ/tCO_2
TRL: 9

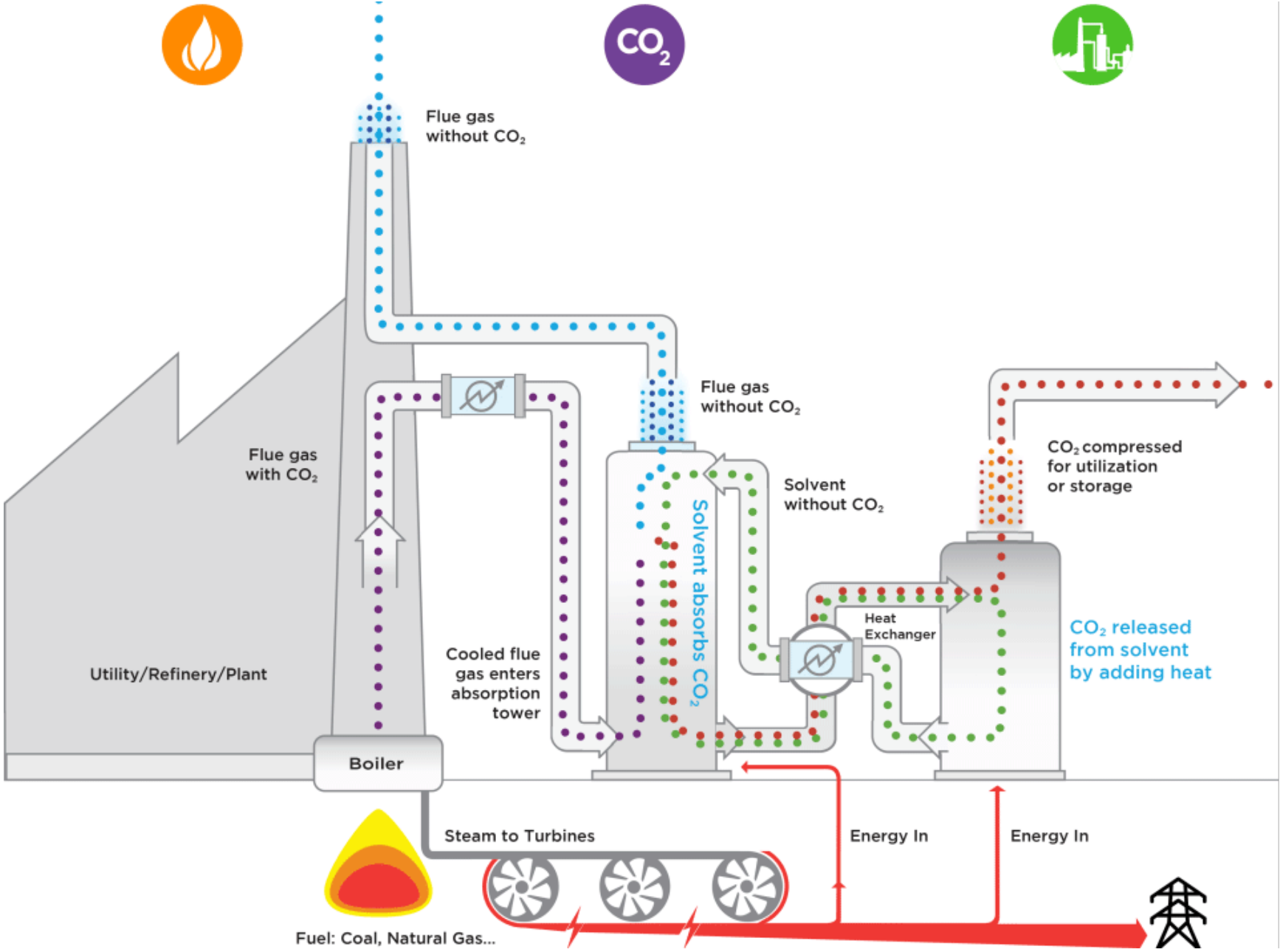
3. Life Cycle Assessment by AP

4. Economic assessment by AP

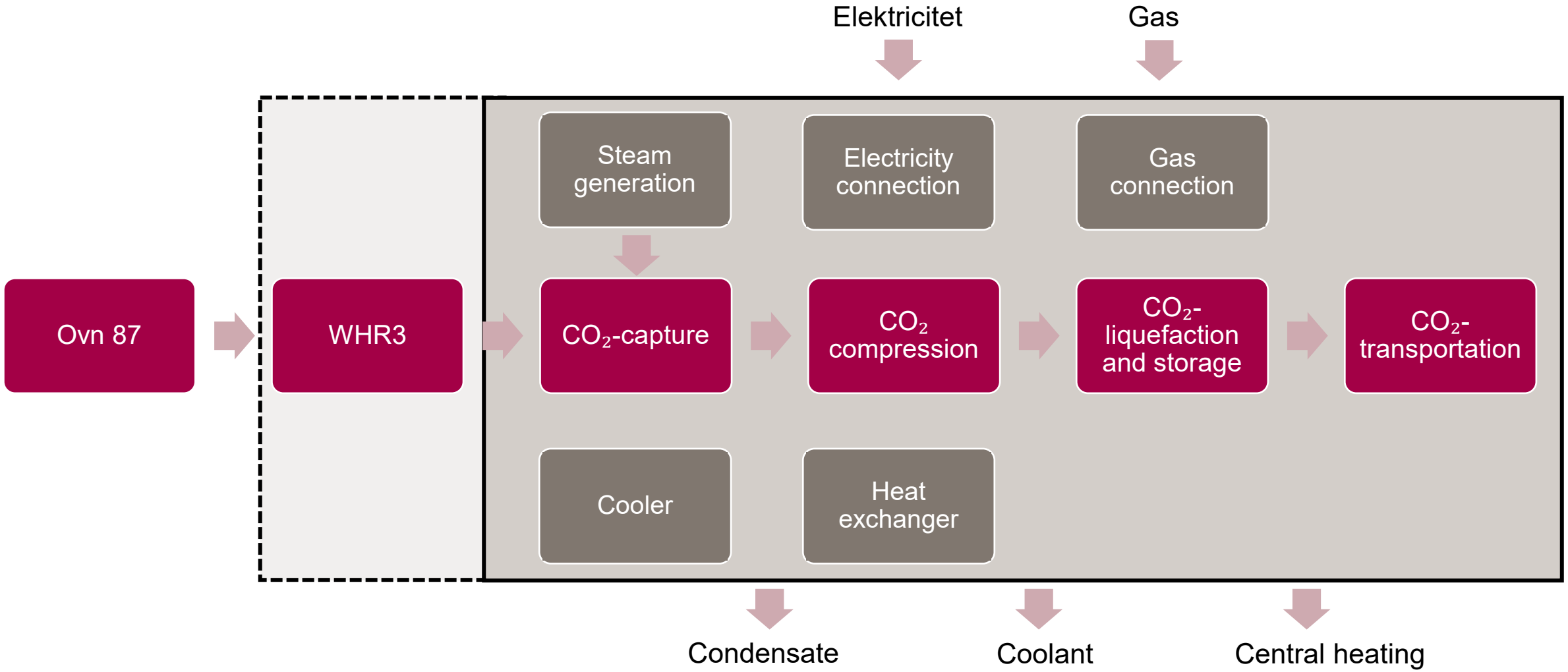
Amin process resumé



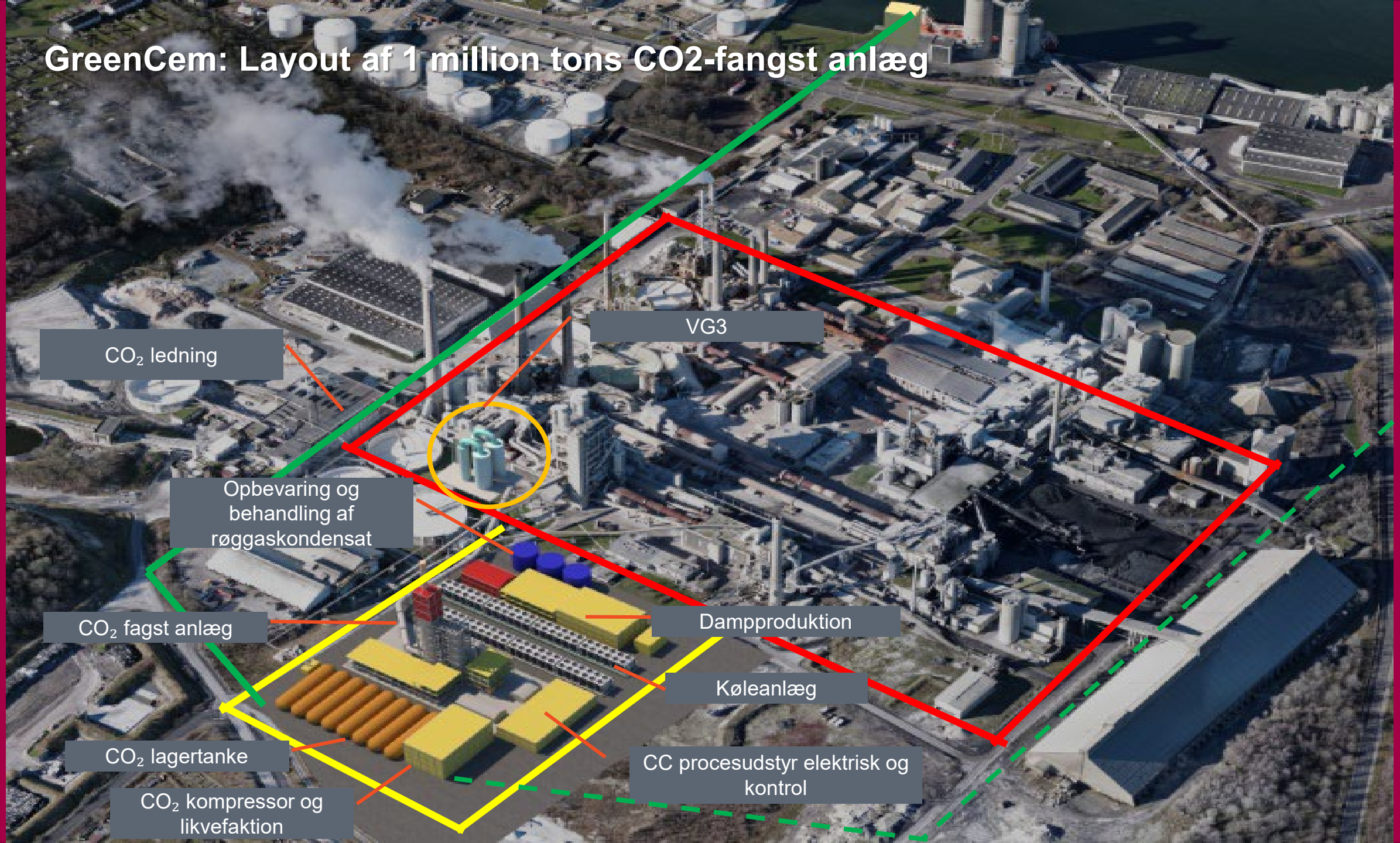
Amin process resumé



Even simpler flow diagram

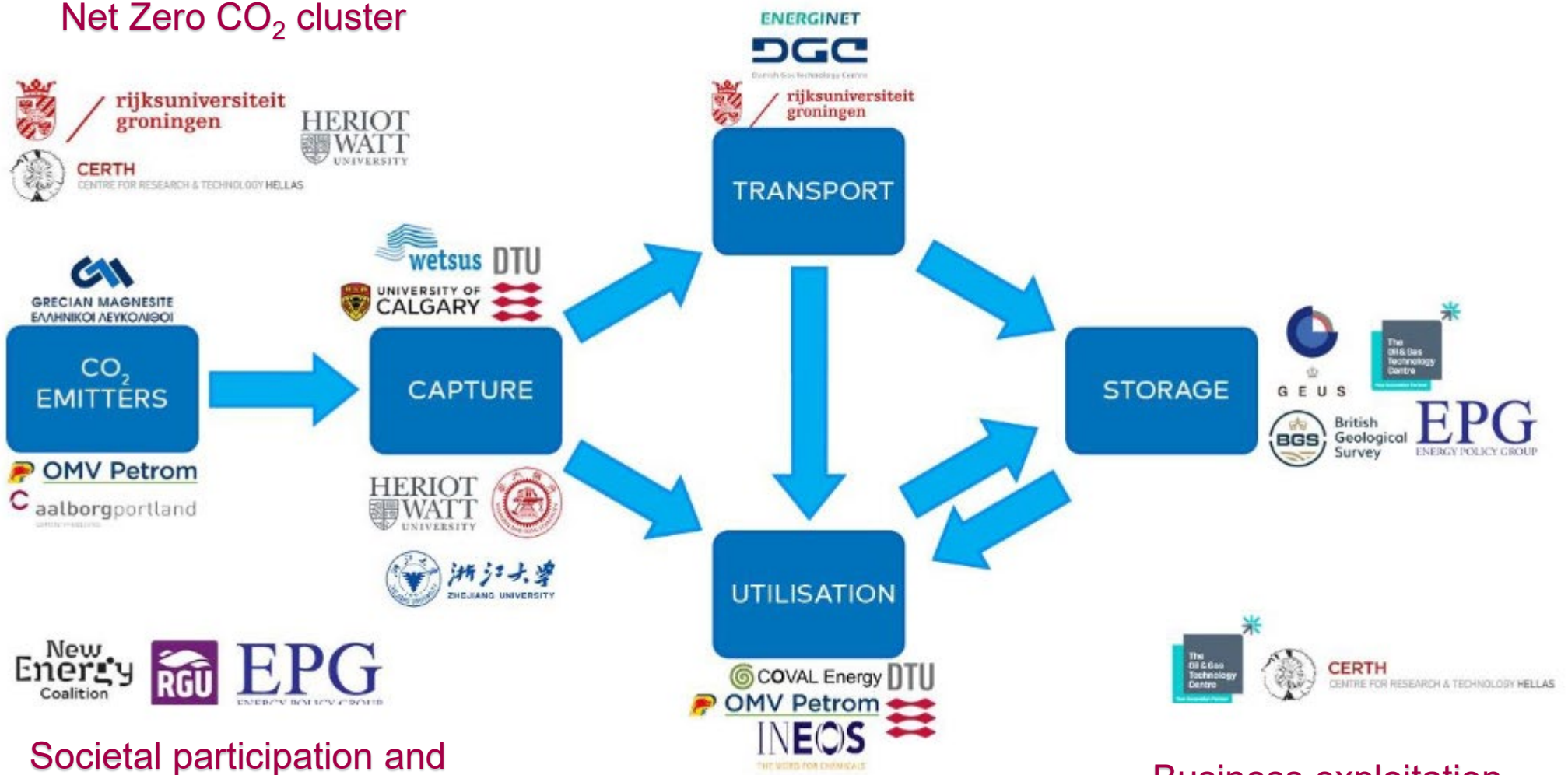


GreenCem: Layout af 1 million tons CO2-fangst anlæg



ConsenCUS

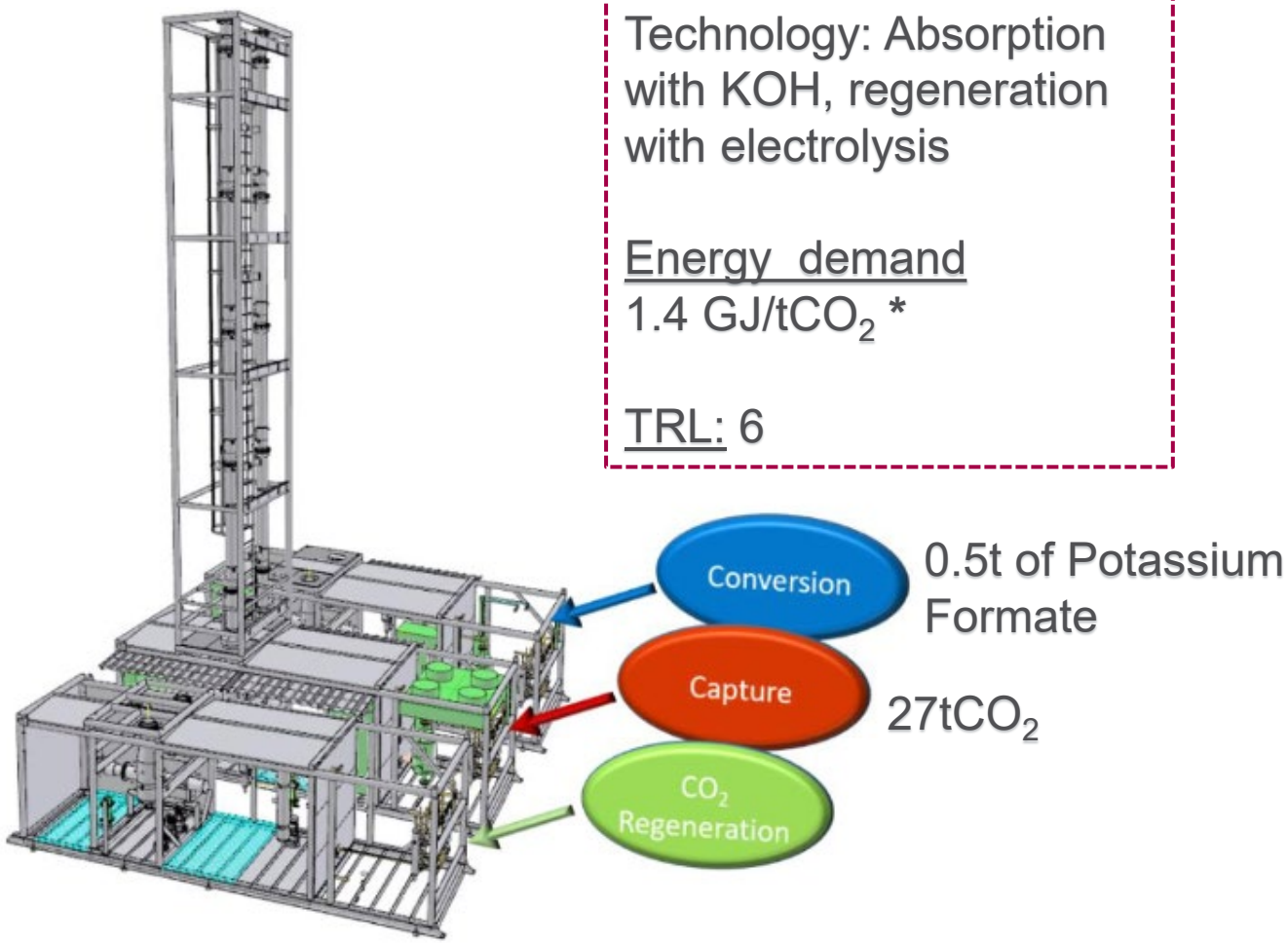
Net Zero CO_2 cluster



Societal participation and LCA

Business exploitation

ConsenCUS



Technology: Absorption with KOH, regeneration with electrolysis

Energy demand
1.4 GJ/tCO_2 *

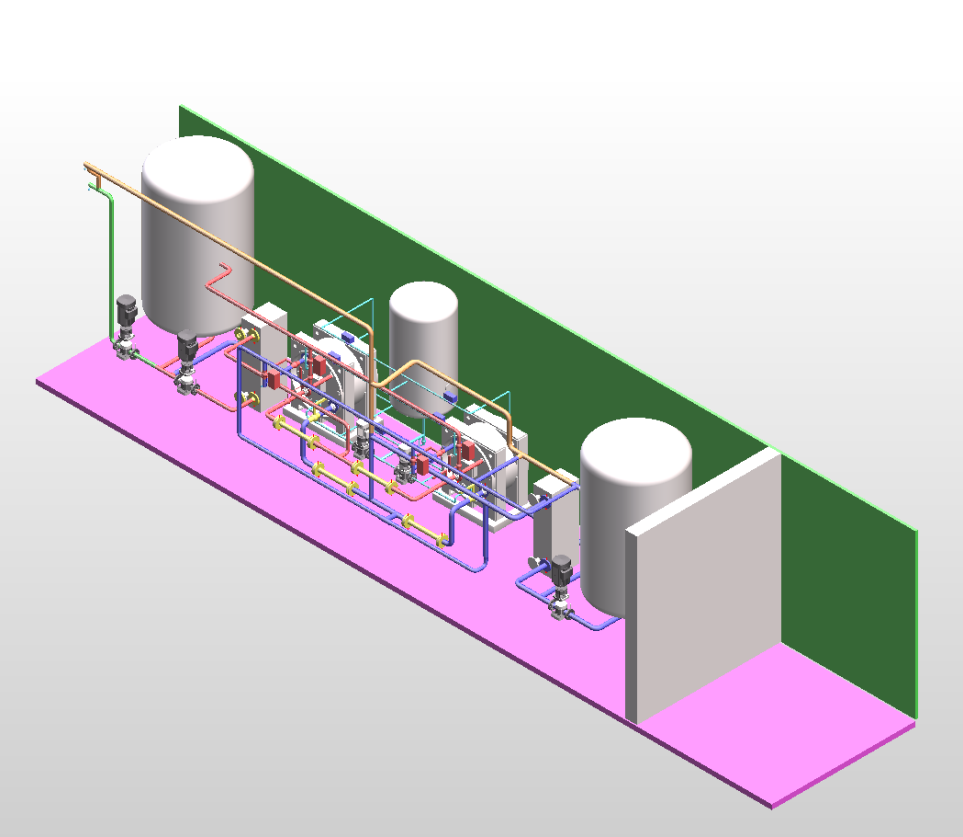
TRL: 6

0.5t of Potassium Formate

27tCO_2

* Compared to the 2.3-3.8 GJ/ tCO_2 of the amine process

ConsenCUS

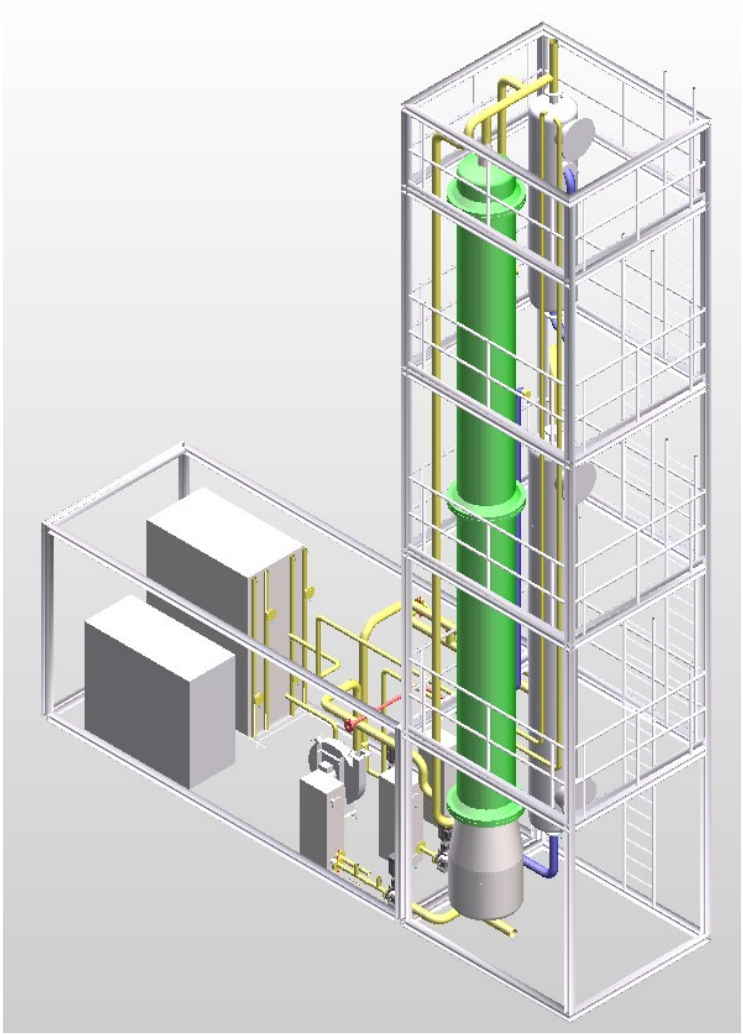


Regeneration with electrolysis

Technology: Absorption with KOH, regeneration with electrolysis

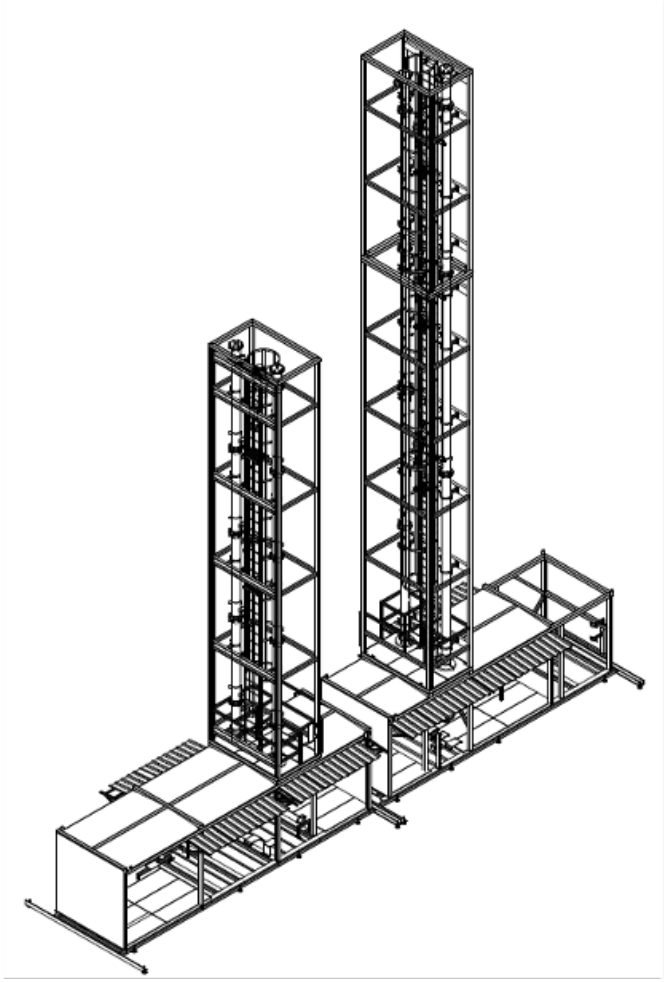
Energy demand
1.4 GJ/tCO_2 *

TRL: 6



Absorption with KOH

Carbon capture Open tests and Review of Technologies (CORT)



- This project will test and demonstrate solvents and process technologies for carbon capture at Aalborg Portland and Ørsted.
- Solvents for carbon capture will be demonstrated at AP and Ørsted. The solvents will all be thermal driven and tested on the same pilot.
- The carbon capture (CC) pilot has previously been constructed for DTU Chemical engineering to test thermal driven CC technologies.
- Some of the technologies that can be tested for the solvents on the CC pilot:
  - Lean vapour recompression;
  - Vacuum stripper;
  - Advanced heat integration;
  - And more.

QUESTIONS

Halil Halilov- halil.halilov@aalborgportland.com