Synthetic Fuel and CCS

Prospects in the heating sector

2025-03-13 | Dovydas Šabūnas | Head of P2X

About Ignitis Renewables

Ignitis Renewables is an international green energy company operating in the **three Baltic states and Poland.**

Our **objective** is to develop low-carbon electricity generation portfolio with a focus on offshore wind, onshore hybrid, Power-to-X and storage technologies.

By developing new projects, we are implementing the strategic goal of Ignitis Group to enable **green and flexible** capacity build-out and to deliver **4–5 GW of installed Green generation capacities by 2030**.

Key P2X Development Drivers

RED III directive

Industry decarbonization

National Energy Independence Strategy

Development of renewable energy sources

2030

Total RES capacity 8,6 GW

Onshore and Offshore wind capacity 4,5 GW
Solar generation capacity 4,1 GW

Electrolysis capacity of 1,3 GW

~129 ktpy of Green hydrogen (6,51 TWh of electricity)

2050

Total RES capacity 19 GW

Onshore and Offshore wind capacity 10 GW
Solar generation capacity 9 GW

Electrolysis capacity 8,5 GW

~732 ktpy of Green hydrogen (36 TWh of electricity)

Source: Lithuanian National Energy Independency Strategy

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Carbon capture technologies

- **Post-Combustion**

Most mature technology. Removes CO2 from flue gas streams after combustion at low pressure. Commercially proven technology, butcomes with a heavy energy cost

- **Pre-Combustion**

Allows the removal of CO2 from a gas mixture before combustion takes place. Operators typically apply this carbon capture in integrated gasification combined cycle (IGCC) power plants.

- **Oxyfuel**

Involves the process of burning the fuel with nearly pure oxygen instead of air.

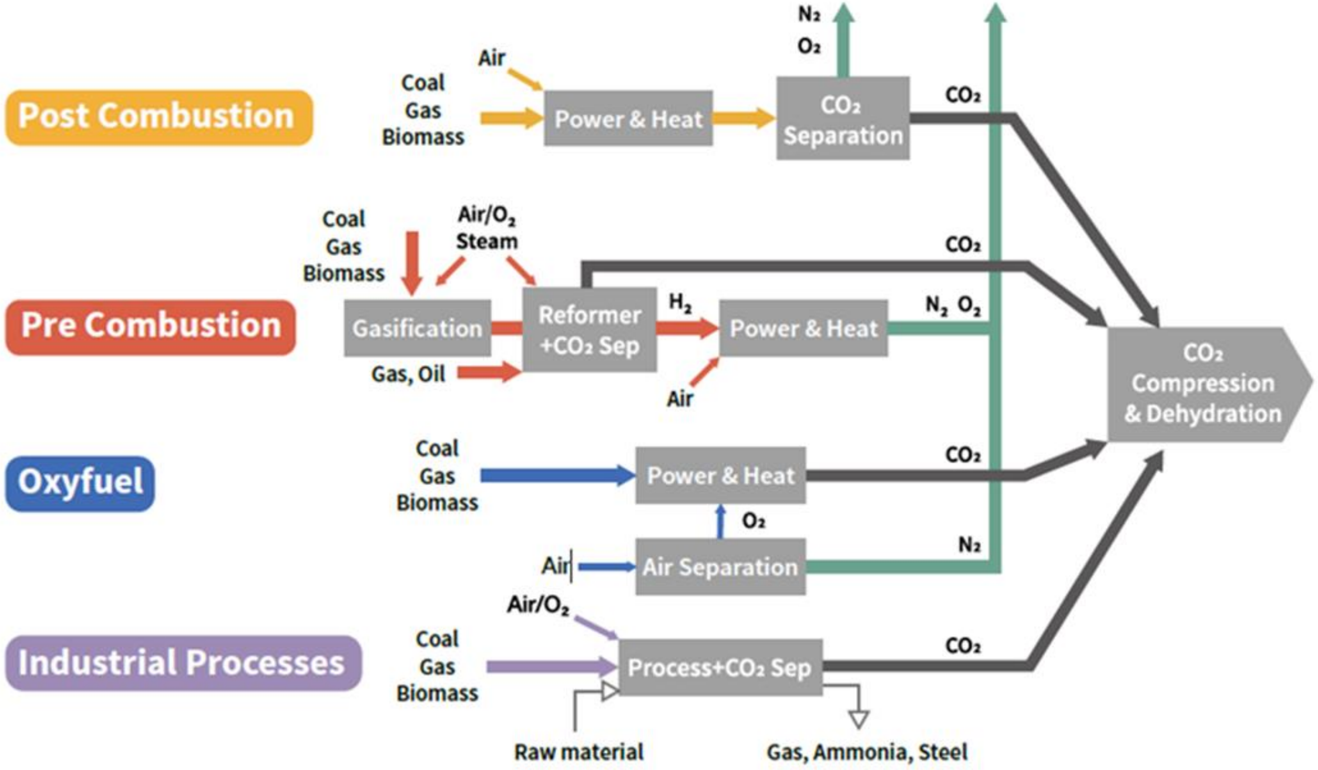
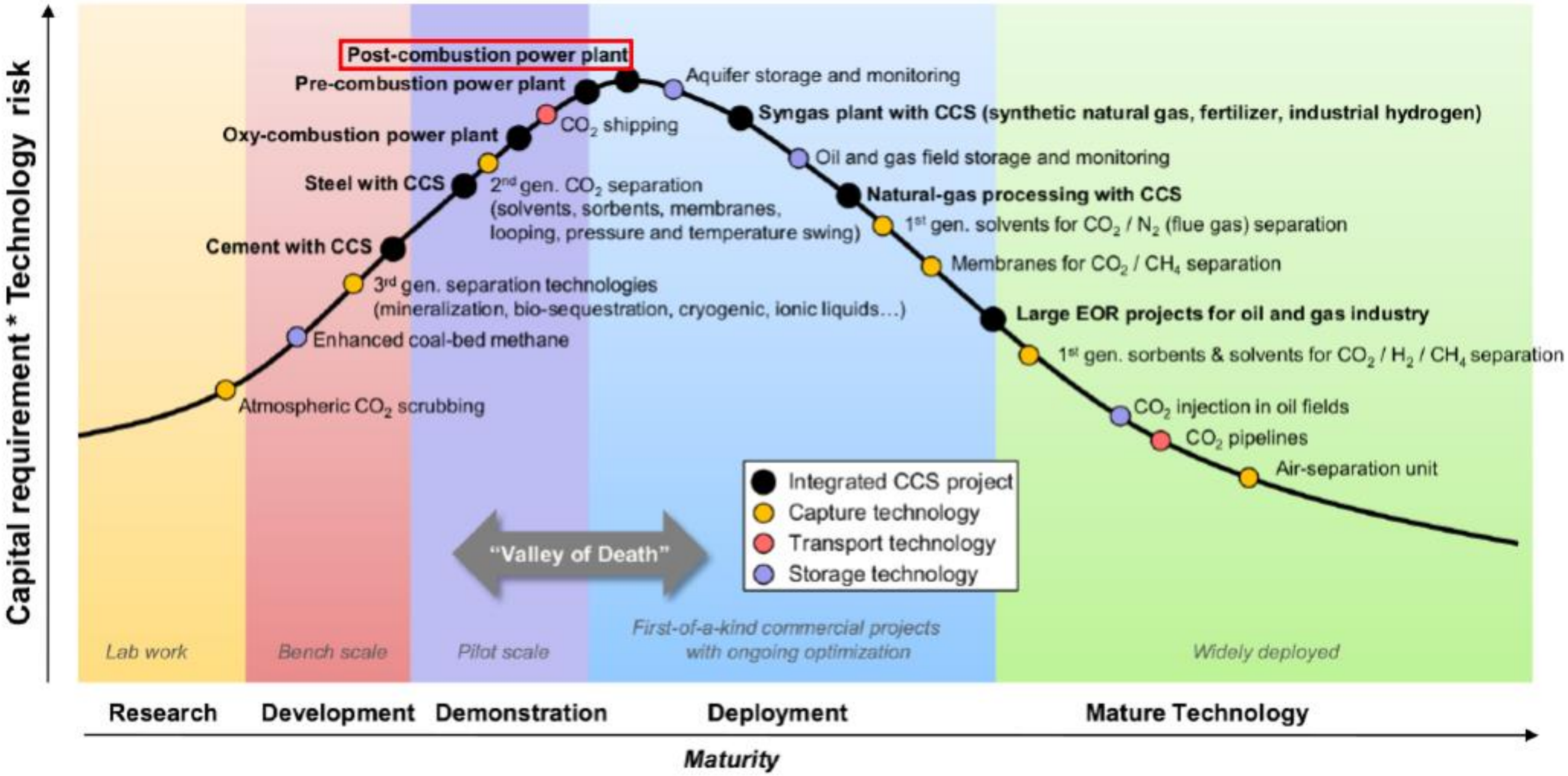


Figure 1. Carbon capture technology overview

Post-combustion technologies represent an easier approach in terms of their integration into existing WtE and BioCHP plants.

Carbon capture technology maturity overview



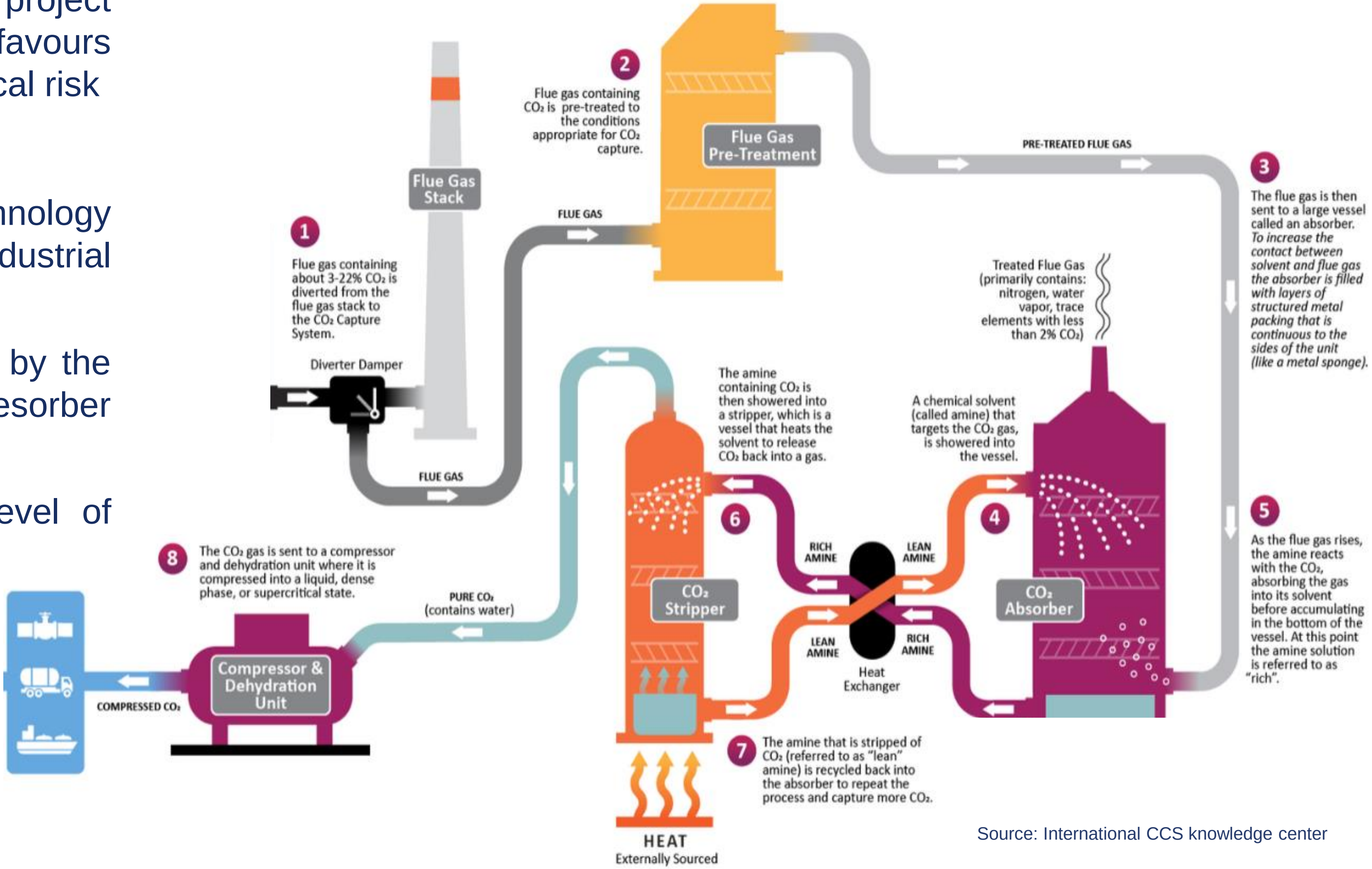
Source: COWI

Amine based absorption Carbon Capture (CC) process

- Exact technology choice depends on project specifics and operation in 2028 favours mature technologies with lower technical risk

Recommended Approach:

- Amine absorption: High Technology Readiness Level (TRL), proven industrial applications
- Process is energy intensive – driven by the steam requirement at the CO2 desorber (stripper) stage
- Amines can lead to medium-high level of toxic emissions if operated incorrectly



Source: International CCS knowledge center

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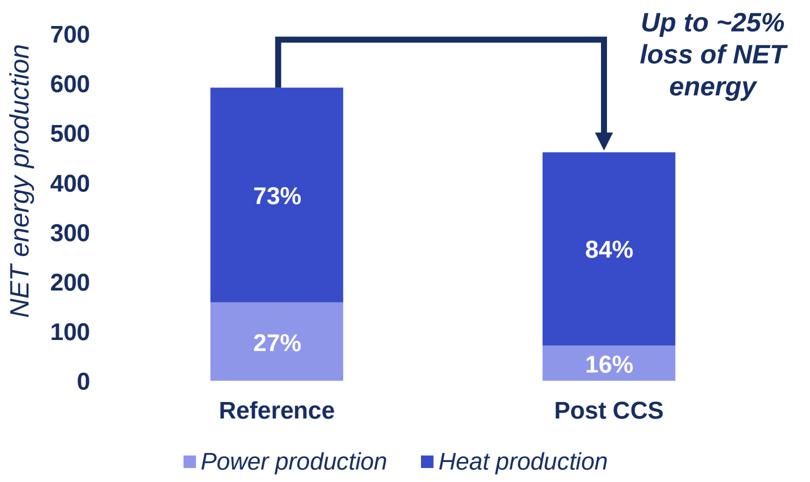
Integration with existing Infrastructure

Amine Technology for CC: Steam Source

- Amine technology requires high-pressure steam for the desorber column which is extracted before the turbine.
- Installation includes a pressure reducing de-superheating station to lower steam parameters, using injected water condensate

Due to CC steam demand, CHPs lose a significant amount of energy, primarily in the form of power.



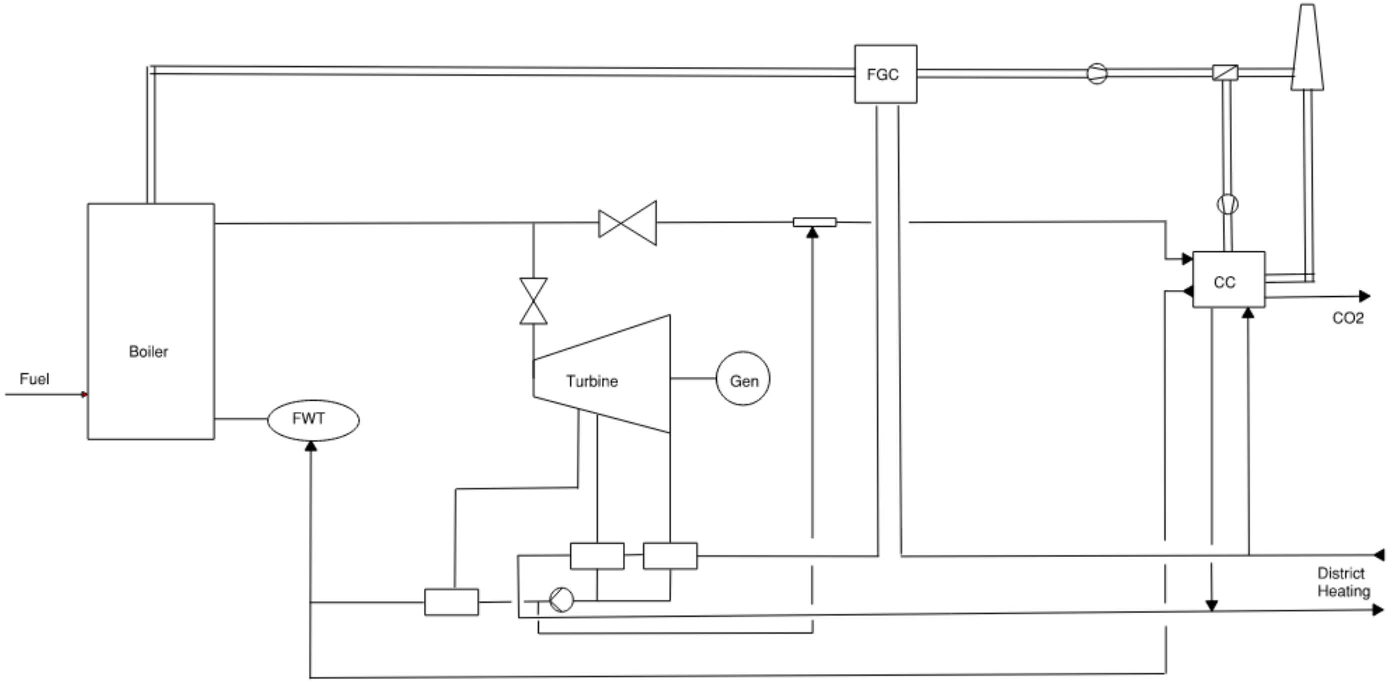
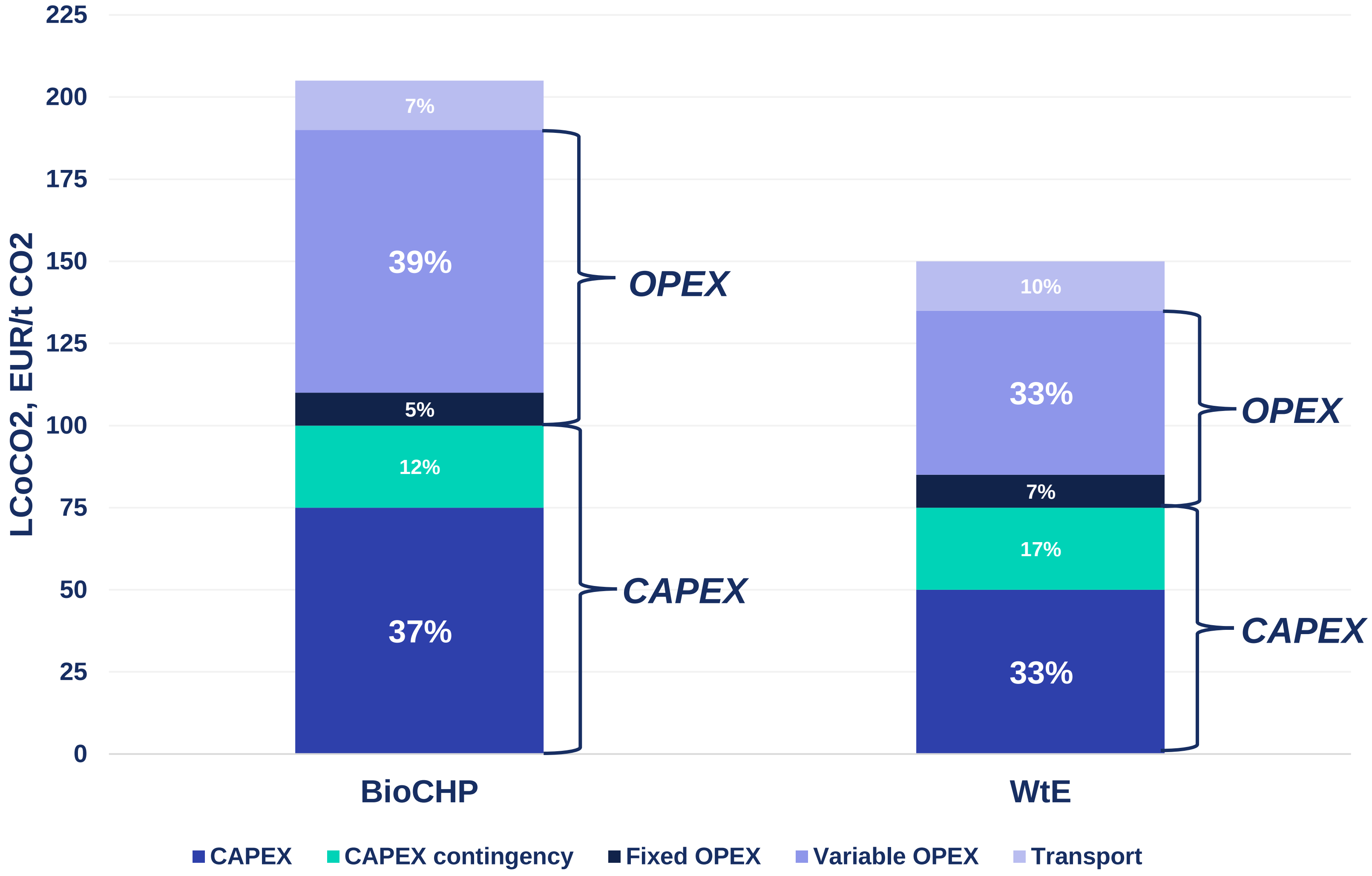


Figure 2. Method to integrate Carbon Capture (CC) within an existing powerplant

Source: IGN study-based evaluation

Cost components of CCS plant (reference case)



Source: IGN study-based evaluation

CAPEX

- High contingency due to limited supply of technology.
- CAPEX subsidies have limited impact on the final CO2 price.

OPEX

- The heat and electricity costs from the energy penalty are the main components of OPEX.
- Load hours highly affect the OPEX/CAPEX ratio.

The EU ETS should reach at least ~250 EUR/ETS to consider the viability of a CCS plant.

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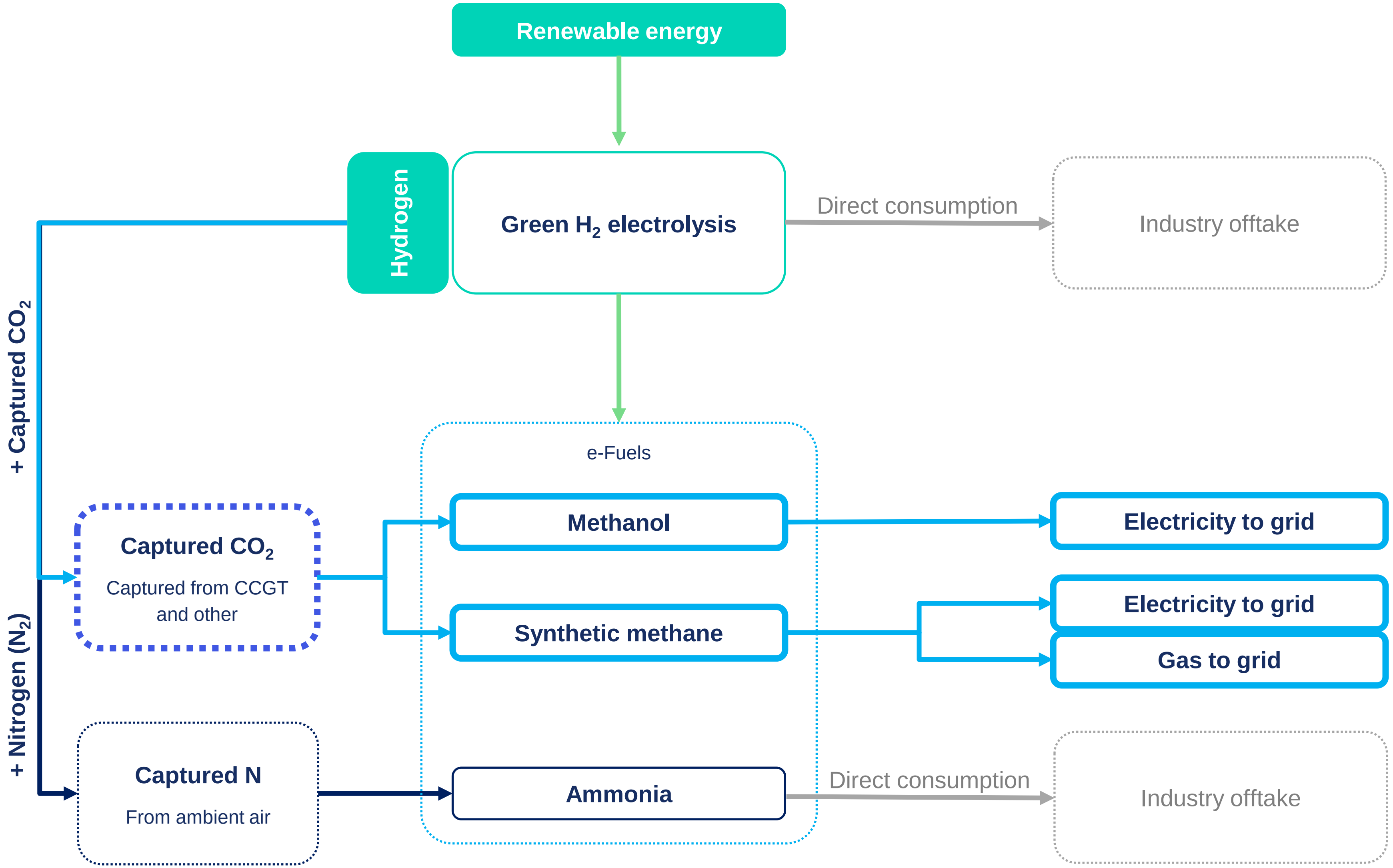
Potential pathways for synthetic fuel production



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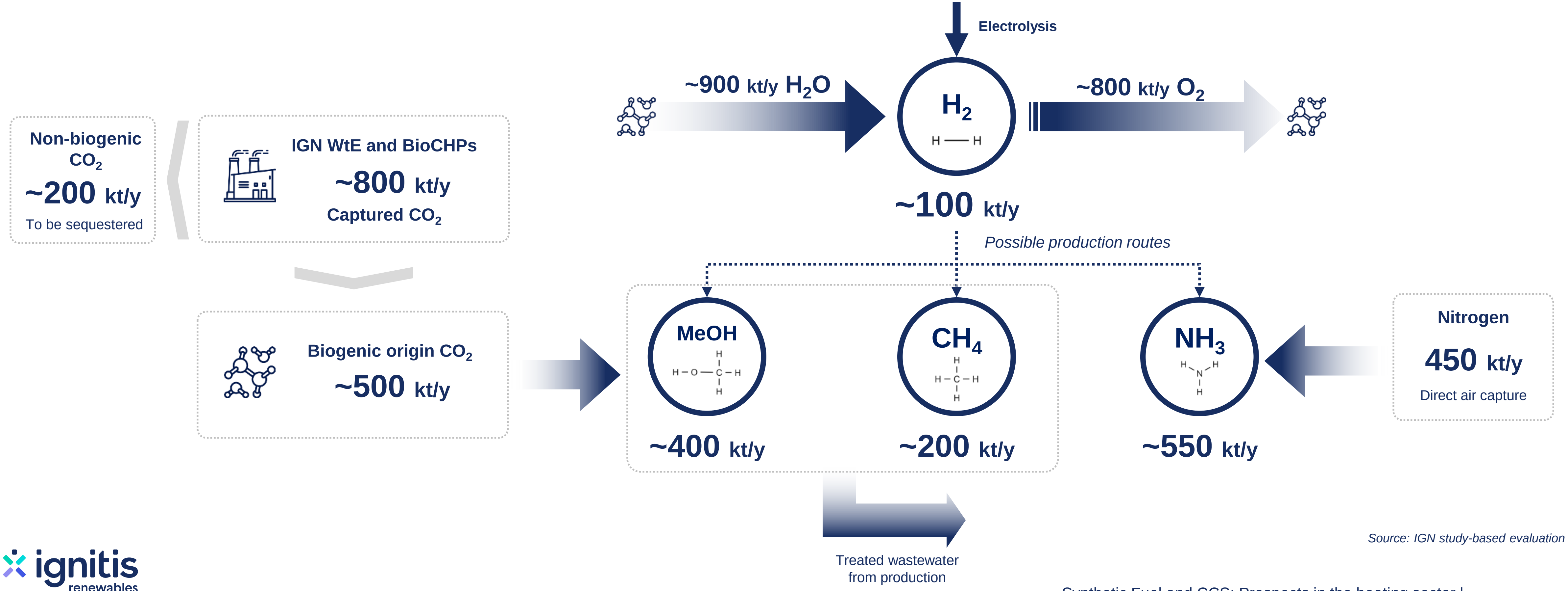
1GW potential product flows

Reference

1t of MeOH requires	1t of CH4 requires
~1,5 t of green CO2 + ~ 0,2 t of H2 (or ~10 MWhe)	~2,8 t of green CO2 + ~ 0,5 t of H2 (or ~25 MWhe)



Source: IGN study-based evaluation

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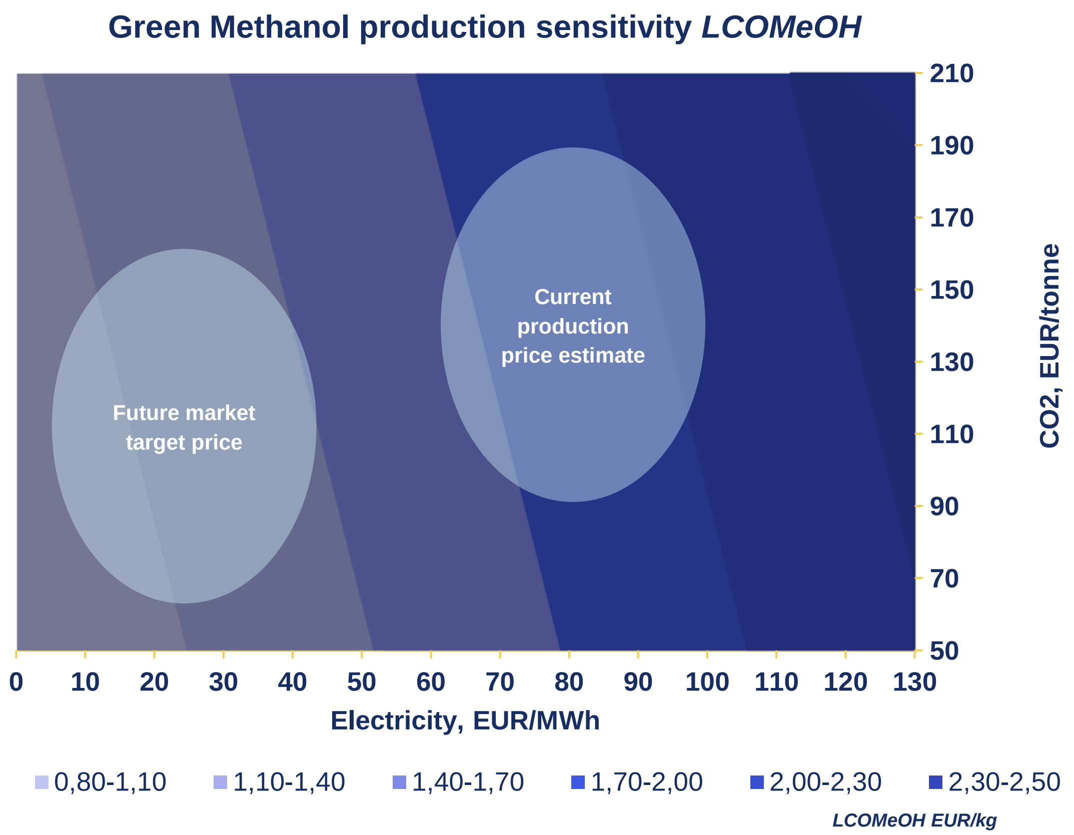
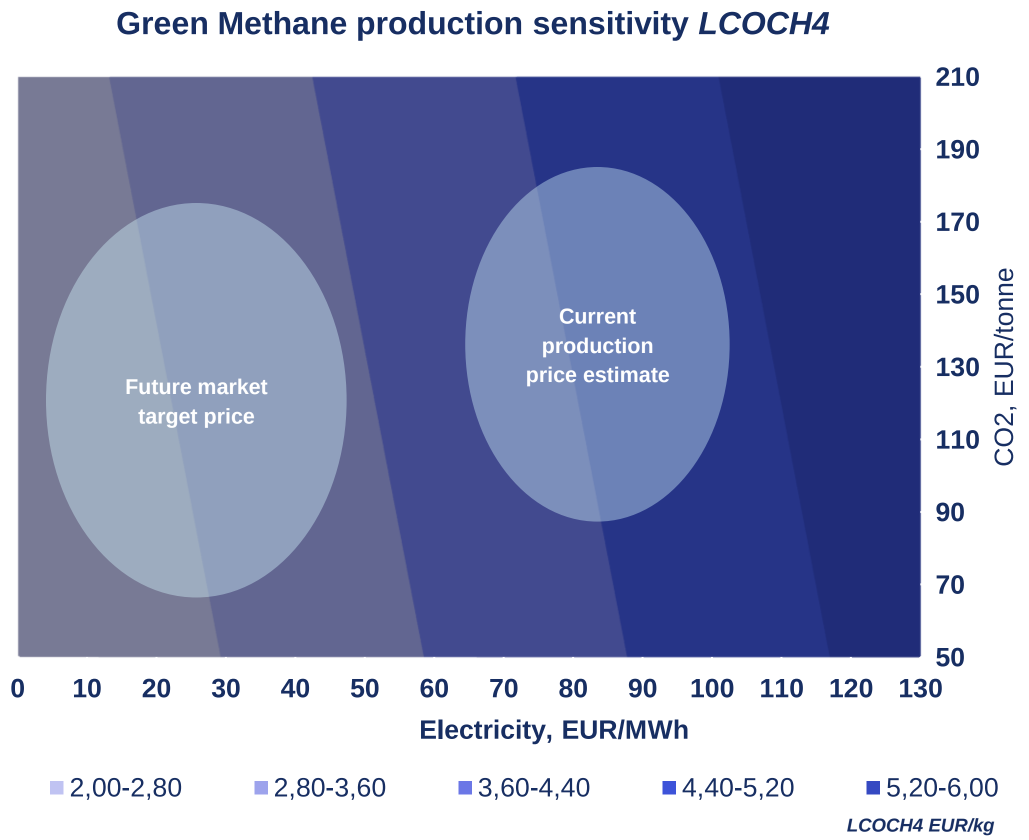
Efuels production sensitivity analysis





Source: IGN study-based evaluation

Main takeaways

Challenges

As a standalone project, CCS faces numerous challenges, making it harder to implement as an independent solution.

- Relatively high installation and operating costs;
- High contingency factor due to limited Technology Suppliers;
- Energy intensity of CCS;
- Lack of transportation infrastructure;
- Economic viability.

Opportunities

Decarbonization of the Heating Sector by Enabling the Use of CO2 for High-Value Synthetic Fuel Production, via:

- Alternative pathway for CO2 sequestration;
- CO2 as a valuable commodity;
- New markets development opportunities;
- Sector coupling opportunities.
- New financing opportunities

Thank you!

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Annex 1. CELSIO WtE plant in Oslo

CCS project financing FID 2022

- **Total Project cost 910 Mill EUR**
  - **CAPEX 550 Mill EUR**
  - OPEX 350 Mill EUR for 10 years operation

- State support **300 Mill EUR**
  +10 years transport and storage service
  +10 year support period for operations;
  Payment per ton CO2 delivered at port (= ETS price)

- City of Oslo direct investment in preference shares of **210 Mill EUR**

- Remaining funding **390 Mill EUR** by Celsio