Current status and future prospects of CCUS in Europe: a perspective from INCITE

Turning CO_2 into Value – Fuels & Chemicals from Solar Energy

Photo2Fuel Final Conference

6 August 2025

Vanessa Ferreira
Project Officer
European Bureau for Research on Industrial Transformation and Emissions (EU-BRITE)
JRC Seville, Unit B5 - Circular Economy and Sustainable Industry

Overview

1. INCITE – Background and context
2. CCUS – International overview
3. CCUS – Key trends in Europe
4. CO_2-to-Fuels and Chemicals at High TRL
5. Final remarks

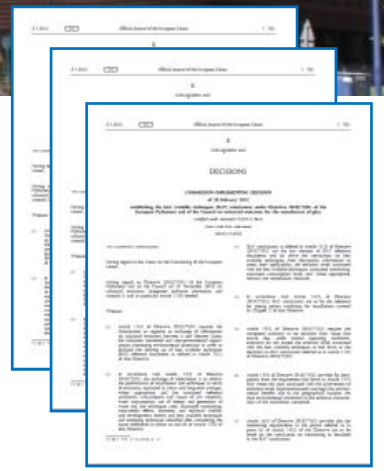
1. INCITE – Background and context

INCITE

The ‘Sevilla Process’ – Industrial Emissions Directive

33 BREFs with the Best Available Techniques (BAT)

Cooperating with +2100 experts



Developing Environmental Norms for the European Industry for +25 years from Sevilla

+200 000
Downloads

BAT Conclusions → **Environmental Norms (4 years implementing period)**

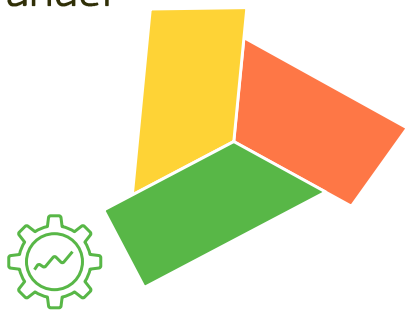
INCITE

INnovation **C**entre for **I**ndustrial **T**ransformation and **E**missions

INCITE is a new strategic element of the revised Industrial Emissions Directive (IED) for tackling industrial transformation. It adds to the 'Sevilla Process' a **forward-looking mechanism**: a necessary evolution of the **Best Available Techniques** concept.

Legal status and mandate

Established under the **IED 2.0**



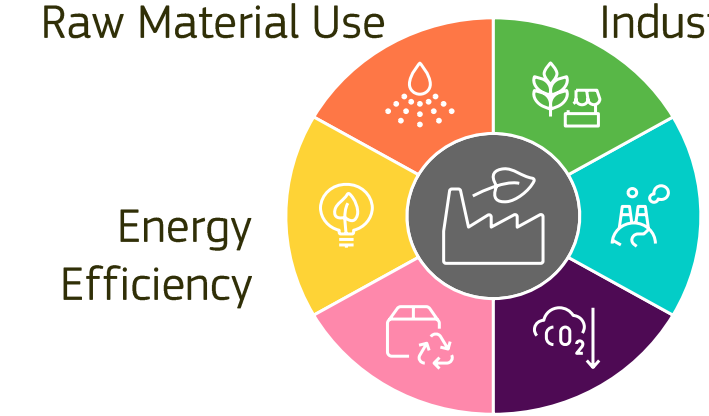
Industry-oriented

Initial focus on **Energy-Intensive** Industries

Readiness

High technology readiness level (TRL > 6)

Integrated approach



INCITE

Unique added value – various uses

Stakeholders / Information sources

EU-funded schemes (Horizon, Innov. Fund)

Industry

Research & Technology Organisations

Technology providers

Member States

Academia

Users

MS authorities / industry

- Inform about most advanced innovative techniques
- Support BREF prioritisation

Policy-makers & analysts

- Curated technological information for funding instruments

Financial institutions

- Curated information to **de-risk financial support** to industrial transformation

INCITE

Milestones achieved & Next steps

June 2024
INCITE launch

October 2024
INCITE Platform launch

May 2025
1st INCITE sectoral workshop – Iron & Steel

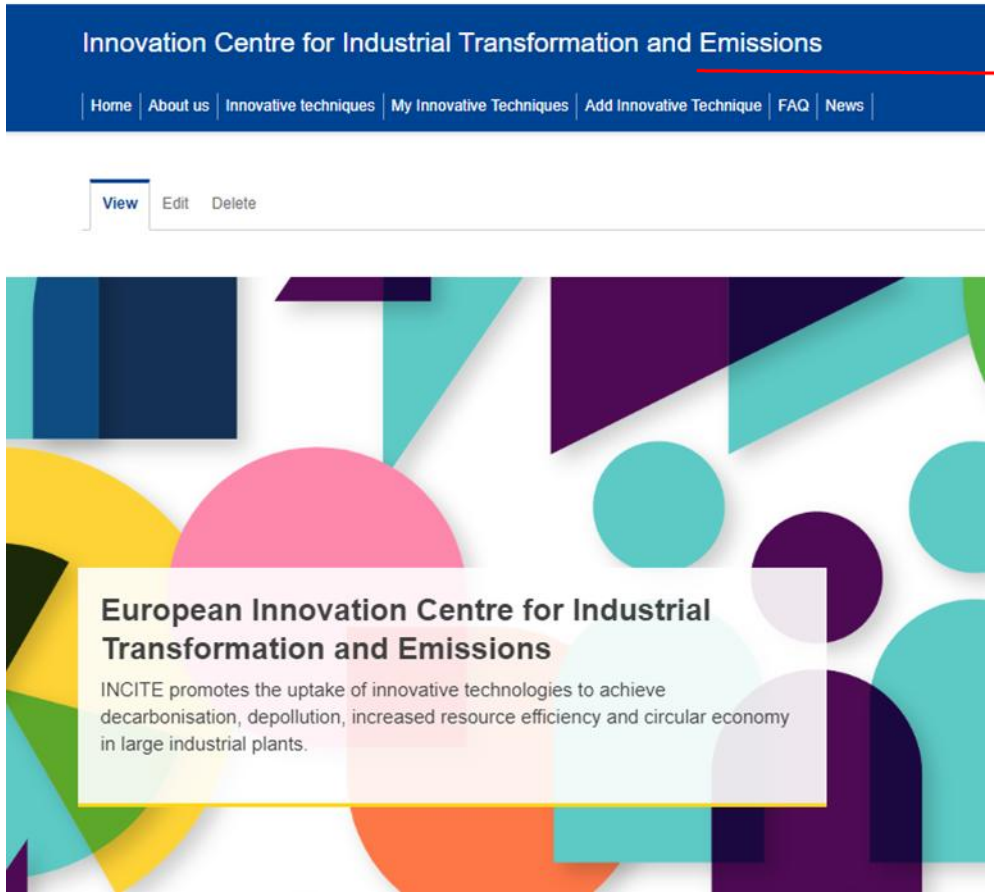
September 2025
Site visits to industrial plants

October 2025
INCITE workshop on cement, lime and magnesium oxide sectors

January 2026
First INCITE report on innovative technologies for Energy Intensive Industries (EIIs)

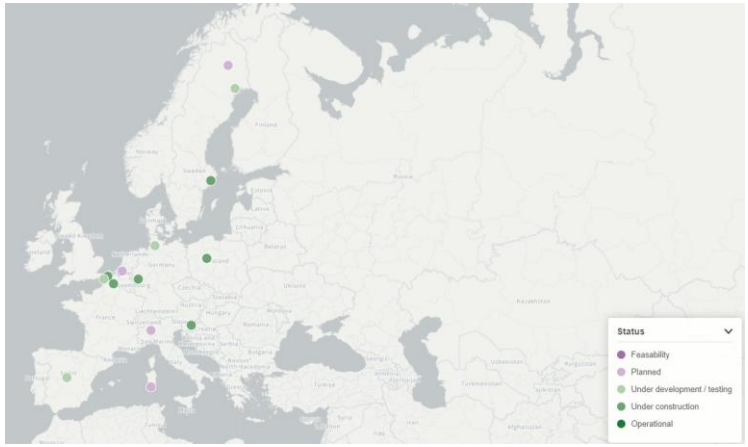
INCITE Information platform

https://innovation-centre-for-industrial-transformation.ec.europa.eu/



Submit your innovative technique >

TRL >=6/7 (pilot scale)



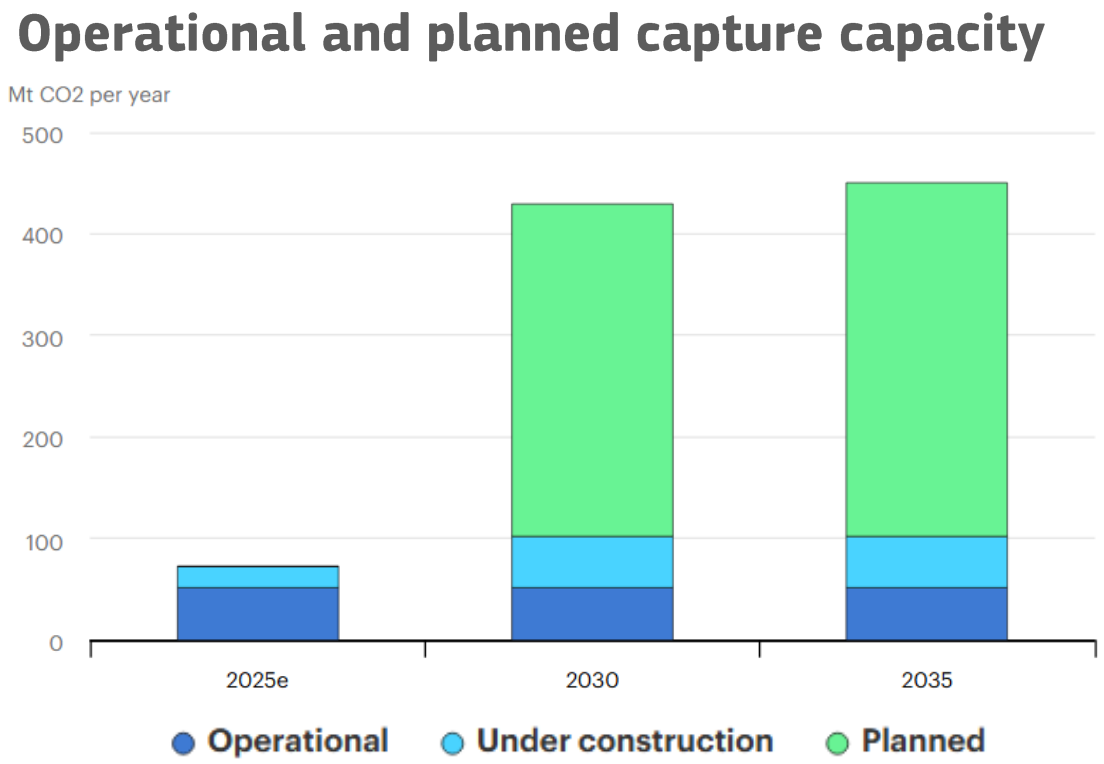
1. Basic information
2. Project
3. Where is your technique being implemented?
4. Production
5. Environmental benefits
6. Cross-media effects
7. Economics
8. Privacy Statement

- **Confidential Business Information (CBI) is not published** – only viewed by INCITE team
- **High cybersecurity level** (Classified non-sensitive data) - data submitted is encrypted

2. CCUS – International overview

CCUS
International overview

- Around **50** operational capture facilities globally
- Capture capacity > 50 Mt of CO_2/year
- 10 large-scale plants entered in operation in 2023:
  - 100 thousand tonnes of CO_2/year for regular capture
  - 1 thousand tonnes of CO_2/year for Direct Air Capture (DAC)
- Good prospects now, but still needs to double planned capacity to reach **1000 Mt by 2050 to achieve net zero target goals**



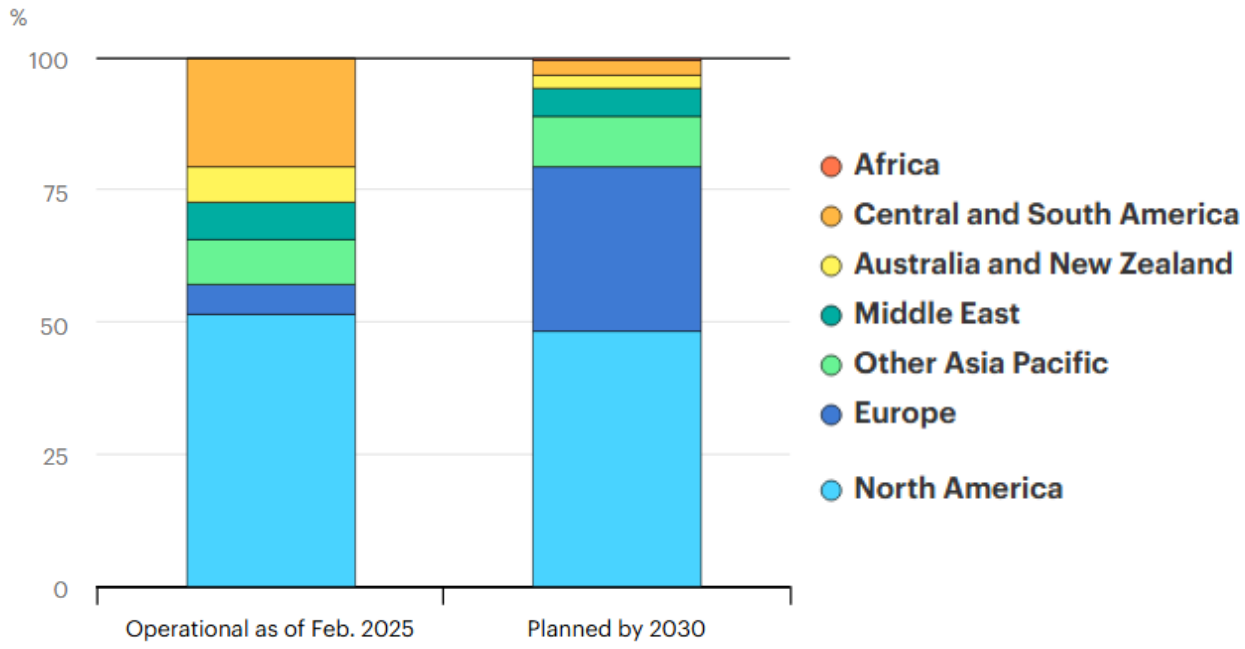
Mt: million tonnes

IEA 2025, *CCUS Projects Explorer*, CCUS Projects Explorer – Data Tools – IEA, Licence: CC BY 4.0 – Last update on 30 April 2025

CCUS
International overview

Geographical distribution

- **80%** of capture capacity that could become operational is in **North America** or **Europe**
- **Outside the EU**: US, Norway, UK, China and Japan are leading the CCUS, with several plants already operational. Progress is also expected in Indonesia and Brazil
- The **medium and long-term outlook** for CCUS could be affected by new players entering the market, **emerging supply chain pressures**, and potential demand from fast-growing sectors



IEA 2025, *CCUS Projects Explorer*, CCUS Projects Explorer – Data Tools – IEA, Licence: CC BY 4.0 - Updated on 30 April 2025

CCUS
International overview

Timeline

- **2024**: Several **first-of-a-kind** (FOAK) projects moved into **construction phases** in new sectors
- **2025**: Major projects became **operational**
  - Largest capture project at a cement plant, in Norway – Brevik CCS
  - World's largest Direct Air Capture (DAC) plant in the US – Oxy

Sectors

- **Current main sectors**: Natural Gas processing, other fuel transformation, chemicals and power and heat
- **Predicted for 2030**: to include hydrogen and ammonia, and increase power and heat and cement shares in CCUS

Picture source: BREVIK plant website - Brevik CCS – World's first CO_2-capture facility in the cement industry | Brevik CSS

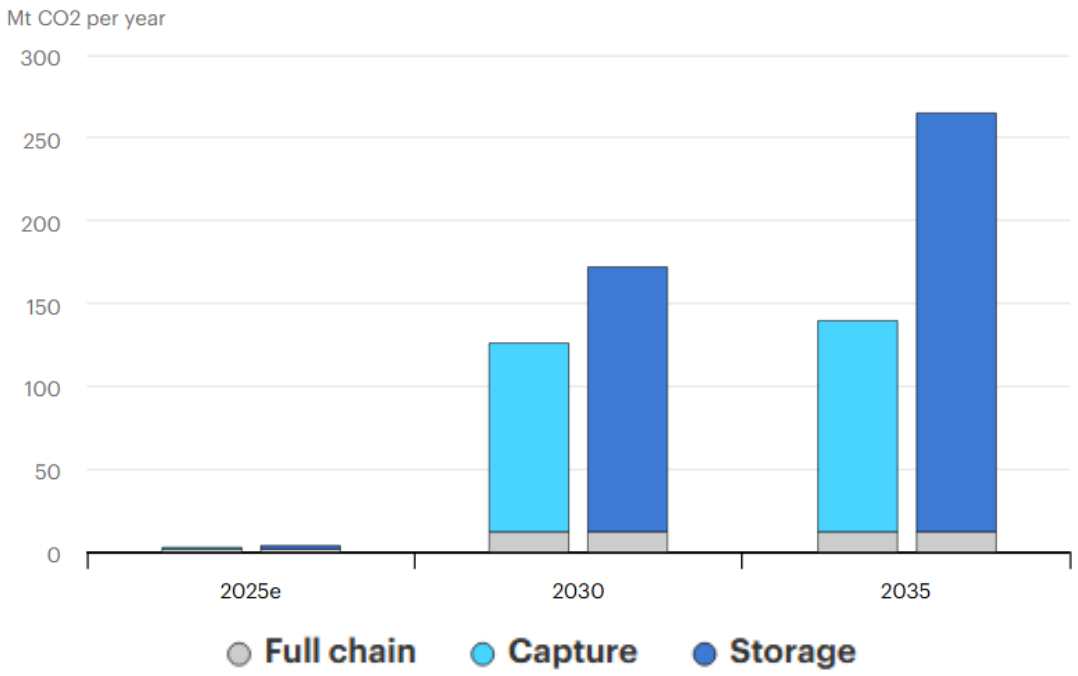
3. CCUS – Key trends in Europe

CCUS

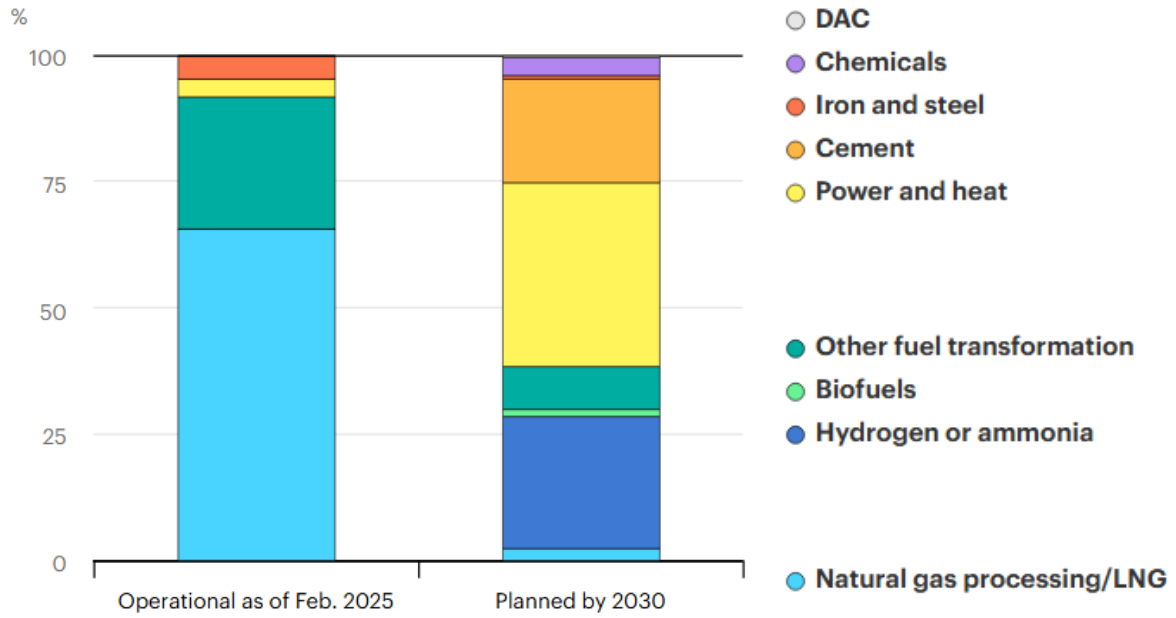
Key trends in Europe

Operational and planned capture capacity

By project type



By sector



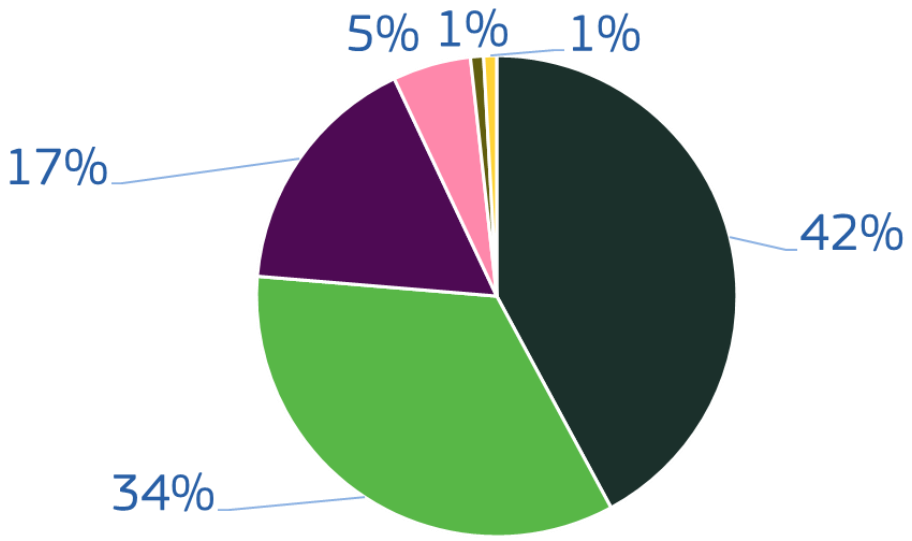
IEA 2025, *CCUS Projects Explorer*, CCUS Projects Explorer – Data Tools – IEA, Licence: CC BY 4.0 – Updated on 30 April 2025

CCUS

Key trends in Europe

Source of funding of CCUS projects in operation or under construction

A total of 115 projects identified, with percentages based on project count



- ✓ **~2.8 billion of EU funding**
- ✓ **90% from the Innovation Fund**

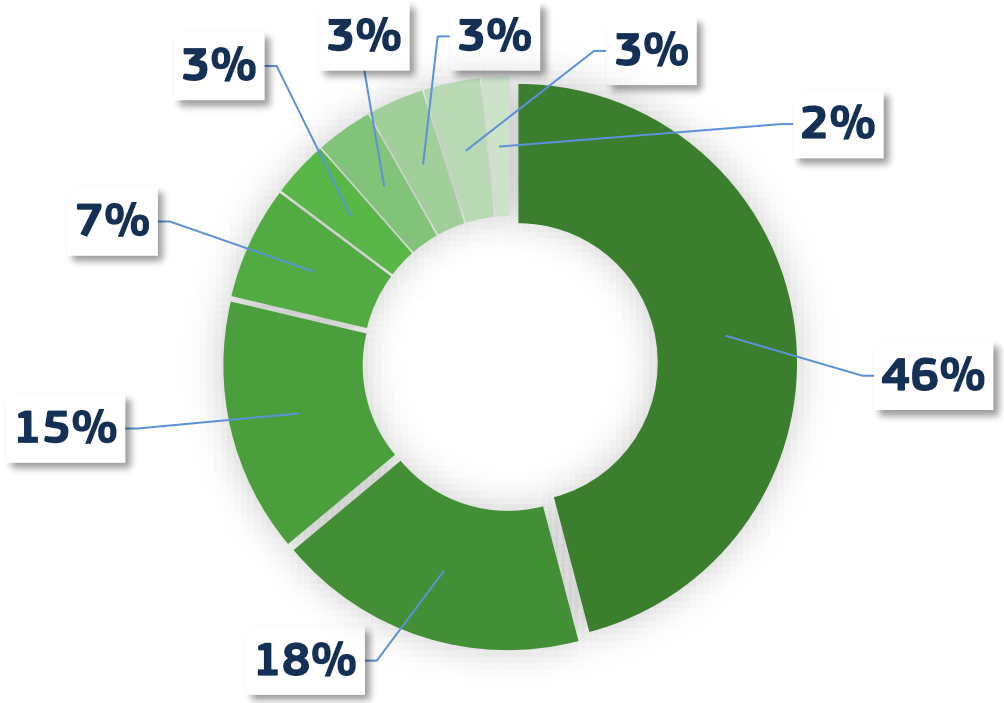
Sources:
IEA 2025, *CCUS Projects Explorer*, CCUS Projects Explorer – Data Tools – IEA, Licence: CC BY 4.0
Own INCITE data

CCUS

Key trends in Europe

Projects financed by EU funding* divided by sector

(Under construction or operational only)



Sources:
IEA 2025, *CCUS Projects Explorer*, CCUS Projects Explorer – Data Tools – IEA, Licence: CC BY 4.0
Own INCITE database

Note: *EU funding includes: H2020, Horizon Europe, Innovation Fund, InnovaFin, and LIFE programmes

CCUS

Policy initiatives driving CCUS growth in Europe

1

Net-Zero Industry Act

Mandates 50 Mt CO_2 injection capacity by 2030, creating clear targets for infrastructure development

2

EU Strategic Frameworks

- Industrial Carbon Management Strategy
- Clean industrial deal
- Carbon Removal Certification Framework (CRCF)

3

Financial Support

EU Innovation Fund committed over €1.5 billion to CCUS demonstration projects

4

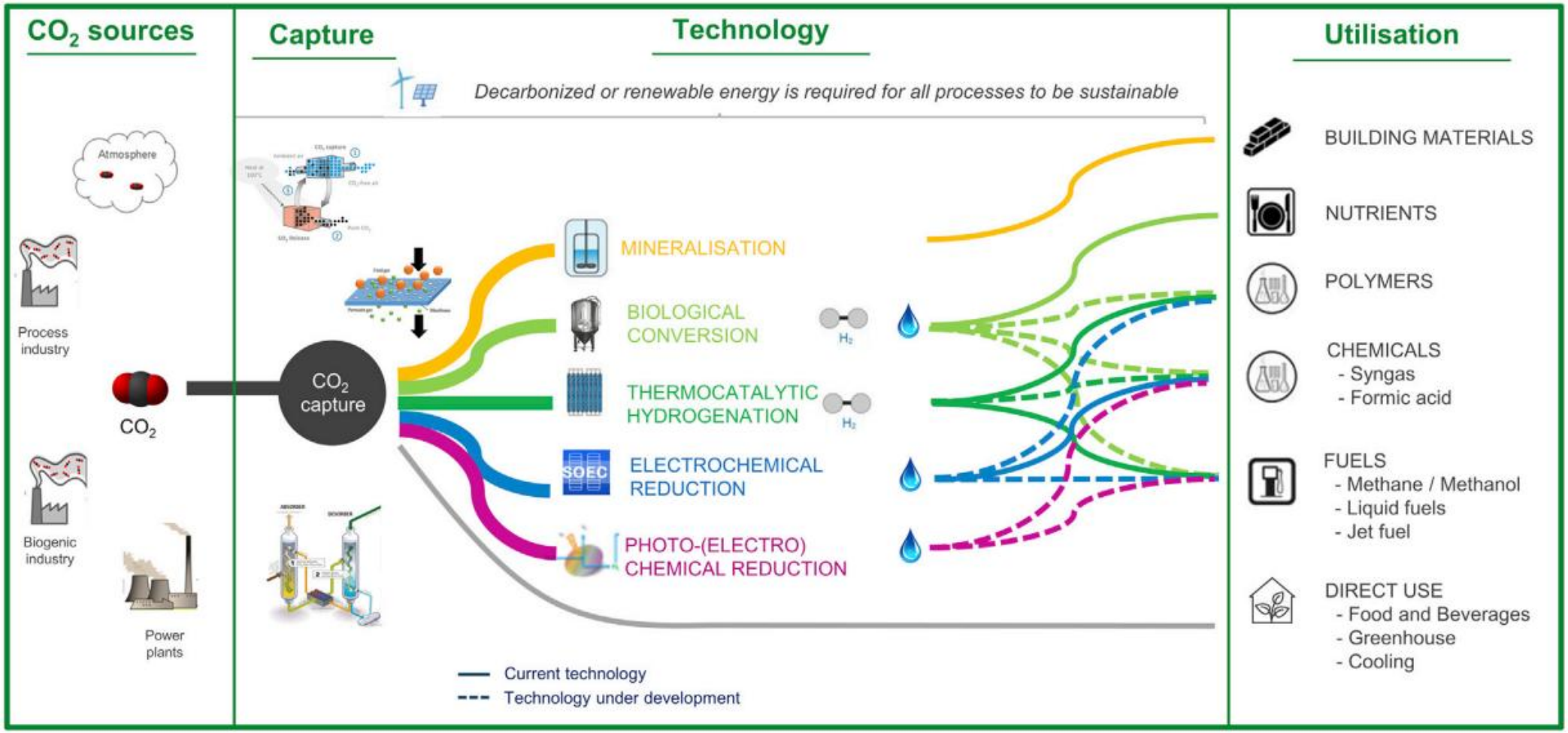
Progress Tracking

Member States required to report annually on CO_2 capture, transport, and storage progress

4. CO_2 into fuels & chemicals

CO_2 into fuels & chemicals

Introduction – Uses of CO_2



Source: Mertens, Jan, et al. "Carbon Capture and Utilization: More than Hiding CO_2 for Some Time." *Joule*, vol. 7, no. 3, 2023, pp. 442–449. https://doi.org/10.1016/j.joule.2023.01.005

CO_2 into fuels & chemicals

Examples of EU funded projects with advanced TRL

Innovation Fund

- **AIR:** TRL9 – Innovation Fund –2027
  - EUR 97 million
  - FOAK plant to produce methanol from CO_2 and waste streams

- **C2B:** TRL9 – Innovation Fund –2028
  - EUR 110 million
  - Innovative carbon capture technology in a cement plant in Germany using oxy-fuel technology
  - CO_2 captured will be used to produce synthetic fuels after methanol synthesis, chemical industries that need carbon dioxide, and carbon sequestration as a bridge option

- **E-fuel pilot:** TRL8-9 – Innovation Fund –2026
  - EUR 40 million
  - FOAK plant for synthetic fuel production
  - CO_2 from a blast furnace waste gas from a Ferro/Silicon-Manganese plant
  - Reversed water gas shift and Fischer-Tropsch technology to produce 8 000 tonnes/year of synthetic hydrocarbons (syncrude)

5. Final remarks

Final remarks

- **INCITE** is compiling and assessing projects with **TRL ≥ 6**, tracking their development over time
- **Over 150 CCUS projects were identified by INCITE**, mainly in the cement, chemical, and refinery sectors
- **2025–2030 is a critical window for CCUS deployment in Europe**, as many projects are set to launch
- **Net Zero Industry Act** and the **Industrial Carbon Management Plan** establish ambitious storage and deployment benchmarks and commit to removing regulatory and financial barriers to CCUS development.
- **Harmonisation EU regulations** for **cross-border CO_2 transport and storage** to enable international projects is necessary, as well as the development of **transport** and **storage infra-structures** and accelerate permitting
- **CCUS** is one of the key factors to enable the EU to reach a 90% reduction of emissions by 2040, following the impact assessment by the Commission on a 2040 Climate Target*
- **CO_2 use for fuels and chemicals is still emerging** – continued investment is key to advance technologies and scale up

* Source: COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT REPORT Part 1 Accompanying the document COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS EUR-Lex - 52024SC0063 - EN - EUR-Lex

Thank you for your attention

https://innovation-centre-for-industrial-transformation.ec.europa.eu/

EMAIL

JRC-INCITE@ec.europa.eu

ADDRESS

Joint Research Centre
Directorate B – Fair and Sustainable Economy
Unit B.5. Circular Economy and Sustainable Industry
EDIFICIO EXPO
CALLE INCA GARCILASO 3
E-41092 SEVILLE, SPAIN