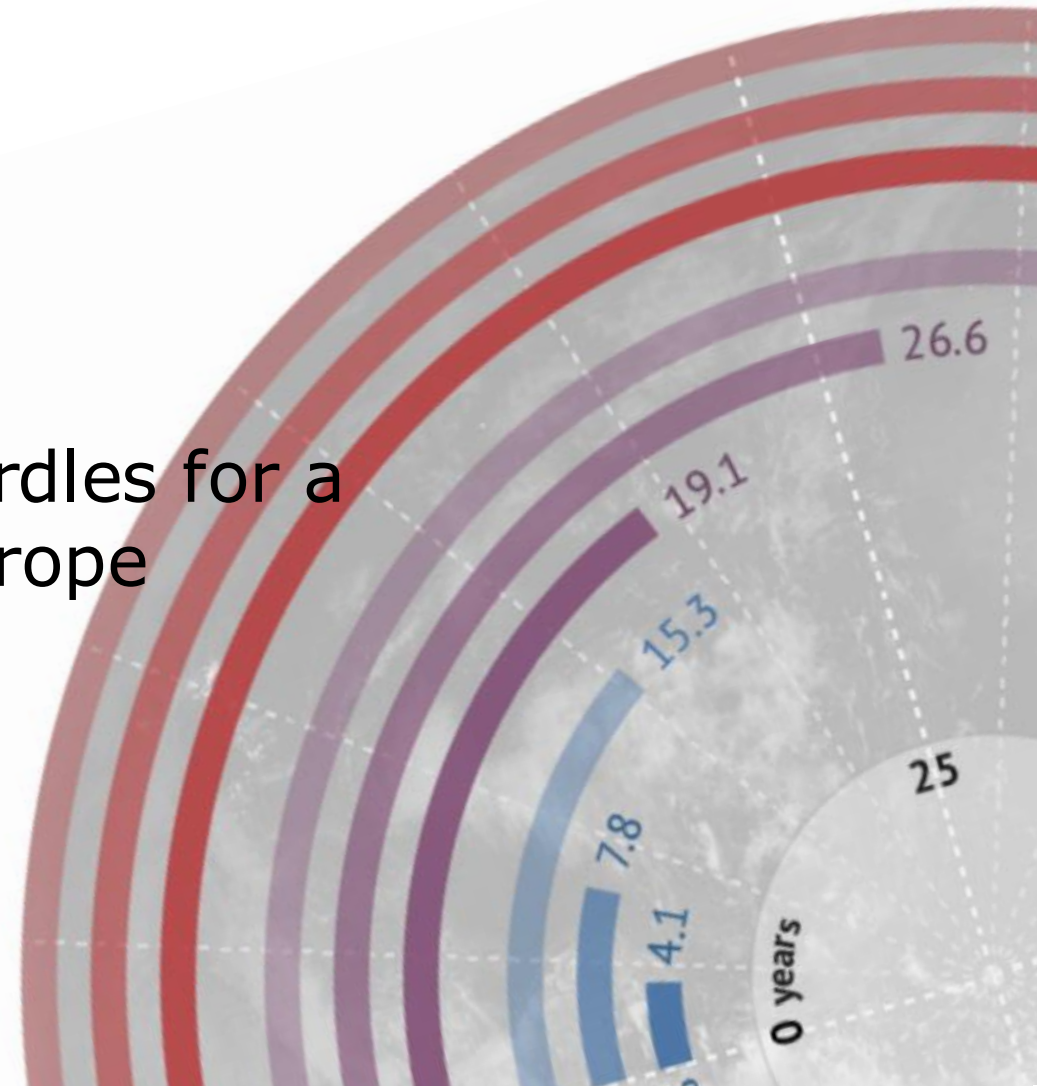


Carbon Countdown:

Overcoming Policy and Technical Hurdles for a Climate-Neutral and Competitive Europe

December 2024 | SCCS Annual Conference



“Doomsday Clock”

2023: “90 seconds to midnight”

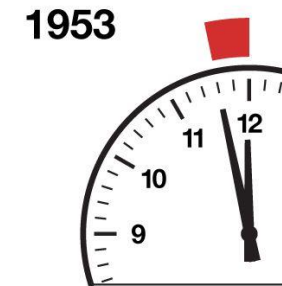
2024: “Still 90 seconds to midnight”



7 minutes to midnight
Initial arbitrary setting



3 minutes to midnight
Start of nuclear arms race



2 minutes to midnight
U.S. and Soviet Union test first hydrogen bombs



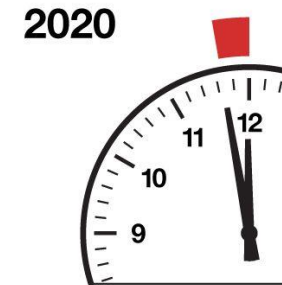
7 minutes to midnight
U.S. nuclear testing moratorium



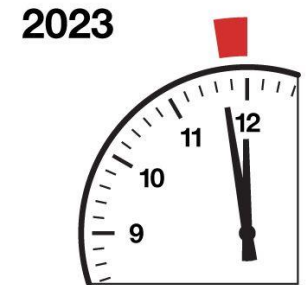
12 minutes to midnight
U.S., U.K., and Soviet Union sign Limited Test Ban Treaty



17 minutes to midnight
U.S. and Soviet Union sign Strategic Arms Reduction Treaty



100 seconds to midnight
Rising dangers of climate change, nuclear proliferation, and breakdown in arms-control cooperation



90 seconds to midnight
Russia threatens to use nuclear weapons in its war with Ukraine

“Carbon Clock”

1.5°C scenario

time left until CO ₂ budget depleted						
year	month	day	hour	min	sec	
4	7	19	18	23	54	64
CO ₂ budget left (tonnes)						
195'572'874'876						

2°C scenario

time left until CO ₂ budget depleted						
year	month	day	hour	min	sec	
22	4	28	4	14	14	64
CO ₂ budget left (tonnes)						
945'572'874'876						

Source: Mercator Research Institute on Global Commons and Climate Change (MCC), December 2024.

2024 on track to be **warmest year on record** and the **first year of more than 1.5°C** above pre-industrial levels (Copernicus Climate Change Service, 2024)

A pivotal decade for the EU

EU carbon countdown:

- 27 years left to reach climate neutrality

Dual challenge:

- Urgent need to reduce net GHG emissions
- How to revitalise a weakened industrial base and remain competitive in global markets

→ A race against time to secure a competitive and sustainable future

EU climate targets (net GHG emission reductions)

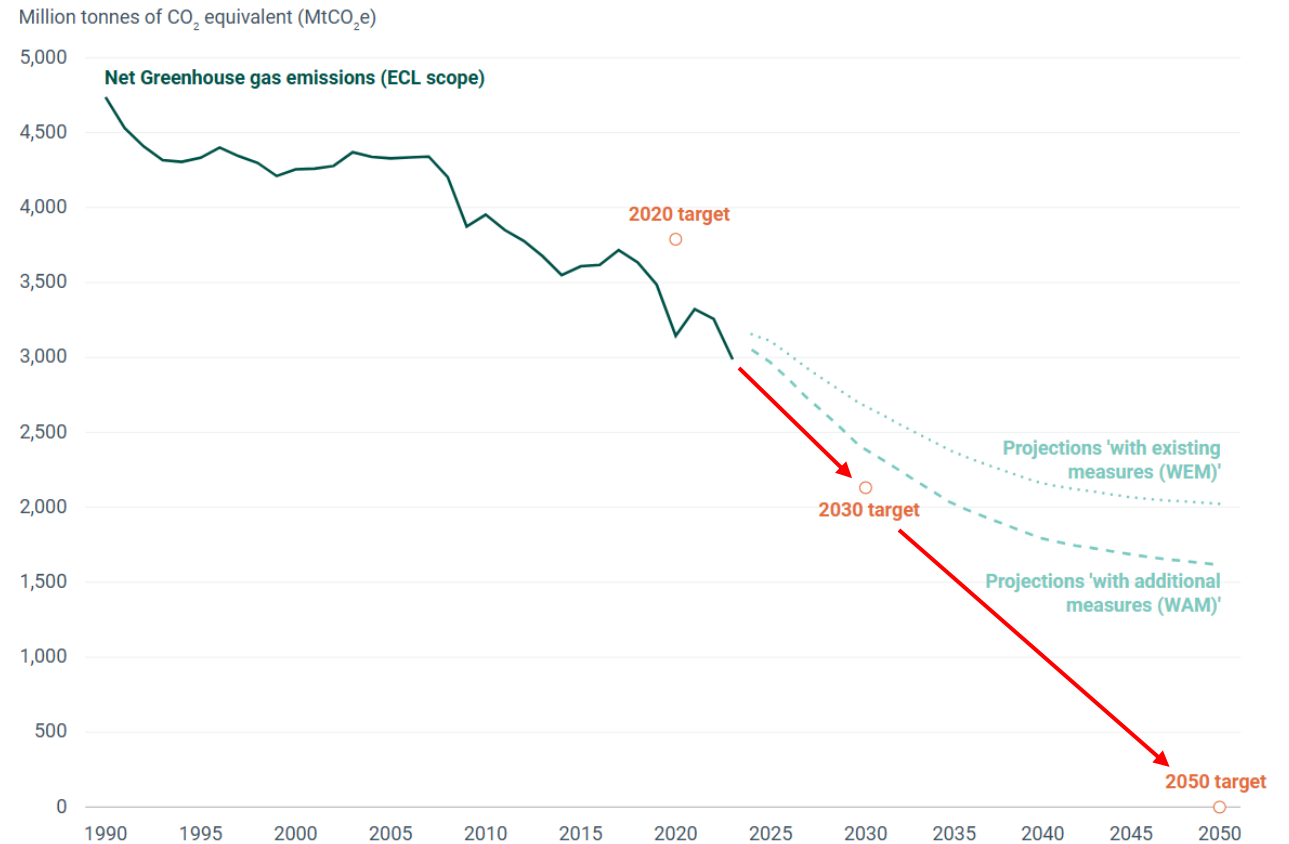
2020	20%
2030	55%
2040	90%*
2050	100%**

*not yet officially confirmed

**net zero target, legally binding

GHG emission trends & projections in Europe

- In 2023, the EU's net GHG emissions were 37% below 1990 levels
- In recent years, driven primarily by:
 - continued rollout of renewable electricity production
 - efficiency gains in industrial sectors
 - reduced output in industrial sectors
- To reach 2030 target: need to reduce 134 MtCO₂eq emissions per year



Source: EEA, 2024.

EU 2040 emissions modelling – Role of CCS

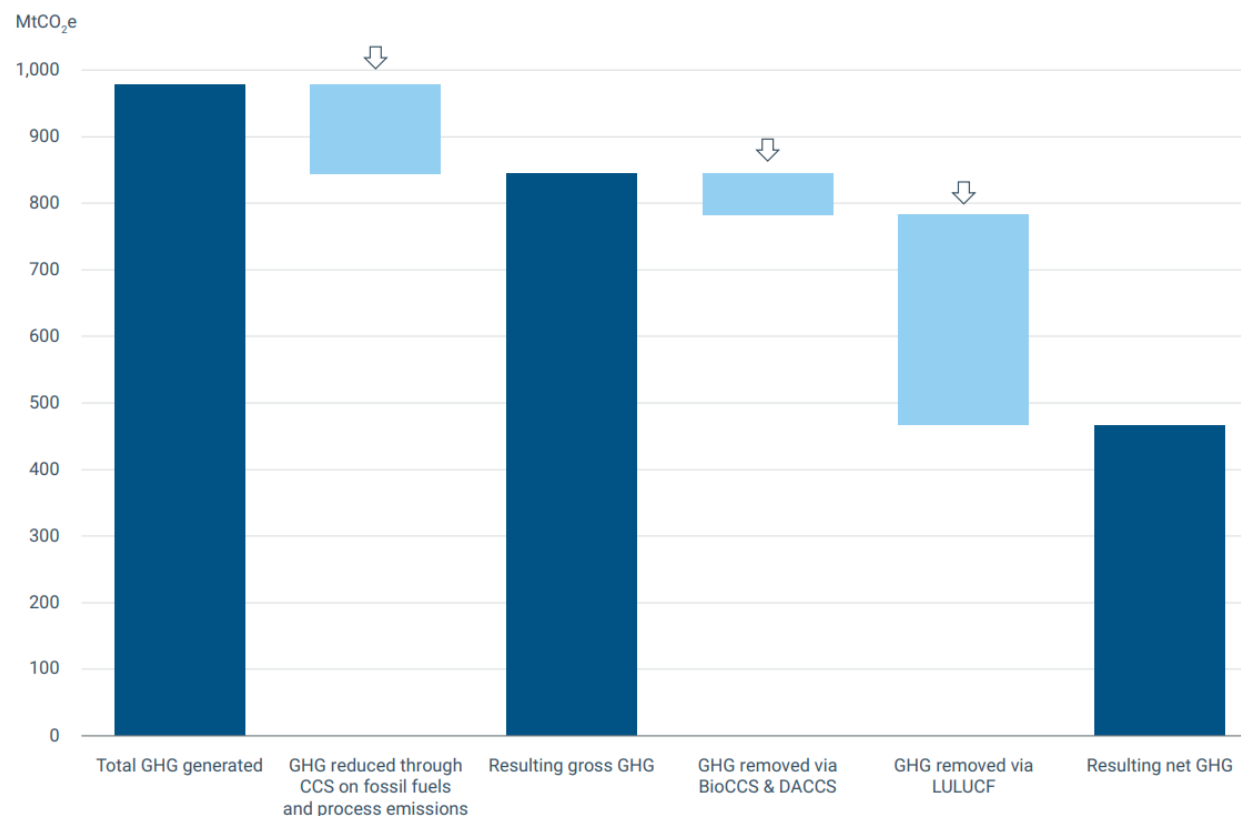
Net 90% reduction scenario:

- Fossil CCS: 134 MtCO₂
 - Industrial processes: 97 MtCO₂
- DACCS: 29 MtCO₂
- BioCCS: 34 MtCO₂
- LULUCF: 317 MtCO₂

ESABCC (2023) recommendations:

- Fossil CCS: 50-200 MtCO₂
 - Industrial processes: 5-70 MtCO₂
- DACCS: 0-7 MtCO₂
- BioCCS: 46-207 MtCO₂
- LULUCF: 100-400 MtCO₂

Note: in all scenarios, CCU is only used for e-fuel production up to 2040 and is thus not taken into account



Source: EEA, 2024, based on EC, 2024 and Öko-Institut, 2024.

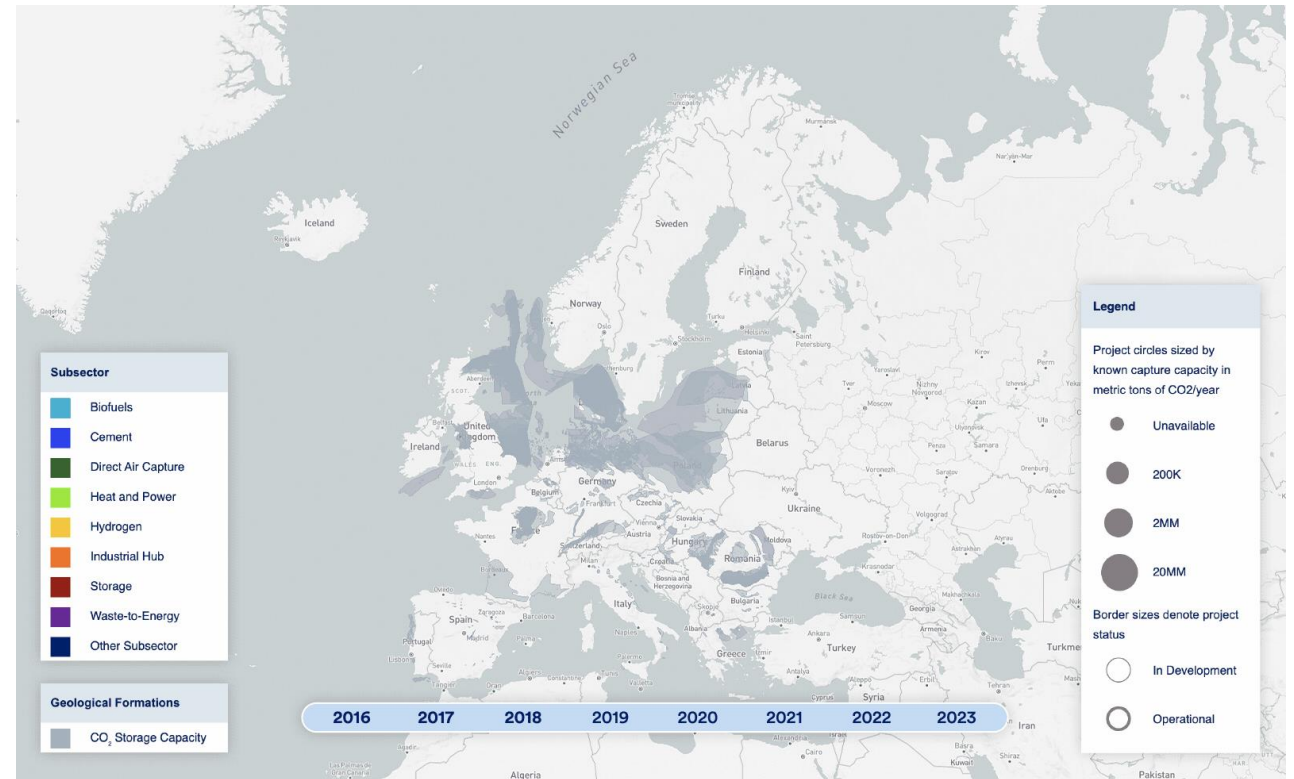
CCS in 2024: Reasons for Optimism

Strong project momentum across Europe

191 commercial CCS projects operating at various stages of development in Europe as of July 2024 (GCCSI, 2024)

Northern Lights: first phase operational since September 2024

Growing number of EU Member States adopting **strategies and roadmaps for CCS deployment**



Source: [Europe Carbon Capture Activity and Project Map](#), Clean Air Task Force.

EU Industrial Carbon Management Strategy

- A roadmap for scaling CCS & CCU in the EU by 2030, 2040 and 2050 (*not legally binding*)
- **Capture Targets:** 280 million tonnes by **2040**, 450 million tonnes by **2050**
- **Storage Targets:** 250 million tonnes of injection capacity by **2040** (EEA)
- **EU CO₂ Storage Investment Atlas**
- **Platform for demand aggregation**
- Regulatory proposal for **CO₂ transport** (expected Q2/Q3 2025)

Net-Zero Industry Act

- **CO2 storage target:** 50 million tonnes of injection capacity per year by 2030 (EU only)
- Injection Capacity Obligation – for licenced oil and gas producers
- **Transparency** on CO2 storage data
- Accelerated **permitting** for infrastructure
- Priority status for “Net-Zero Strategic Projects”

Future European CO₂ transport network

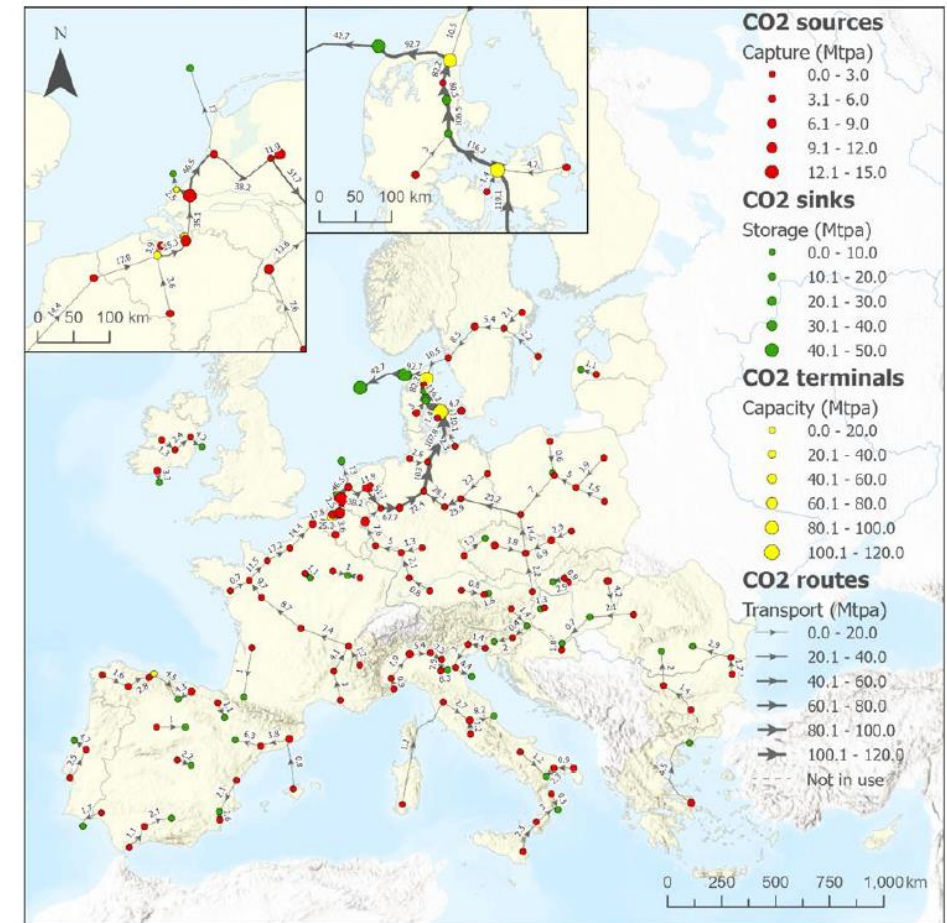
Projections for total length and deployment costs (JRC, 2024):

- **2030:** 6,700-7,300 km | € 6.5 - 19.5 billion
- **2050:** 15,000-19,000 km | € 9.3 - 23.1 billion

Early CCS adopters will have a significant impact on the evolution and extent of the future network

→ the CO₂ network will likely develop around their locations.

Figure 1. Potential CO₂ transport network in 2050 according to scenario C1



EU Policy Landscape for CCS/U

Existing frameworks:

- CCS Directive (2009)
- Renewable Energy Directive (2018)
- Net-Zero Industry Act (2024)
- Industrial Carbon Management Strategy (2024)
- Inclusion of permanent CCU in the EU ETS (2024)
- Revised CCS Guidance Documents (2024)
- Carbon Removals and Carbon Farming Regulation (2024)

Upcoming in 2025:

- Communication on a Clean Industrial Deal
- Industrial Decarbonisation Accelerator Act
- Legal proposal for 2040 climate target
- Proposal for an EU Competitiveness Fund
- CO2 transport regulatory package

Reality Check

We have been here before... Further policy delays could double the challenge (again) later.

Such incentives could be provided through various mechanisms, for example:

- Establishing a more favourable context for long-term investment decisions by ensuring the relative perpetuity of the emissions trading scheme and by facilitating commercial financing and risk-sharing instruments (e.g. through the EIB).

- Developing EU CO2 storage sites (onshore, offshore) and pipelines for multi-user access or projects for CO2 infrastructure development at Member State level.

- Adopting legally binding measures to regulate maximum allowed CO2 emissions per kWh after 2020 and/or introduce a timed phase-out (for instance by 2050) of all high CO2 emitting (i.e. non-CCS) electricity generation.

resources. Closer collaboration on zero-emission power generation with key third countries, with the focus on large fossil fuel exporters and large emerging economies, will therefore be imperative.

Concrete actions to reinforce collaboration with interested third countries should include projects in:

- increasing the energy efficiency of the coal chain

- identification and testing of potential sites for geological CO2 storage (including possibilities in hydrocarbon fields)

- cooperation in the development of Sustainable Coal technologies and in the preparation and construction of demonstration plants

- establishing a suitable regulatory framework for CO2 emission limits and the deployment of CCS using experience from the European model.

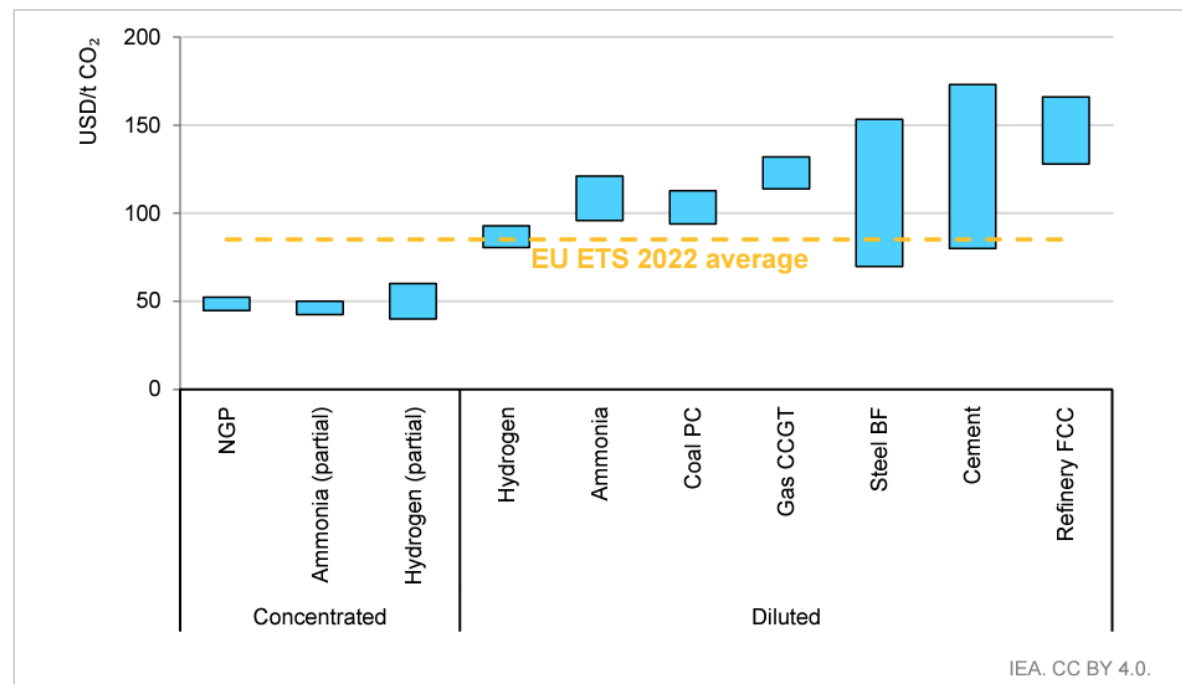
European Competitiveness

- The EU retains a **technological edge** in CCS (Draghi, 2024)
- The EU is a **global frontrunner** in carbon capture technologies, with 158 inventions in 2019-2021 and two companies – Air Liquide and Linde – in world top 10 (JRC, 2024).
- Leading EU Member States in annual **RD&I funding**: Germany, France, Denmark.
- However still **barriers** hindering the deployment of CCS in Europe.
- The EU lags behind on venture capital companies compared to other regions (US, Japan and Canada).
- **New business models**, new opportunities?
E.g. PPPs for CO2 transport and storage hubs



Challenging economics of CCS

- Projects in Europe are yet to find a clear business case
- **Prevailing cost gap** for most emitters in Europe
- **Difficult investment appetite** – only few FIDs
- **Cross-chain risk:** CO₂ capture, transport, and storage must all align

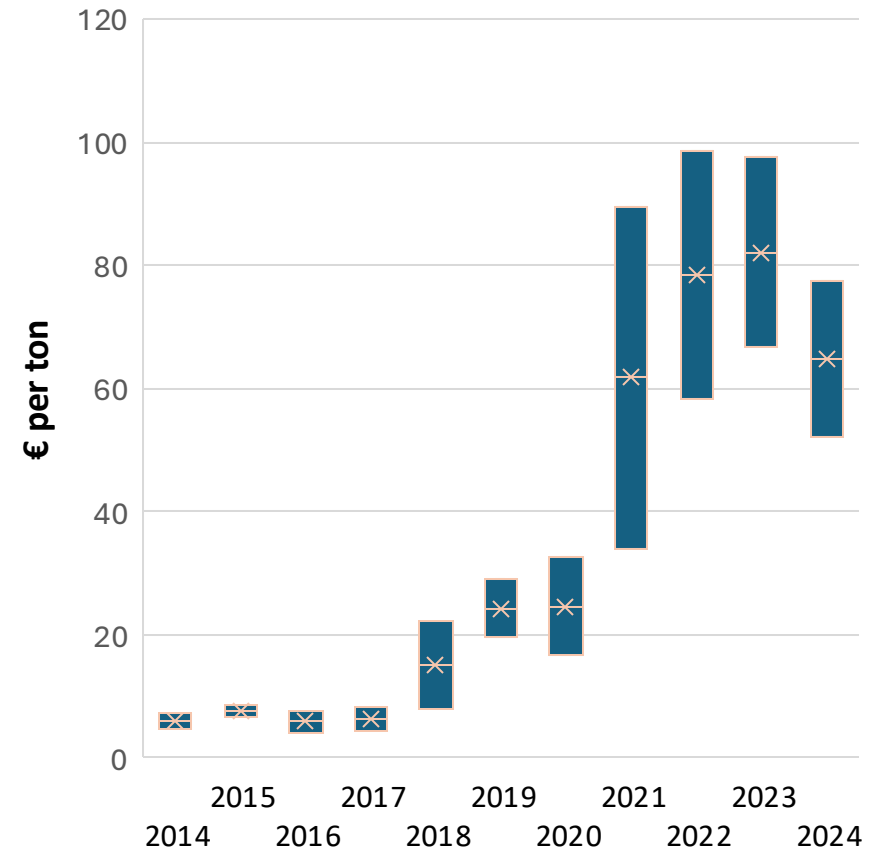


Levelised cost of CO₂ avoided between CCUS and unabated route across sectors. Source: IEA (2023).

Emissions trading alone will not suffice

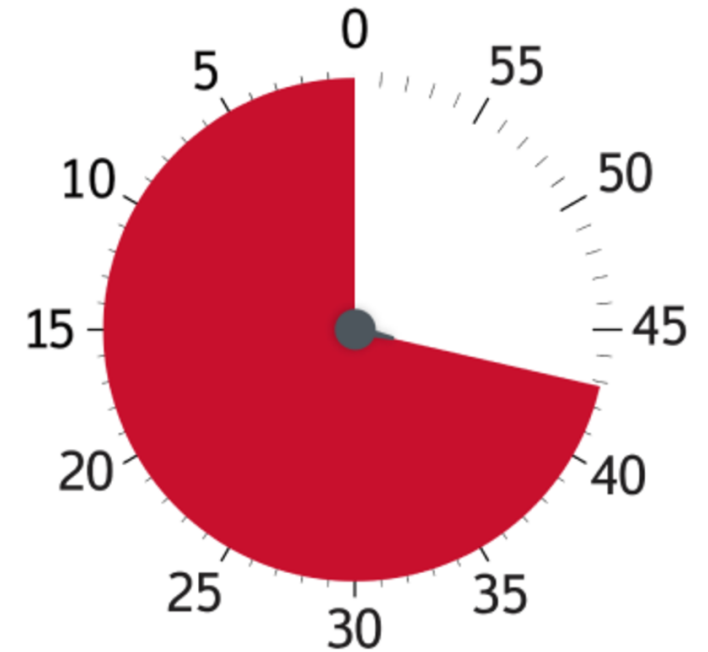
- Carbon price: Good for cost-effective mitigation, bad for infrastructure investments.
- The **EU ETS**: Successful at capturing the 'low-hanging fruit', but current prices are too low and uncertain
- **Carbon contracts for difference** may solve some issues, but no silver bullet:
 - Cross-chain risk not addressed explicitly
 - High administrative burden
 - Uncertainties in contractual arrangements
 - Government funding commitments

Price of EU Allowances (EUAs) between 2014-2024
(52-week high/low)



A new cycle allows for new thinking

- Injection capacity obligations
- Infrastructure-focused grants & loans
- Per ton payments (cf. tax credit)
- Carbon take-back obligations
- Emissions limits on power generation facilities
- Low-carbon and near-zero emissions product standards
- Procurement rules and premium markets
- Mandated product demand



About ZEP

Established in 2005, the Zero Emissions Platform (ZEP) is the trusted advisor to the European Union on industrial carbon management technologies. We work on developing and accelerating the commercial deployment of these climate technologies to achieve climate neutrality by 2050 and net negative emissions thereafter.

ZEP's technical and policy advice draws on the expertise and experience of a broad and diverse member base, ranging from energy producers and industrial companies to infrastructure and equipment providers, environmental NGOs, academic researchers, and trade unions.

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