

2023 THOUGHT LEADERSHIP

# CCS IN EUROPE REGIONAL OVERVIEW

NOVEMBER 2023



GLOBAL CCS  
INSTITUTE

**ELLINA LEVINA**

Senior Finance and European Affairs Manager

**BRUNO GERRITS**

Regional Business Development Manager - Europe

**MATHILDE BLANCHARD**

Senior Policy & Advocacy Adviser – Europe



**MANY EUROPEAN COUNTRIES HAVE  
MADE IMPORTANT ADVANCEMENTS  
ON THE PATH TO CCS DEPLOYMENT.**

# CONTENTS

1.0 EXECUTIVE SUMMARY	3
2.0 KEY TAKEAWAYS	4
3.0 INTRODUCTION	5
4.0 EU POLICIES	6
5.0 GOVERNMENT SUPPORT: EU FUNDS & STATE AID GUIDELINES	12
6.0 NATIONAL POLICIES AND PROJECTS	14
7.0 CO <sub>2</sub> INFRASTRUCTURE	24
8.0 BILATERAL AGREEMENTS	29

---

## Acknowledgements

This report was prepared by the Global CCS Institute. Ellina Levina, Mathilde Blanchard and Bruno Gerrits were the main authors of this report. Ellina Levina provided overall guidance and oversight of this publication.

The authors are grateful to Guloren Turan for support and guidance.

Dominic Rassool contributed to the report by providing some data and information.

The report was edited by Wendy Wells and designed by Creative Instinct.

# 1.0 EXECUTIVE SUMMARY

The momentum for carbon capture and storage (CCS) is continuing to build in Europe, where 119 commercial-scale CCS facilities are in various stages of development.

The European Commission in 2023 has initiated a series of new legislative proposals, adopted others that have been in the works since the release of the Fit for 55 Package and made further progress in funding CCS projects through the Innovation Fund or Connecting Europe Facility – Energy.

The North Sea continues to dominate as the preferred location for CO<sub>2</sub> storage sites in Europe, but other opportunities are emerging. Bulgaria, Croatia and Greece are developing CCS projects in south-east Europe, Italy has awarded a pilot storage license in the Adriatic Sea, and Denmark and Poland are considering onshore storage. The transport and storage is one service model delinked from specific capture plants.

Many European countries have also made important advancements on the path to CCS deployment. Denmark, Norway, the Netherlands, and the United Kingdom have been leading the way in terms of national CCS policy developments and supporting CCS projects. France and Germany have launched consultations on policies that aim to support CCS, while Belgium, Denmark, France, Germany, Iceland, the Netherlands, Norway, Sweden, Switzerland and the UK have made progress in bilateral agreements, declarations and/or collaborations on CCS. Several other countries have opted to include CO<sub>2</sub> capture in their climate mitigation strategies but not store it domestically. Sweden plans to use CCS only for generating carbon removals. Finland has a similar approach but is also exploring carbon utilisation. Belgium, Bulgaria, Greece and Romania are making important advancements to be able to implement CCS projects.

While overall a lot of progress has been made, there have been setbacks. The Porthos project was delayed due to a lawsuit related to nitrogen emissions before this was successfully resolved and the project received approval in August 2023, followed by FID in October. Celsio Oslo has been halted temporarily due to cost concerns. A project in Romania has been stopped temporarily due to a perceived lack of public acceptance.

EU support through the Innovation Fund and Connecting Europe Facility – Energy and individual national subsidy programs continue to be the main driver for CCS deployment in Europe. The price of emissions allowances traded on the EU's Emissions Trading Scheme reached a new high of €100 per tonne of CO<sub>2</sub> in February 2023, helping to improve the business case for CCS projects in some sectors. France, Germany, the Netherlands and the United Kingdom are relying on carbon contracts for difference (CCfDs) or examining them.

While progress has been made in Europe and globally in enhancing support and understanding of CCS, more work is needed. CCS projects in construction and advanced stages of development need to move towards implementation to provide much needed success stories.

# 2.0 KEY TAKEAWAYS

1. Interest in CCS as a key climate change mitigation tool is surging, with the number of commercial-scale CCS projects in various stages of development in Europe rising 61% since last year and reaching 119 in 2023.
2. The European Commission is supporting the acceleration of CCS deployment with legislative and regulatory actions under the Fit for 55 Package, the Green Deal Industrial Plan and Sustainable Carbon Cycles. An important milestone for CCS, the EU Industrial Carbon Management Strategy, is due for release in 2024.
3. Financial support is crucial in securing that CCS projects are economically viable in the first phase of deployment. The Innovation Fund, Connecting Europe Facility – Energy and Horizon Europe are the main funding mechanisms available to CCS developers at the EU level, while at a national level, the revised Climate Energy and Environmental State Aid Guidelines allow Member States to channel aid towards CCS projects, with notable support now available in Denmark and the Netherlands.
4. The North Sea continues to dominate as the preferred location for CO<sub>2</sub> storage sites in Europe, but storage opportunities are emerging in Bulgaria, Croatia, south-west France, Greece, Italy, and Romania.
5. CCS is increasingly being explored by more sectors in Europe across hard-to-abate industries such as cement, steel, and chemicals, and in power generation, fertilisers, hydrogen production and waste management.
6. Bioenergy with carbon capture and storage (BECCS) and direct air capture and storage (DACCS) are also making their way into the regulatory and investment landscape in Europe through the European Commission's proposed Carbon Removal Certification Framework and the Innovation Fund, but further policy interventions will be needed.
7. The CCS value chain will require coordination and collaboration across public institutions, private companies and communities, as well as between jurisdictions, to achieve cost reductions and efficiency gains. Ratification of the London Protocol Article 6 amendment and additional bilateral agreements between countries are part of this and necessary to improve investability.
8. Widespread support for CCS is not a given in Europe, and additional efforts are needed to secure government and community endorsement of CCS as a critical tool in achieving cost-effective carbon neutrality. The CCS projects currently in construction and advanced stages of development need to move towards implementation to provide much needed examples of the value of CCS.



# 3.0 INTRODUCTION

The momentum for carbon capture and storage (CCS) is continuing to build in Europe. There were 119 commercial-scale CCS facilities in various stages of development across Europe as of October 2023, up 61% from a year earlier.

EU support through the Innovation Fund and Connecting Europe Facility – Energy, and individual national subsidy programs (notably in Denmark, the Netherlands, Norway, and the United Kingdom) continue to be the main driver for CCS deployment in Europe. In addition, the price of emissions allowances traded on the EU's Emissions Trading Scheme reached a new high of €100 per tonne of CO<sub>2</sub> in February 2023, contributing to an improved business case for CCS projects in some sectors.

CCS is becoming more prominent EU-wide and in some national policies as 2030 climate targets approach and new targets for 2040 are developed to chart the next step in the path to the 2050 commitment of carbon neutrality. Analyses by governments, industry players and analytical institutions consistently conclude that CCS and carbon removals will play a significant role in reducing the cost of achieving this target.

CCS developments in Europe set examples for other countries considering CCS in their transition plans. Policy and regulatory frameworks developed and tested in Europe, along with success stories of early CCS projects, offer learning and collaboration opportunities across the world.



**THE MOMENTUM FOR CARBON  
CAPTURE AND STORAGE IS  
CONTINUING TO BUILD IN EUROPE.**

# 4.0 EU POLICIES

CCS has been gaining traction in the European Union (EU) as the importance of this technology in mitigating climate change and reducing GHG emissions to achieve EU climate targets is increasingly acknowledged. Yet the policy and regulatory framework around this technology appears dispersed, hence the need to map the latest developments, which can be grouped according to the different European Commission's action plans they refer to: the Fit for 55 Package, the Green Deal Industrial Plan, the long-awaited EU industrial carbon management strategy and the Sustainable Carbon Cycles.

## A. Fit for 55 Package

### *Revised EU ETS Directive (May 2023)*

The reform of the EU Emissions Trading System (EU ETS)<sup>1</sup> was published in the Official Journal of the EU in May 2023. After two years of negotiations, the revised EU ETS supports the target of a 55% reduction of GHG emissions by 2030 compared to 1990 while its scope was expanded to the maritime sector. The allocation rules for free allowances were also adapted with a gradual phase-out for industry from 2026 until 2034.

The key revisions relevant to CCS include:

- The scope of activities covered under the EU ETS is no longer restricted to CO<sub>2</sub> pipelines and refers to all means of CO<sub>2</sub> transport.
- A mandate for the European Commission to submit a report to the European Parliament and the Council by 31 July 2026 on how permanent carbon removals could be integrated into the EU ETS.

The European Commission will need to update monitoring, reporting, and verification procedures to reflect the changes triggered by the revised EU ETS Directive. The European Commission held a public consultation in July-August 2023 to adjust the EU ETS Monitoring and Reporting Regulation (EU MRR)<sup>2</sup>. This was followed by an assessment and positive opinion from the Climate Change Committee<sup>3</sup> in September 2023. Article 49 of the EU MRR offers EU ETS participants the possibility of subtracting from the emissions of their installation any fossil CO<sub>2</sub> that is captured for transport and geological storage in a site permitted under the CCS Directive rather than emitted.

It is also important to note that the ETS carbon price reached its highest mark of €100 per ton of CO<sub>2</sub> in February 2023, boosting the business case of CCS and other green technologies [Figure 1].

### *Carbon Border Adjustment Mechanism (May 2023)*

After two years of negotiations, the CBAM regulation<sup>4</sup> was ratified in May 2023, along with the revised EU ETS directive. This tool aims at putting a fair price on the carbon emitted during the production of goods entering the EU market, creating a level playing field for European industries subject to the EU ETS and stimulating de facto cleaner production processes in third countries.

The CBAM launched its transitional phase on 1 October 2023. It applies to imports of selected goods for which production is carbon intensive or exposed to carbon leakage risk; cement, iron and steel, aluminium, hydrogen, fertilisers and electricity. For the first reporting period, importers of these products will only focus on embedded GHG emissions (direct and indirect) and will not have to make any monetary payments. From 2026 onwards, all EU importers of goods covered by the CBAM will be required to surrender a CBAM certificate for every tonne of emissions embedded in the goods that they import.

<sup>1</sup> Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and Regulation (EU) 2015/757, OJ L 130/134

<sup>2</sup> Draft Commission Implementing Regulation amending Implementing Regulation (EU) 2018/2066 as regards updating the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council

<sup>3</sup> Formal results of voting on Draft Commission Implementing Regulation amending Implementing regulation (EU) 2018/2066 as regards updating the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council

<sup>4</sup> Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023 establishing a carbon border adjustment mechanism, OJ 2023 L 130/52

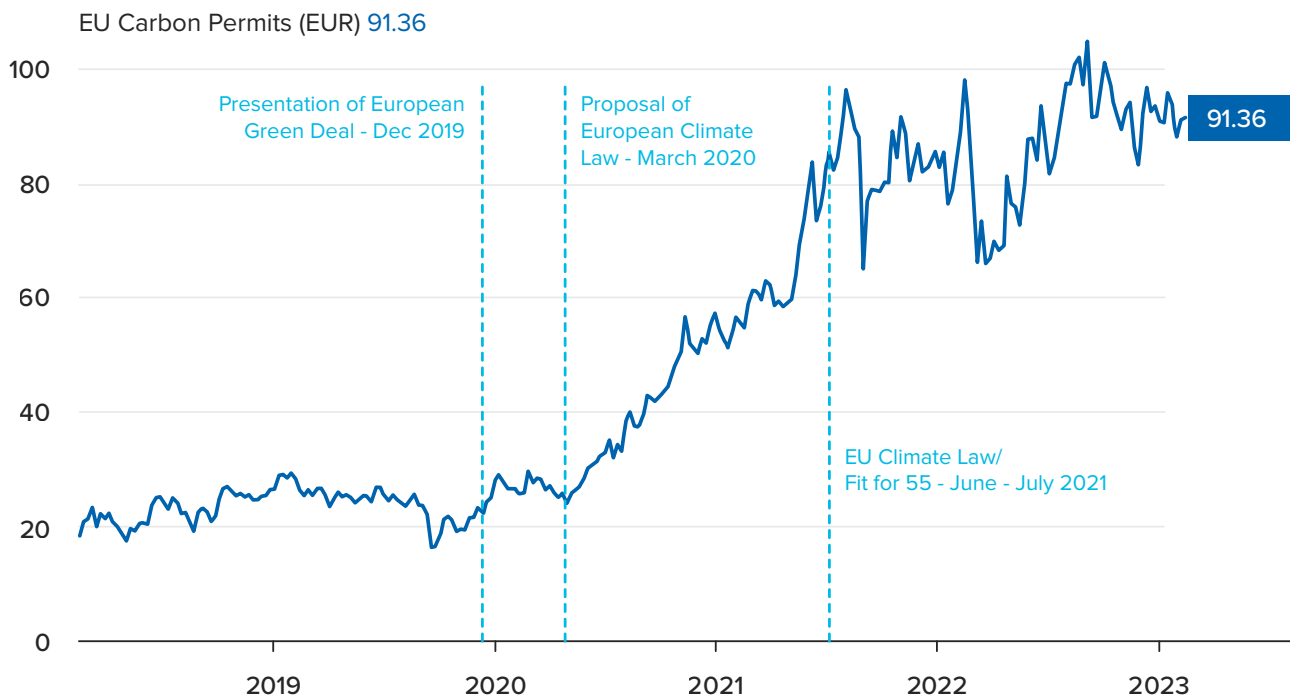


Figure 1: EU ETS price chart dated 15 August 2023.<sup>5</sup>

To help installation operators outside the EU and importers of goods into the EU prepare for their obligations, the European Commission published a series of guidance documents in August 2023. In the one related to CBAM implementation for importers<sup>6</sup>, it clarified that operators using CCS/CCU need to document that the CO<sub>2</sub> is permanently stored or chemically bound so that it cannot enter the atmosphere in order for this CO<sub>2</sub> not to qualify as an embedded emission.

## B. Green Deal Industrial Plan

In February 2023, the European Commission released its Communication on a 'Green Deal Industrial Plan for the Net-Zero Age'<sup>7</sup> to further support climate neutrality targets while heightening Europe's growing clean industrial sector. As major economies are boosting their investment in the net-zero industry (the United States, Japan and China, to name a few), the plan aims to scale up the European manufacturing capacity of green technologies, which are expected to play a key role in the shift to a low-carbon economy. The strategies and initiatives outlined in the plan are focused on four key pillars – a predictable and simplified regulatory environment, faster access to funding, enhancing skills, and open trade for resilient supply chains. Various regulatory proposals were announced such as the Net-Zero Industry Act<sup>8</sup>, the Critical Raw Materials Act<sup>9</sup>, and the Electricity Market Design Reform<sup>10</sup>.

<sup>5</sup> Cevikel, S. & Thomas, J. (2023) 'The investment case for CCS: Policy Drive and Case Studies', Global CCS Institute. Available at: <https://www.globalccsinstitute.com/wp-content/uploads/2023/09/The-Investment-Case-for-CCS-Global-CCS-Institute.pdf>

<sup>6</sup> Guidance document on CBAM implementation for importers of goods into the EU, European Commission, Directorate-General Taxation and Customs Union, 17 August 2023

<sup>7</sup> Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. A Green Deal Industrial Plan for the Net-Zero Age, COM/2023/62 final

<sup>8</sup> Proposal for a Regulation of the European Parliament and of the Council on establishing a framework of measures for strengthening Europe's net-zero technology products manufacturing ecosystem (Net Zero Industry Act), COM/2023/161 final

<sup>9</sup> Proposal for a Regulation of the European Parliament and of the Council establishing a framework for ensuring a secure and sustainable supply of critical raw materials and amending Regulations (EU) 168/2013, (EU) 2018/858, 2018/1724 and (EU) 2019/1020, COM/2023/160 final

<sup>10</sup> Proposal for a Regulation of the European Parliament and of the Council amending Regulations (EU) 2019/943 and (EU) 2019/942 as well as Directives (EU) 2018/2001 and (EU) 2019/944 to improve the Union's electricity market design, COM/2023/148 final

## Net-Zero Industrial Act (March 2023)

As part of the first pillar of the Green Deal Industrial Plan, the European Commission proposed the Net-Zero Industry Act (NZIA) in March 2023. The regulation seeks to scale up manufacturing capacities in technologies that will drive decarbonisation and strengthen competitiveness and supply chain resilience. It defines two categories – ‘net-zero technologies’ and ‘strategic net-zero technologies’ – with additional benefits for the second one.

The list of ‘strategic net-zero technologies’ [Figure 2] is available in the Annex<sup>11</sup> that accompanies the proposal of the European Commission, while still being subject to changes during the inter-institutional negotiations. Upon compliance with some criteria, projects under this label will benefit from priority status at the national level, accelerated permitting processes, and facilitated access to public tenders and support schemes.

The NZIA constitutes an important shift in the approach taken by the European Commission towards CCS, with major implications for the sector:

- The act introduces an injection target of 50 Mtpa CO<sub>2</sub> within the EU by 2030.
- It calls on Member States to enhance their transparency and reporting of geological data through the creation of a European storage atlas.
- It also puts an obligation on oil and gas producers in the EU to invest collectively in CO<sub>2</sub> storage capacities.

Co-legislators, i.e. the European Parliament and the Council of the EU, are redoubling their efforts to reach an interinstitutional agreement by the next legislative mandate (2024-2029). The ITRE Committee agreed on its position on 25 October 2023 and will look for the Plenary’s support in November 2023, while the Council of the EU expects to finalise its General Approach in early December 2023.

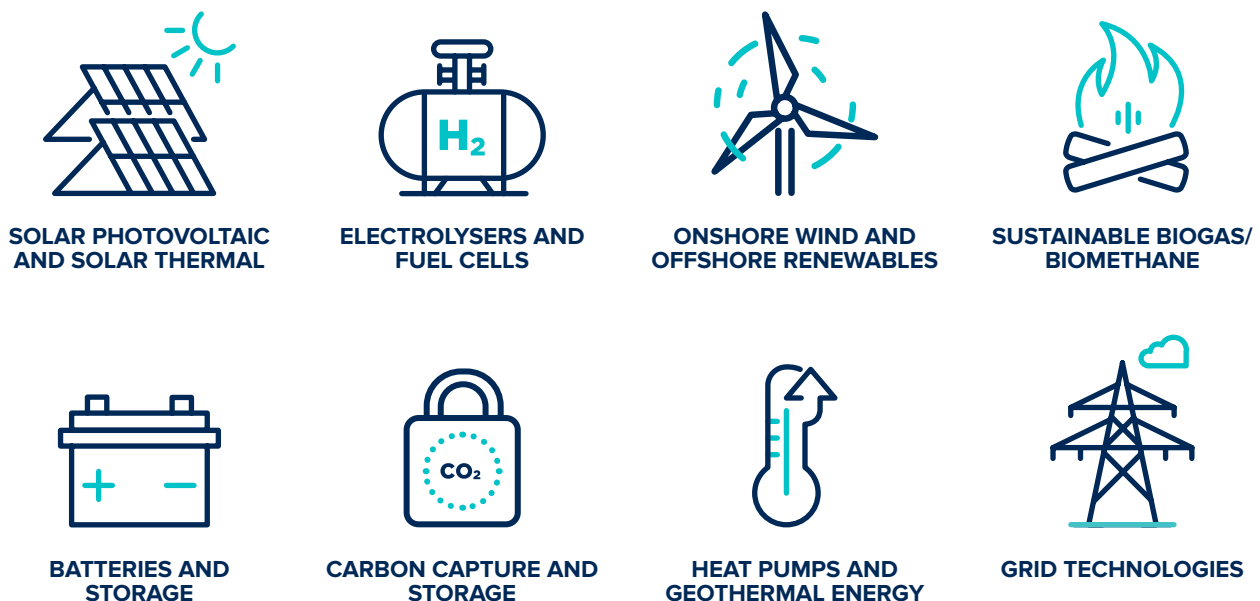


Figure 2: – Illustration of ‘net-zero strategic technologies’.<sup>12</sup>

<sup>11</sup> Annex to the Proposal for a Regulation of the European Parliament and of the Council on establishing a framework of measures for strengthening Europe’s net-zero technology products manufacturing ecosystem (Net Zero Industry Act), COM/2023/161 final

<sup>12</sup> According to European Commission (2023) EU Net-Zero Industry Act: Making the EU the home of clean tech industries, factsheet, March 2023. Available at: [https://ec.europa.eu/commission/presscorner/detail/en/FS\\_23\\_1667](https://ec.europa.eu/commission/presscorner/detail/en/FS_23_1667)



## C. EU industrial carbon management strategy

### *Studies on the EU regulation for the development of the market for CO<sub>2</sub> transport and storage (May 2023) and on the evolution of the extent and the investment requirements of a trans-European CO<sub>2</sub> transport network (November 2023)*

To underpin the long-awaited CCS strategy, the European Commission also commissioned two studies; one on the EU regulation for the development of the market for CO<sub>2</sub> transport and storage and the other on the evolution of the extent and the investment requirements of a trans-European CO<sub>2</sub> transport network:

- The first report<sup>13</sup> was commissioned to the Energy Transition Expertise Centre, a consortium of consultancies and research organisations monitoring and analysing trends in technologies and innovations relevant for the energy transition. Released in May 2023, the objective of the report was to analyse options for a regulatory framework to support the infrastructure for CO<sub>2</sub> transport and storage and business models in Europe.
- The second report will be delivered by the Joint Research Centre and analyse the optimisation of the future cross-border CO<sub>2</sub> transport grid. It will notably model the location of emitters and storage sites in Europe and examine the repurposing of the existing gas infrastructure. The results are expected to be presented at the CCUS Forum in November 2023.

### *Industrial carbon management public consultation (June-August 2023)*

In June 2023, the European Commission published a call for evidence and a public consultation on industrial carbon management. Open until 31 August, the consultation aimed at collecting insights from stakeholders and citizens to feed into the preparations of a new EU communication on CCUS deployment.

The strategy, initially announced for the end of 2023 but now foreseen for Q1 2024 following the changes in the College of Commissioners, will cover what role CCS, CCU and carbon dioxide removal (CDR) technologies

can play in decarbonising the EU economy by 2030, 2040 and 2050. It will also explore the policy and regulatory measures that are needed to optimise their potential across the continent, including through the deployment of an EU-wide CO<sub>2</sub> transport infrastructure. First legal proposals stemming from this strategy can be expected to be published under the new Commission in 2025. Meanwhile, results from the public consultation were presented by consultancy Trinomics and German think tank Fraunhofer, two members of the Energy Transition Expertise Centre, *at a workshop on 6 October 2023*.

### *CCS Directive implementing report (October 2023)*

In accordance with the CCS Directive, Member States submitted to the European Commission their updates on the implementation of this legislation at national level over the past four years. The European Commission then collected the different feedbacks to share the progress with the European Parliament and the Council of the EU. The 4th implementing report, released in October 2023, concludes that the CCS Directive has been correctly applied from 2019 to 2023 across the EU, acknowledges some progresses in Europe on the development and exploration of CO<sub>2</sub> storage sites, and welcomes the large support for CCS R&D projects in most European countries.

#### **CCS DIRECTIVE GUIDANCE DOCUMENT REVIEW (JANUARY 2023-SUMMER 2024)**

Besides the actions described above, DG CLIMA commissioned DNV to revise the CCS Directive Guidance Documents to reflect the global state of play of CCS and remove ambiguities identified during the development of the first CCS projects in the European Economic Area.

A public stakeholder consultation workshop was held on 11 July 2023 to discuss the draft zero versions. Capacity-building workshops will be organised for Member States in the first part of 2024 while the final report can be expected in summer Q3 2024.

The revised Guidance Documents of the CCS Directive aim to provide best possible support for operators and Competent Authorities in the practical implementation of permitting procedures in line with the CCS Directive.

<sup>13</sup> European Commission, Directorate-General for Energy, Bolscher, H., Guevara Opinska, L., Finesso, A. et al. (2023) EU regulation for the development of the market for CO<sub>2</sub> transport and storage. Publications Office of the European Union. Available at: <https://data.europa.eu/doi/10.2833/093881>

## D. Sustainable Carbon Cycles

### Carbon removal certification framework (November 2022)

As a follow-up to the EU communication on Sustainable Carbon Cycles<sup>14</sup> published in December 2021, the European Commission adopted in November 2022 a legislative proposal for a first EU-wide voluntary framework to certify carbon removals<sup>15</sup>. Removals are defined according to three categories: permanent carbon removals (including BECCS and DACCS), carbon farming practices that store CO<sub>2</sub> in the soil or forests, and carbon storage in long-lasting products and materials [Figure 3].

Besides defining criteria for high-quality carbon removals, the proposal also identifies certification rules for the measurement, monitoring, reporting, and verification of carbon removals. These certificates could ultimately be traded on voluntary carbon markets, used as labels for building companies willing to invest in sustainable products, or provide new funding opportunities (public and private).

In the same vein as the Net-Zero Industry Act, the file is being revised by the co-legislators who will aim to adopt it by the next legislative mandate. In parallel, the European Commission will prepare Delegated Acts to detail the certification methodologies for the different types of removal activities and make the scheme operational.



**Carbon farming**, such as restoring forests, soils, and management of wetlands and peatlands



**Permanent storage**, such as bioenergy with carbon capture and storage, or direct air carbon capture and storage



**Carbon storage in long-lasting products and materials** such as wood-based construction

Figure 3: Type of carbon removals.<sup>16</sup>

## E. What will come next?

### EU 2040 climate target (Q1 2024)

The EU is preparing to define its 2040 climate target in order to bridge its two previously-agreed climate objectives – achieving carbon neutrality by 2050 and reducing GHG emissions by 55% by 2030. It is set to be developed through a communication due for release in Q1 2024 that will be followed by a legislative proposal amending the European Climate Law.<sup>17</sup>

The relevance of CCS for the 2040 intermediary target became clear when the Commission announced its willingness to align the publication date with the EU industrial carbon management strategy, leading to the postponement of the latter. If CCS is confirmed as one of the main policy options to put the EU to stay on track for this new target, it is likely that the European Commission will adopt further legislative proposals, as it did when unveiling the Fit for 55 Package in July 2021.

<sup>14</sup> Communication from the Commission to the European Parliament and the Council on Sustainable Carbon Cycles, COM/2021/800 final

<sup>15</sup> Proposal for a Regulation of the European Parliament and of the Council establishing a Union certification framework for carbon removals, COM/2022/672 final

<sup>16</sup> According to European Commission (2022) Delivering the European Green Deal: First EU certification of carbon removals, factsheet, 30 November 2022. Available at: [https://ec.europa.eu/commission/presscorner/detail/en/fs\\_22\\_7161](https://ec.europa.eu/commission/presscorner/detail/en/fs_22_7161)

<sup>17</sup> Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'), OJ L 243/1

## Updated National Energy and Climate Plans (June 2024)

In line with the Regulation on the governance of the energy union and climate action<sup>18</sup>, Member States must submit a draft revised version of their National Energy and Climate Plan (NECP) by 30 June 2023 and a final one by 30th June 2024. NECPs are comprehensive roadmaps detailing how each country intends to achieve its 2030 climate targets by addressing aspects related to decarbonisation, energy efficiency, energy security, internal energy market, and research, innovation and competitiveness.

In their updates, Member States will also need to integrate the policy changes triggered by the completion of the first part of the Fit for 55 Package. Almost two-thirds of the draft updated NECPs were available on the European Commission's website as of October 2023. All available online versions except one mention the future role envisaged for carbon capture, utilisation and storage (CCUS), reflecting one of the recommendations put forward by the CCUS Forum in 2022.

Below is the table that summarises the main recent and upcoming EU initiatives related to CCS.

Directorate-General responsible for the file	Name of the file	Category of the file	Adoption by the European Commission	Votes by the European Parliament		General approach by Council of the EU	Interinstitutional agreement	Publication in Official Journal of the EU
				In responsible Committee	In Plenary			
● DG ENER	Revision of the guidelines for trans-European energy infrastructure	Regulation	15 December 2020	27 September 2021 (ITRE Committee)	6 October 2021	11 June 2021	15 December 2021	3 June 2022
● DG CLIMA	Revision of the EU Emissions Trading System	Directive	14 July 2021	17 May 2022 (ENVI Committee)	22 June 2022 (after rejection in session of 8 June)	29 June 2022	18 December 2022	16 May 2023
● DG TAXUD	Carbon Border Adjustment Mechanism	Regulation	14 July 2021	17 May 2022 (ENVI Committee)	22 June 2022	15 March 2022	12 December 2022	16 May 2023
● DG CLIMA	A Union certification framework for carbon removals	Regulation	30 November 2022	24 October 2023 (ENVI Committee)	21 November 2023	Expected on 18 December 2023	TBC	TBC
● DG GROW	A Green Deal industrial plan for the net-zero age	Communication	1 February 2023					1 February 2023
● DG GROW	Net-Zero Industry Act	Regulation	16 March 2023	25 October 2023 (ITRE Committee)	21 November 2023	Expected on 7 December	TBC	TBC
● DG ENER	EU industrial carbon management strategy	Communication	Expected in Q1 2024					Expected in Q1 2024
● DG CLIMA	Update of the rules for monitoring and reporting emissions	Implementing Act	Expected in Q4 2023					Expected in Q4 2023
● DG CLIMA	2040 Climate Target	Communication	Expected in Q1 2024					Expected in Q1 2024

- EU initiatives that have been completed
- EU initiatives whose process is ongoing
- EU initiatives that are pending

**Table 1: Summary of main EU initiatives related to CCS as of October 2023.<sup>19</sup>**

<sup>18</sup> Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council, OJ 2018 L 328

<sup>19</sup> Global CCS Institute based on its own research.

# 5.0 GOVERNMENT SUPPORT: EU FUNDS & STATE AID GUIDELINES

Government support for CCS projects is crucial for creating a business case for the rollout of a CO<sub>2</sub> value chain in this early stage of CCS deployment. At the EU level, the Innovation Fund, the Connecting Europe Facility – Energy and the Horizon Europe have been the main funding mechanisms available for CCS developers. At the national level, the revised Climate Energy and Environmental State Aid Guidelines also enable Member States to channel aid towards CCS projects.

## A. EU funds

### *Innovation fund*

Fed by EU ETS revenues, the Innovation Fund focuses on the deployment of innovative clean technologies. Depending on the carbon price, the Innovation Fund may amount to €40 billion for the period 2020-2030. With every new call for projects under the Innovation Fund, we have seen a larger number of projects with a CCS component apply.

In November 2022, the European Commission launched its third call for large-scale projects. For the first time, the EU divided its Innovation Fund budget, which has doubled due to increased ETS prices (to around €3 billion), and CCUS will be funded under €1 billion allocated to ‘general decarbonisation’. Energy-intensive industries accounted for more than two-thirds of all applications received across all topics (239 in total), demonstrating a clear momentum in this sector. Among those, the European Commission selected 41 projects, including 10 on carbon management, in July 2023. Final grant decisions are due to be announced in Q4 2023.

Applications for the third call for small-scale projects (defined as having total capex below €7.5 million) were open from March to September 2023 with a budget of €100 million. As with the large-scale projects program, projects including CCUS technologies within the European Economic Area can apply for support. Results and grants will be published in the first six months of 2024.

The next Innovation Fund call will be open to all types of projects – small, medium, and large – from 23 November 2023 to 9 April 2024.

### *Connecting Europe Facility – Energy*

In addition to the Innovation Fund, several CCS infrastructure projects have been funded as Projects of Common Interest (PCIs). To qualify as a PCI, projects must have a significant impact on at least two EU countries and, as such, can benefit from accelerated permitting procedures and access to funding through the Connecting Europe Facility for Energy (CEF-E).

Six CO<sub>2</sub> transport projects were included in the 5th PCI list published in November 2021; five in the North Sea and one in Poland. Three industrial CO<sub>2</sub> capture and storage proposals have been selected for funding under CEF-E: Antwerp@C CO<sub>2</sub> Export Hub, Ghent Carbon Hub and D’Artagnan hub.

This year’s 6<sup>th</sup> PCI list – the fourth to include CO<sub>2</sub> networks – is of particular interest since it comes after a major revision of the TEN-E regulation<sup>20</sup> in 2022. The list of candidates includes a substantial number of CCS projects, demonstrating the growing conviction that carbon capture and storage will be a vital enabler of

<sup>20</sup> Regulation (EU) 2022/869 of the European Parliament and of the Council of 30 May 2022 on guidelines for trans-European energy infrastructure, amending Regulations (EC) No 715/2009, (EU) 2019/942 and (EU) 2019/943 and Directives 2009/73/EC and (EU) 2019/944, and repealing Regulation (EU) No 347/2013, OJ L 152

industrial decarbonisation in Europe. Also significant is the much wider geographical reach of the current crop; where plans have previously been confined to the North Sea, we now see interest from the four corners of the continent, spanning from Iceland to Greece, and from Spain to Lithuania.<sup>21</sup>

The 6<sup>th</sup> PCI list will be adopted by the European Commission in November 2023. Co-legislators will have two months to object the selection (extendable by two months). Without objection, the list will enter into force in Q1 2024.

## Horizon Europe

Last but not least, Horizon Europe is the EU's key funding program for research and innovation, including CCS technologies. It aims at facilitating collaboration and strengthening the impact of research and innovation to tackle climate change while boosting the EU's competitiveness. For the 2021-2027 period, it has a budget of €95.5 billion.

CCS and CCU projects can receive support from two clusters under the second pillar of Horizon Europe on 'Global challenges and European industrial competitiveness':

- Cluster 5 on 'Climate, Energy and Mobility': In the Work Programme for 2023-2024, CCS, CCU, or CDRs are explicitly mentioned under Destination 'Sustainable, secure and competitive energy supply'.
- Cluster 4 on 'Digital, Industry and Space': In the Work Programme for 2023-2024, Destination 'Climate neutral, circular and digitized production' addresses CCS and CCU in the context of industrial symbiosis and Hubs for Circularity.

## B. Climate, Energy and Environmental State Aid Guidelines

To complement EU funding, Member States might also support CCS projects through their national budgets. The Climate Energy and Environmental State Aid Guidelines (CEEAGs)<sup>22</sup> have to be followed in this context. Aligned with the EU climate objectives since 2022, they enable European countries to implement national support measures to a project if it meets pre-defined criteria. Prior to delivering this support, national authorities must notify the European Commission, which will assess whether the aid is compatible with EU competition laws.

CCS projects could be considered under three categories of aid:

- Aid for the reduction and removal of greenhouse gas emissions including through support for renewable energy and energy efficiency (section 4.1).
- Aid for the security of electricity supply (section 4.8).
- Aid for energy infrastructure (section 4.9).

Which category applies would depend on the nature of the project, for example CO<sub>2</sub> capture or infrastructure, capture plans in industries or power plants, etc.

Examples of national mechanisms that can support CCS projects, developed and implemented in accordance with the CEEAGs, include:

- €30 billion SDE++ scheme in the Netherlands.<sup>23</sup>
- €1.1 billion scheme in Denmark.<sup>24</sup>

<sup>21</sup> Clean Air Task Force (2023) Europe's cross-border CO<sub>2</sub> networks start to take shape, 21 February 2023. Available at: <https://www.catf.us/2023/02/europes-cross-border-co2-networks-start-to-take-shape/>

<sup>22</sup> Communication from the Commission – Guidelines on State aid for climate, environmental protection and energy 2022, OJ C 80/1

<sup>23</sup> European Commission (2023) State aid: Commission approves modification of Dutch scheme to reduce greenhouse gas emissions, 10 July 2023. Available at: [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_23\\_3743](https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3743)

<sup>24</sup> European Commission (2023) State aid: Commission approves €1.1 billion Danish scheme to support roll-out of carbon capture and storage technologies, 12 January 2023. Available at: [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_23\\_128](https://ec.europa.eu/commission/presscorner/detail/en/ip_23_128)

# 6.0 NATIONAL POLICIES AND PROJECTS

Supportive policy and financial frameworks have improved the business case for CCS projects in Europe. This has led to a 61% increase in the number of projects in 2023 since the 2022 Global CCS Status report<sup>25</sup>. In total, 119 CCS facilities (capture, storage, transport, or integrated ones) are currently in various stages of development across Europe [Figure 4].

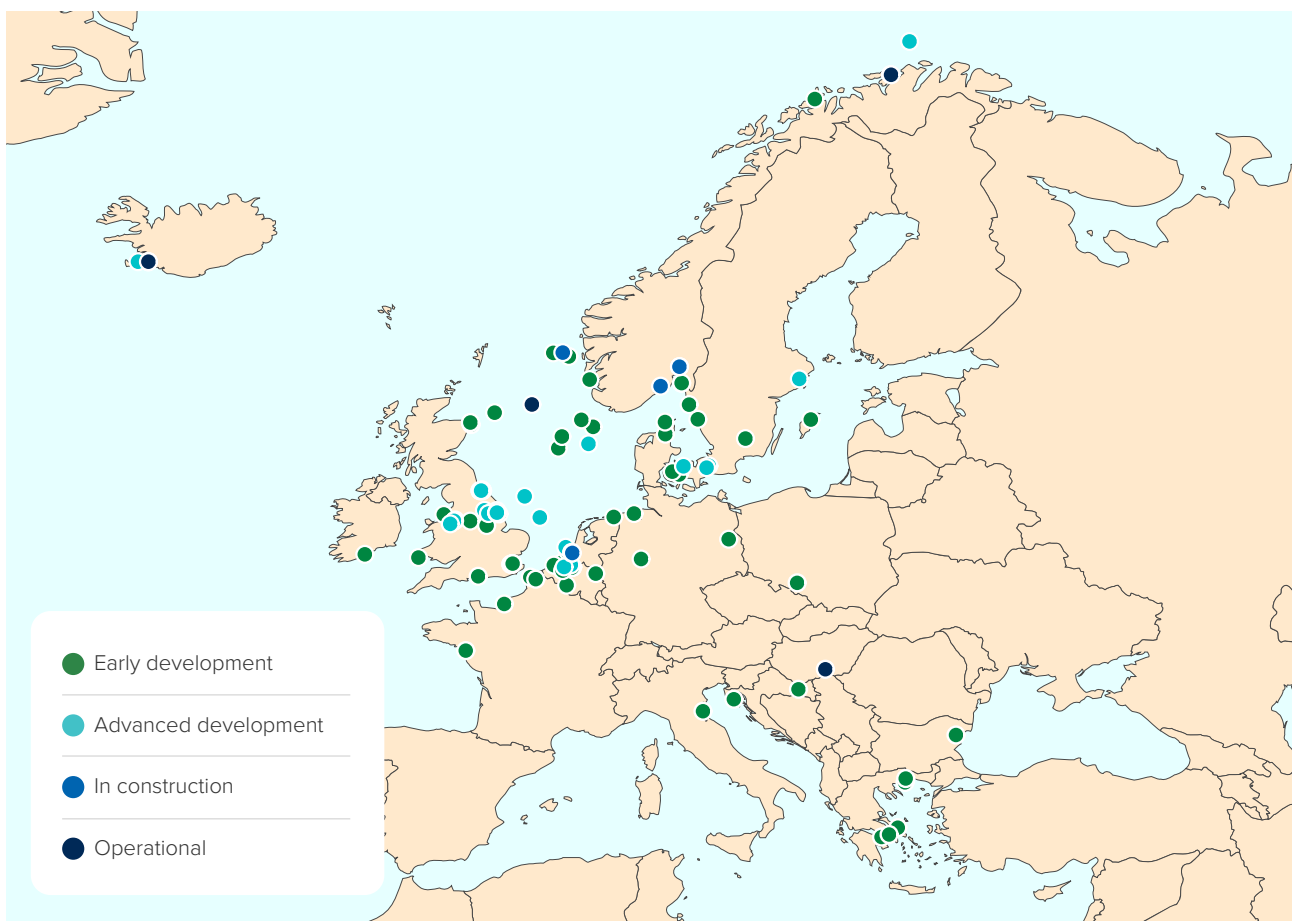


Figure 4: Map of CCS projects in various stages of development as of October 2023.<sup>26</sup>

<sup>25</sup> Global CCS Institute (2022) Global status of CCS 2022. Available at: [https://status22.globalccsinstitute.com/wp-content/uploads/2023/03/GCCSI\\_Global-Report-2022\\_PDF\\_FINAL-01-03-23.pdf](https://status22.globalccsinstitute.com/wp-content/uploads/2023/03/GCCSI_Global-Report-2022_PDF_FINAL-01-03-23.pdf)

<sup>26</sup> Global CCS Institute (2023) Global status of CCS 2023. Available at: <https://status23.globalccsinstitute.com/>

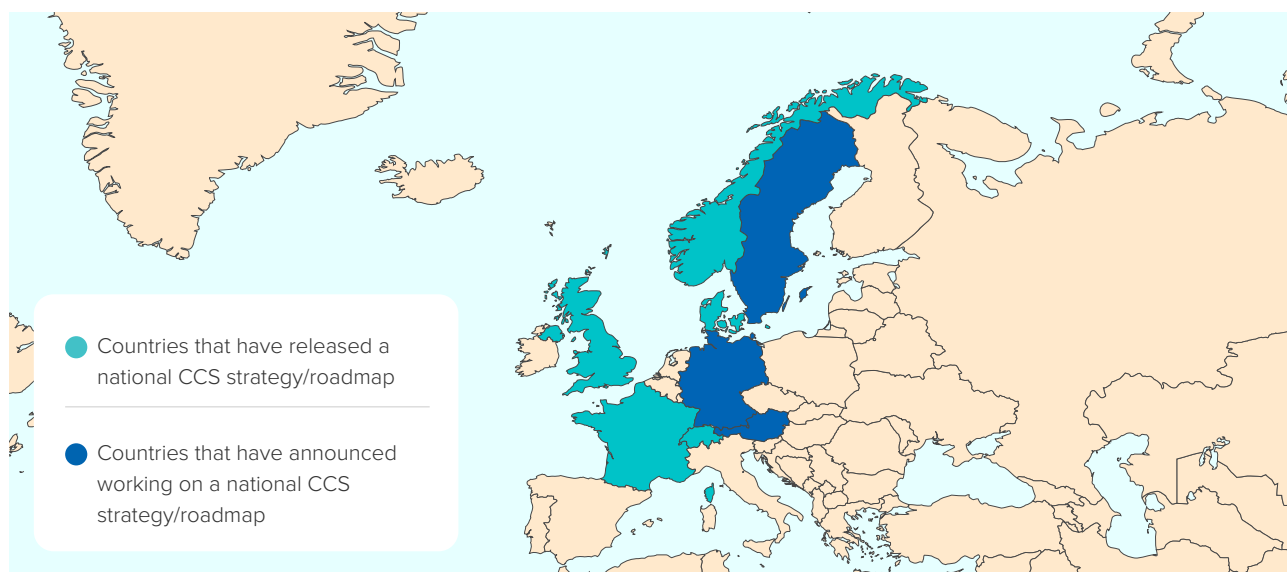
Several European countries are leading the way, notably Denmark, the Netherlands, Norway, and the United Kingdom. Denmark<sup>27</sup> and the United Kingdom<sup>28,29</sup>, recently launched their first tenders of CO<sub>2</sub> storage licenses in the North Sea, including in both saline aquifers and depleted oil and gas fields. Lately, the Norwegian Petroleum Directorate offered Wintershall DEA and CapeOmega an exploration license for CO<sub>2</sub> storage in the North Sea<sup>30</sup>. Furthermore, the world's first open-source CO<sub>2</sub> transport and storage infrastructure, Northern Lights<sup>31</sup>, is expected to be online by 2025 and is being built ready for expansion to accommodate increasing storage demands.

In the Netherlands, Porthos, a joint venture between the Port of Rotterdam Authority, Gasunie and EBN, has announced its final investment decision (FID) for the development of the first large-scale CO<sub>2</sub> transport and storage system. With construction set to commence in 2024, Porthos is expected to be operational by 2026 and aims to store 2.5 million tonnes of CO<sub>2</sub> per year for 15 years. Another large-scale Dutch project, the Aramis project<sup>32</sup>, will allow several CO<sub>2</sub> storage sites to connect to its offshore transport backbone. Countries that have previous experience with oil and gas exploration and associated legislation typically have the capacity

to move faster with launching CO<sub>2</sub> storage projects. However, new CCS projects have also emerged in other geographies. Belgium, Bulgaria, Croatia, France, Germany, Greece, Poland and Sweden have announced new CCUS projects in various stages of development.

An analysis of the Global CCS Institute's CO<sub>2</sub>RE database shows that several sectors dominate in terms of CCS project development. This includes the cement sector, hydrogen/ammonia/fertiliser production, BECCS, and power and heat generation (predominantly in the United Kingdom). There are also several CCS projects in various stages of development in natural gas processing, chemicals, oil refining and Direct Air Capture.

Several European governments offer explicit policy support for CCS through the development of CCS strategies or roadmap at national level [Figure 5], inclusion of CCS in their national decarbonisation strategies (e.g. Belgium, Denmark, France, Germany, Norway, Sweden, Switzerland, and the United Kingdom) and/or through dedicated subsidy programs (e.g. Denmark, the Netherlands, Norway, and the United Kingdom). Denmark, the Netherlands and Norway are also leading the way in developing and implementing rules for CO<sub>2</sub> storage and transport licenses.



**Figure 5: Map of European countries with a national CCS Strategy/Roadmap** <sup>33</sup>

<sup>27</sup> Danish Energy Agency (2022) Very first tender of CO<sub>2</sub> storage licenses is opening, 12 August 2022. Available at: [https://ens.dk/en/press/very-first-tender-CO<sub>2</sub>-storage-licenses-opening](https://ens.dk/en/press/very-first-tender-CO2-storage-licenses-opening)

<sup>28</sup> North Sea Transition Authority (2022) Bids invited in UK's first-ever carbon storage licensing round. 14 June 2022. Available at: [Bids invited in UK's first-ever carbon storage licensing round](https://www.nstauthority.co.uk/news-publications/carbon-storage-licensing-round-attracts-26-bids/)

<sup>29</sup> North Sea Transition Authority (2022). Carbon storage licensing round attracts 26 bids, 22 September 2022. Available at: <https://www.nstauthority.co.uk/news-publications/carbon-storage-licensing-round-attracts-26-bids/>

<sup>30</sup> Norwegian Petroleum Directorate (2023) Licenses for carbon storage: Announcement 2022, round 1, 15 September 2023. Available at: <https://www.npd.no/en/facts/carbon-storage/licences-for-carbon-storage/2022/>

<sup>31</sup> Northern Lights (2022) Major milestone for decarbonising Europe, 29 August 2022. Available at: <https://norlights.com/news/major-milestone-for-decarbonising-europe/>

<sup>32</sup> Aramis (2021) Netherlands: TotalEnergies, Shell Netherlands, EBN and Gasunie Form Partnership to Develop the Offshore Aramis CO<sub>2</sub> Transport and Sequestration Project, 7 September 2021. Available at: <https://www.aramis-ccs.com/news/eerste-nieuwsitem>

<sup>33</sup> Global CCS Institute based on its own research.

## Austria

In September 2023, Austria's Finance Minister Magnus Brunner initiated a stakeholder dialogue around a future national carbon management strategy. It focused on two policy stages: the establishment of a legal framework for the transport, storage and use of CO<sub>2</sub>, and the repeal of the present law banning the geological storage of CO<sub>2</sub> domestically. On this occasion, the Austrian Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology stressed that the development of a CO<sub>2</sub> value chain was essential to achieve the national 2040 climate neutrality objective, but also to safeguard growth and jobs. To prepare the ground for this future initiative, a feasibility study for potential CO<sub>2</sub> capture and transport infrastructure in Austria is currently in development.

## Belgium

Belgium is emerging as an active player in the CCS market. Most notably, CCS constitutes one of the most promising instruments to reduce emissions in Flanders, according to the long-term strategy of the region. In April 2023 the Flemish government approved the first version of its regulatory framework for CO<sub>2</sub> transport, laying down rules on the management of the future CO<sub>2</sub> networks. At national level, given the lack of available local storage sites, the government has intensified its international cooperation.

Antwerp@C CO<sub>2</sub> Export Hub, a project aimed at developing an open-access modular infrastructure for the capture, transport, liquefaction, and export of CO<sub>2</sub> captured by industries in the Antwerp port area, has secured €145 million in funding from the Connecting Europe Facility for Energy. The hub will have an initial export capacity of 2.5 Mtpa, with the ambition to reach up to 10 Mtpa by 2030. The BASF/Air Liquide plant is the biggest local emitter. Having passed Front End Engineering Design (FEED), it aims to reduce emissions by 1.5 Mtpa from 2025.

ArcelorMittal in Ghent has inaugurated its Steelanol CCU project, which recycles carbon-rich industrial waste gases into advanced bio-ethanol. ArcelorMittal, together with Fluxys Belgium and North Sea Port, have received EU funding for the Ghent Carbon Hub project, an open-access multi modal CO<sub>2</sub> storage and liquefaction terminal in North Sea Port.

In the south of the country, several projects are seeking to connect to Fluxys' announced domestic CO<sub>2</sub> pipeline network, such as Heidelberg Materials' Anthemis and Holcim's Go4Zero project, which aims to put into operation an innovative, pollutant free, carbon negative clinker plant coupled to a CCS solution. Carmeuse has received EU funding for its Columbus CCU project, which targets the avoidance of direct CO<sub>2</sub> emissions from lime production by transforming CO<sub>2</sub> into e-methane. Both projects have been awarded support from the 2023 EU Innovation Fund.

## Denmark

Denmark continues to surprise with the speed with which it is developing CCS rules and regulations and moving towards implementation. Denmark's commitment to becoming a European CCS Hub with a total expected capacity of up to 52 Mtpa in 2030-2032<sup>34</sup> remains strong. The Danish Ministry of Climate, Energy and Utilities has granted the first three exclusive licenses for exploration for full-scale CO<sub>2</sub> storage in the Danish North Sea.

The government is supporting CO<sub>2</sub> storage and capture development through subsidies; €5 billion is expected to be distributed to store an estimated 3.2 million tonnes of CO<sub>2</sub> per year from 2030 through CCS projects in Denmark, with €500 million allocated in 2023. The Danish scheme is expected to drive investments in CCS, reduce costs for its future application and facilitate the development of a commercial CCS market in Denmark. The European Commission has approved €1.1 billion to go towards a Danish scheme that will contribute to the roll-out of carbon capture and storage technologies within the country.

The government awarded three full-scale exploration permits for offshore storage in February 2023. A TotalEnergies consortium (including Noreco, Nordsøfonden, Ørsted and DTU) received two exploration licenses. Expected storage capacity is 2-3 Mtpa in 2029-2030 and 10-15 Mtpa in 2030-2032. An INEOS consortium (including Maersk Drilling, GEUS and Wintershall DEA) received both a pilot storage permit and a full-scale exploration permit. This kickstarted the world's first cross-border offshore CCS initiative. Expected storage capacity is up to 1.5 Mtpa in 2025 and up to 8 Mtpa by 2030.

<sup>34</sup> Danish Energy Agency (2023) Status on CCS in Denmark, presentation of 30 March 2023. Available at: [https://climate.ec.europa.eu/system/files/2023-05/policy\\_ccs\\_implementation\\_presentations\\_20230330\\_en.pdf](https://climate.ec.europa.eu/system/files/2023-05/policy_ccs_implementation_presentations_20230330_en.pdf)



Onshore storage is also being considered, at least as temporary storage before CO<sub>2</sub> is transported for permanent storage in the Danish North Sea. As part of this:

- A Geological Survey of Denmark and Greenland has begun seismic preliminary studies of possible storage structures on land and near the coast and the Danish Energy Authority has started the Environmental Impact Assessment.
- The Stenlille project is only 0.5 Mtpa (by 2025) but is intended as a learning project for bigger projects.
- The Ruby project expects a storage capacity of 1 Mtpa in 2027 and 5-10 Mtpa by 2030.
- Gas Storage Denmark and Fidelis New Energy are collaborating on the development of the Norne Carbon Storage Hub, a large onshore carbon storage system in Denmark. Norne will consist of two CO<sub>2</sub> port reception facility sites in Denmark, pipelines and wells to store CO<sub>2</sub> in existing natural reservoirs, with an expected storage capacity of 2.3 Mtpa in 2026 and 18.7 Mtpa by 2030.

On the capture side, the Danish Energy Agency received final offers in the first round of its CCUS subsidy scheme and awarded approximately half of its DKK 216 billion fund to Ørsted Bioenergy Thermal Power in support of their capture and storage of at least 400,000 tonnes of CO<sub>2</sub> annually starting from 2026 and for 20 years onwards<sup>35</sup>.

## Finland

The Sustainable Growth Programme for Finland allocated €150 million to hydrogen and carbon capture and utilisation projects. The Climate and Energy Strategy, published in 2022, states that the development and use of carbon capture and utilization technologies and solutions will be accelerated in Finland with a view of promoting clean e-fuels and reaching their deployment at 3% of all transport fuels by 2030. The Strategy also prioritizes CCUS for waste incineration as well as carbon removal solutions.

In March 2023 the government published a final report of a strategic research project “Carbon Dioxide Use and

Removal: Prospects and Policies”.<sup>36</sup> Recommendations of this project included the following among others:

- Prepare a strategy on carbon dioxide use and removal.
- Define targets for negative emissions.
- Sign agreements with countries storing carbon dioxide.
- Introduce financial incentives.

Finland has been exploring opportunities for CCU, with a National Research Center VTT piloting a CCU project. Carbonaide, a spin-out company from the VTT Technical Research Centre of Finland that enables the manufacturing of carbon-negative concrete, has raised €1.8 million in seed funding led by Lakan Betoni and Vantaa Energy. The round was completed with public loans and in-kind contributions from Business Finland and other Finnish concrete companies and strategic investors.

The company will use the funding to integrate its CO<sub>2</sub> curing technology into an automated production line of its precast concrete factory in Hollola, Finland. With its factory-sized pilot unit and fully operational value chain, Carbonaide can mineralise up to 5 tonnes of CO<sub>2</sub> per day and increase production by 100-fold of its carbon-negative concrete products. Carbonaide’s vision is to open 10 operational units in the Nordics by 2026 and bind approximately 500 megatons of carbon dioxide annually by 2050 – corresponding to 10–20% of the concrete market.

## France

France released its Carbon Capture, Storage and Utilisation Strategy in summer 2023 as part of the government’s efforts to reach carbon neutrality by 2050. The strategy notes that CCUS has the potential to capture and store between 4 Mtpa and 8.5 Mtpa of CO<sub>2</sub> by 2030. CCUS deployment in the country will be conducted in three stages and focused on industrial zones, such as Dunkerque, Le Havre, Fos-sur-Mer, Lacq/Sud-Ouest, Loire-Estuaire, and Grand Est. To support project developers and scale up CCS deployment, the government will launch a call for tenders through

<sup>35</sup> Danish Energy Agency (2023) The first tender of the CCUS subsidy scheme has been finalized: the Danish Energy Agency awards the contract to Ørsted’s full scale CCS project, 15 May 2023. Available at: <https://ens.dk/en/press/first-tender-ccus-subsidy-scheme-has-been-finalized-danish-energy-agency-awards-contract>

<sup>36</sup> <https://julkaisut.valtioneuvosto.fi/handle/10024/164795>

a Contracts for Difference scheme. Under the aims outlined in the strategy, a regulatory framework for CO<sub>2</sub> transport will be developed, and geological storage sites will undergo pilot testing from 2024-2025 onwards.

The PYCASSO program launched in 2021 is studying how CO<sub>2</sub> storage could be developed in south-west France, where depleted gas fields offer onshore storage capacity of around 500 Mt. The region supplied France with gas for 60 years and possesses an extensive industrial infrastructure that was built around gas facilities. The FID for CO<sub>2</sub> storage is planned for 2026. If the project goes ahead, it would be able to store 15 Mtpa of CO<sub>2</sub> from emitters in France and northern Spain.

Another pilot project is exploring CO<sub>2</sub> capture and reuse solutions. The industrial and port platform of Dunkirk, France's leading CO<sub>2</sub> and H<sub>2</sub> hub, is a home to the 3D pilot project of ArcelorMittal. Launched in 2019, it involves building a DMX™ Demonstration plant at ArcelorMittal Dunkirk. By demonstrating that the DMX™ process can successfully be applied on an industrial scale, the project could significantly cut the cost of carbon capture utilisation and/or storage, making it replicable across heavy industrial sites.

The 3D Project will also play an essential part in the design of the future European Dunkirk-North Sea Cluster, which aims to capture, transport, and store 10 Mtpa of CO<sub>2</sub> and should be operational by 2035. The cluster will be supported by the transport infrastructure developed by Norway's Northern Lights project. The 3D Project is supported by Horizon 2020 and has a €19.3 million budget spread over four years, including €14.8 million in European Union subsidies.

## Germany

The German government is developing a Carbon Management Strategy for CO<sub>2</sub> storage and utilization as part of its aim to achieve carbon neutrality by 2045. The draft report is due for release by the end of 2023. To prepare the ground for the future discussions on this subject, the German Federal Ministry of Economics and Climate Protection released in December 2022 an evaluation report of the Carbon Dioxide Storage Act, 10 years after the law intended to frame the first demonstration CCS projects in Germany came into force.

Germany has also launched a €50 billion programme in a bid to decarbonise its prized heavy industry. Following a preparatory phase that began in early June 2023, the country plans to introduce Carbon Contracts for Difference (CCfDs) that compensate energy-intensive companies for the extra cost of climate-friendly production. In July, Germany updated its national hydrogen strategy, under which it introduced the possibility of supporting applications using blue hydrogen produced from fossil fuels with CCS during the ramp-up phase of the hydrogen market.

The 2023 Innovation Fund has awarded funding to a full-value chain, full-scale carbon project from Heidelberg Materials in Geseke (North Rhine-Westphalia). The CO<sub>2</sub> will be transported by rail to a geological end-storage site under the North Sea. The fund also awarded funding to nearby located lime plant Rheinkalk for a decarbonisation project. German-based Wintershall Dea has also signed an agreement with Norway to develop a full CCS value chain.

## Greece

CCS in Greece is progressing rapidly, with success at the recent EU Innovation Fund's third call for large-scale projects for Titan Cement and Motor Oil Hellas. Energean's storage project Prinos has also applied in the sixth edition of the PCI list. Finally, Greece's regulator Herema is making good progress on the policy, legal, and regulatory front.

## Italy

The first phase of the Eni/Snam Ravenna CCS Hub in northern Italy is taking shape: phase 1 storage license was granted and operations are expected to start in the first quarter of 2024 for injection into a depleted offshore gas field. The project will start with capturing emissions from Eni's local natural gas treatment plant but a letter of intent has been signed with five emitters from nearby hard-to-abate industries.

## The Netherlands

The Dutch government has continued to reward early deployment of CCS in 2023, along with other green technologies, through its SDE++ subsidy. A new round was open in June 2023 with a budget of €8 billion that will allow, if fully allocated, to realise up to 4 Mtpa of CO<sub>2</sub> savings by 2030. The new envelope for this scheme was approved by the European Commission under EU State aid rules in July<sup>37</sup>.

To maintain a pioneering position in the CCS sector internationally, NEN, the Royal Netherlands Standardization Institute, has proposed the creation of a European standards commission for CCS and carbon accounting with a kick-off meeting held in May 2023.

In August 2023, Porthos received final approval from the Council of State after delays related to a lawsuit over nitrogen emissions during construction of the transport and storage infrastructure. In October 2023 the project received its FID. Porthos, which stands for Port of Rotterdam CO<sub>2</sub> Transport Hub and Offshore Storage, will transport CO<sub>2</sub> from industrial facilities and store it in depleted gas fields under the North Sea. Porthos plans to store around 37 Mt of CO<sub>2</sub>, approximately 2.5 Mtpa for 15 years.

Meanwhile, the Aramis project, which is planning CO<sub>2</sub> transport infrastructure from Rotterdam to multiple storage fields in the high North Sea, is fully subscribed by launch customers for the first 5 Mtpa of CO<sub>2</sub> to be transported and stored. Nine Heads of Terms have been signed. While non-binding, they contain an exclusivity clause in return for a provisional capacity reservation. Aramis has also released its specifications for the CO<sub>2</sub> to be fed into the envisaged transport infrastructure. Aramis is expected to decide on the FEED phase start date after the summer, whereafter the FID will be made. The Aramis CCS project, a joint initiative between TotalEnergies, Shell, Energie Beheer Nederland (EBN) and Nederlandse Gasunie, aims to make a significant contribution to the energy transition in Europe by reducing CO<sub>2</sub> emissions from hard-to-abate industries and providing a 22 Mtpa solution for CO<sub>2</sub> transport and offshore storage.

Neptune Energy is pushing ahead with its L10 storage project that is expected to be able to take CO<sub>2</sub> supplied through the Aramis pipeline as well as by ships. L10 has the potential to safely store 120-150 million tonnes<sup>38</sup> of CO<sub>2</sub>. Currently in FEED, FID is expected by the end of 2023 with first CO<sub>2</sub> injection in 2026. Neptune Energy has also teamed up with Norwegian energy infrastructure investor CapeOmega on project Noordkaap, which will offer cross-border CCS solutions along the North Sea coast using vessels suitable for directly injecting the CO<sub>2</sub> at offshore locations.

## Norway

The centre of the country's recent focus is Longship, Norway's full-scale CCS project aimed to support both domestic and cross-border CCS efforts. It has the potential capture and storage capacity of 5 Mtpa of CO<sub>2</sub>, with the government providing a substantial US\$2.3 billion support for the project.

Owned by Equinor, Shell and TotalEnergies, Longship remains the largest integrated CCS project with two capture plants (Hafslund Oslo Celsio waste-to-energy and Brevik Cement) and ship based open-access transport and storage provided by Northern Lights.

Northern Lights has completed well drilling and started production of its ships. The capture facilities of the Longship project expect to launch operations in 2024, at least at the Heidelberg Materials Brevik plant, which reports still being on schedule and on budget. It is thus on track to become the world's first cement factory equipped with a CO<sub>2</sub> capture plant. However, in light of an updated cost estimate revealing larger expenses than originally planned, Celsio Oslo is now looking to pause CCS instalment operations at its waste-to-energy Klemetsrud plant<sup>39</sup>.

Following the world-first commercial cross-border CO<sub>2</sub> T&S agreement with Yara<sup>40</sup> in 2022, Northern Lights has signed another international agreement, with Ørsted<sup>41</sup>, for the commercial transport and storage agreement of 430,000 tonnes of biogenic CO<sub>2</sub> per year for 10 years. According to verbal reports from Equinor and Gassnova, the Northern Lights capacity is fully booked.

<sup>37</sup> European Commission (2023) State aid: Commission approves modification of Dutch scheme to reduce greenhouse gas emissions, 10 July 2023. Available at: [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_23\\_3743](https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3743)

<sup>38</sup> Neptune Energy (2022) L10 Area CCS development, Dutch North Sea. Available at: <https://www.neptuneenergy.com/esg/l10-area-ccs-development>

<sup>39</sup> NTB (2023) Hafslund Oslo Celsio: The carbon capture project at Klemetsrud is carrying out a cost-reducing phase, 26 April 2023. Available at: <https://kommunikasjon.ntb.no/pressemedling/karbonfangstprosjektet-pa-klemetsrud-gjennomforer-en-kostnadsreducerende-fase?publisherId=17848166&releaseId=17964354&lang=no>

<sup>40</sup> Yara (2022) Major milestone for decarbonising Europe, 29 August 2022. Available at: <https://www.yara.com/news-and-media/news/archive/news-2022/major-milestone-for-decarbonising-europe/>

<sup>41</sup> Northern Lights (2023) Northern Lights enters into cross-border transport and storage agreement with Ørsted, 15 May 2023. Available at: <https://norlights.com/news/northern-lights-enters-into-cross-border-transport-and-storage-agreement-with-orsted/>

Norway has also started awarding other exploration and storage licenses to expand its CO<sub>2</sub> storage capacity to meet growing demand for storage capacity in Europe. Other storage projects underway are Poseidon (exploration license), Luna, Smeaheia and Havstjerne (storage licenses). An exciting development is the floating injection unit being proposed by Altera Infrastructure and Wintershall DEA for the Havstjerne license. Equinor is leading the planning behind a larger project covering the whole CCS value chain known as the EU2NSEA project, which is an applicant of the European Commission's PCI. The aim of the project is to connect CO<sub>2</sub> emitters in Europe with storage sites in the North Sea by pipeline, with an expected capacity to transport and store 30-40 Mtpa of CO<sub>2</sub>.

Helpful to CCS is placing a price on carbon as part of a polluter-pays principle, as seen in Norway's carbon tax, along with the EU's ETS. The Norwegian government maintains it will continue to utilise financial measures to support and encourage CCS through a combination of state aid and a national carbon tax, which is expected to increase to NOK 2,000 per tonne of CO<sub>2</sub> in 2030, from its current rate of NOK 952 per tonne.

Removr, a Norwegian company that removes CO<sub>2</sub> directly from the atmosphere, has received NOK 36.3 million in governmental backing for an industrial-scale pilot. This will be the first-ever Direct Air Capture (DAC) pilot at Technology Centre Mongstad (TCM) in Norway, the world's leading carbon capture technology test center. The backing was provided in the form of an innovation grant from Norwegian governmental body Enova and is Norway's first grant for DAC. Enova is owned by the Norwegian Ministry of Climate and Environment and supports the development of energy and climate technology.

Removr and its technology partner GreenCap Solutions have demonstrated proof of concept through four successful pilots to date. Removr's first industrial pilot at TCM will capture 300 tonnes of CO<sub>2</sub> per year from 2024, its first commercial pilot 2,000 tonnes per year in 2025 and first large-scale facility 30,000 tonnes per year in 2027. The company is working with a number of partners, including SINTEF, Metier, DNV, Citec and Carbfix, on its next facilities while developing a concept for what will be the world's first million-tonne DAC facility based on solid sorbent in 2029.

## Poland

In August 2021, the Polish Minister of Climate and Environment established a CCUS Working Group to facilitate the development of CCUS technologies. This advisory body, composed of representatives from public organisations, the energy and industrial sectors, academia and research institutes, discusses the potential of domestic CO<sub>2</sub> storages, the different options for CO<sub>2</sub> transport, and questions around public acceptance for which a separate workstream was created in 2023. The Ministry issued several recommendation letters to support CCS initiatives and is now considering changing the legal framework to allow CO<sub>2</sub> storage off- and onshore, as well as in hydrocarbon deposits.

In the Gdansk region, the Poland-EU CCS Interconnector intends to offer an open access multi-modal liquid CO<sub>2</sub> network in the Port of Gdansk with related CO<sub>2</sub> transport infrastructure from emitter facilities to the North Sea. In Katowice, a new cluster is emerging around local emitters in the cement, lime, fertilizer, zinc and power sectors, where there is the geologic possibility to sequester the carbon locally onshore.

## Slovenia

Slovenia prohibited the injection and storage of CO<sub>2</sub> when transposing the EU CCS Directive at the national level. Notwithstanding, in its draft updated NECP<sup>42</sup>, Slovenia has announced that it is considering CCS for existing energy sites and energy intensive industry, in particular for sectors with process emissions, showing growing support for this technology from this initially rather reluctant country. To facilitate deployment, support mechanisms such as a CCfD scheme and subsidies to apply to domestic and EU project funding tenders are being investigated.

<sup>42</sup> Republika Slovenija (2023) Draft update proposal: Integrated National Energy and Climate Plan of the Republic of Slovenia, 22 June 2023. Available at: [https://commission.europa.eu/system/files/2023-07/EN\\_SLOVENIA%20DRAFT%20UPDATED%20NECP.pdf](https://commission.europa.eu/system/files/2023-07/EN_SLOVENIA%20DRAFT%20UPDATED%20NECP.pdf)

## Sweden

Sweden promotes negative CO<sub>2</sub> emissions/BECCS through its Industrial Leap program<sup>43</sup> that supports the transition to net zero emissions of greenhouse gases by 2045 and negative emissions thereafter. Under this program, the government is partnering with industry in sharing risks of investments in new clean technologies, which comprises a total SEK 1,354 million in 2023. The Swedish Energy Agency has invested €10 million between 2019 and 2022 and will invest €5 million over 2023-2027. A new national centre for CCS has also been created. In 2023, a first reverse auction was launched to stimulate 2 million tonnes of negative emissions by 2030. First storage is expected in 2026, but will have to be in another country, potentially Norway.

Sweden is also home to the Cementa plant from HeidelbergMaterials in Slite, Gotland. Cementa's intention is to develop the world's first carbon-neutral cement plant by capturing and storing the Slite plant's total emissions of 1.8 Mt of CO<sub>2</sub>. This corresponds to approximately 3% of Sweden's total emissions.

## Switzerland

Developing solutions for CCS and CDR are part of Switzerland's climate and energy strategy as an EU ETS participant. In May 2022, the Federal Offices for the Environment and Energy jointly established a roadmap dedicated to these technologies as part of the country's carbon neutral objective. To make it happen, Switzerland and Norway have been discussing a bilateral agreement to cooperate on CCS and CDR since November 2022.

## The United Kingdom (UK)

In March 2023 the UK government made a new CCS funding commitment during the release of the Spring Budget, committing to investing £20 billion to scale up CCS projects across the United Kingdom. The UK government's CCS efforts are part of its broader climate target to reach net-zero by 2050 that was signed into law in 2019. The government aims to capture 20-30 Mtpa of CO<sub>2</sub> through CCS by 2030 and anticipates

50,000 jobs will be supported through CCS investment. The new funding will be rolled out 20 years and support the development of CCS initiatives, particularly in North Wales, north-west England and the east coast. This builds on the governments cluster sequencing process, where £1 billion was previously announced to scale up CCS efforts, selecting the HyNet Cluster and the East Coast Cluster as initial beneficiaries.

A 'treasure map' of what lies beneath the North Sea will be created to help the United Kingdom become a world leader in CCS. Estimates suggest that there may be enough space underneath the UK's oceans – including its old oil and gas fields – to store up to 78 billion tonnes of CO<sub>2</sub>. Companies licensed to drill in the North Sea will have to report what they find to the regulator, which will develop the most comprehensive picture yet of the geological area's make-up. The government intends to bring forward these new powers for the North Sea Transition Authority (NSTA) in an amendment to the Energy Bill.

In November 2022, the government set out a Dispatchable Power Agreement (DPA) to support power generation with CCS. The objectives are to:

- Incentivise power CCUS to operate flexibly, dispatching after renewables and nuclear but ahead of other unabated power plants as part of a flexible electricity system.
- Have the capacity to be competitively allocated.
- Provide fair return on investment with appropriate risk allocation and without overcompensation.
- Ensure costs are affordable for electricity consumers.

The DPA has been developed as part of the wider CCUS Cluster Sequencing Process, and projects were able to make submissions for a DPA in Phase 2 of this process. Any power CCUS business model would be subject to value for money and affordability assessments. The government has expressed the intention to develop a business model with a revenue mechanism consisting of a payment for availability of low carbon generating capacity and a variable payment, the combination of which should enable a plant to operate flexibly, providing value to a low carbon electricity system whilst providing sufficient certainty to investors. In April 2023, the UK government published a new edition of its investor roadmap.

<sup>43</sup> Swedish Energy Agency (2023) The Industrial Leap. Available at: <https://www.energimyndigheten.se/en/innovations-r-d/energyintensive-industry/the-industrial-leap/>

The United Kingdom is steadily progressing with project development. Following the selection of HyNet and East Coast as Track-1 CCUS clusters in November 2021 and the publication of the shortlist of power CCUS, industrial carbon capture (ICC), waste and CCUS-enabled hydrogen projects in August 2022, the Department for Energy Security and Net Zero has selected the final eight projects to proceed to negotiations for support through the relevant Business Models.

- The East Coast cluster projects are Net Zero Teesside (gas-fired power), bpH2Teesside (low carbon hydrogen) and Teesside Hydrogen CO<sub>2</sub> Capture.
- The HyNet Cluster projects are Hanson Padeswood (cement), Viridor Runcorn (waste-to-energy), Protos Energy (waste-to-energy), Buxton Net Zero (lime) and HPP1 HyNet (hydrogen).

On the storage side, the NSTA has issued carbon storage licenses in the North Sea for the first time, awarding 12 companies with 21 licenses. Issued licenses include offshore sites by Aberdeen, Teesside, Liverpool and Lincolnshire, with the first injection of CO<sub>2</sub> expected to occur within the decade. In addition, the North Sea Transition Authority (NSTA) announced the list of companies that have accepted the 21 carbon storage licenses awarded under the first-ever carbon storage licensing round.

## Other Developments

CCS is no longer purely a North Sea affair in Europe. Heidelberg Materials has secured €190 million from the EU Innovation Fund for its ANRAV project in Varna, Bulgaria, which intends to store CO<sub>2</sub> under the bed of the Black Sea. In Croatia, Holcim's KODECO project has secured funding from the 2023 Innovation Fund call.





## WASTE TO ENERGY AND CCS

The waste incineration industry continues its advances into CCUS. With the fossil emissions from 500 such plants in Europe accounting for approximately 1% of the continent's overall GHG balance according to the European Environmental Agency, this is possibly where the next wave of projects will arise. The Confederation of European Waste-to-Energy Plants has included CCUS as one of the key mitigation options in its Waste to Energy Climate Roadmap.

The fossil and the biogenic carbon held within residual waste can be captured and permanently injected into deep geological storage (CCS). Alternatively, the captured CO<sub>2</sub> can be utilised (CCU) as a valuable resource in other industries or as a feedstock for new products like synthetic fuels, which are currently based on fossil imports such as oil and gas.

“The integration of WtE and carbon capture and storage (CCS) could enable waste to be a net zero or even net negative emissions energy source. For example, in Europe only, the integration of CCS with WtE facilities has the potential to capture about 60 to 70 million tons of carbon dioxide annually.” UN IPCC Report, AR6 WGIII, Mitigation of Climate Change, April 2022.

Companies are trying to make the business case through carbon pricing, government funding and/or the conversion of CO<sub>2</sub> into useful products. One example is a CCS project on a waste to energy plant near Oslo. Starting in 2026, the full-scale plant will capture 400,000 tonnes of CO<sub>2</sub> per year (90% of its total CO<sub>2</sub> emissions). The fossil and the biogenic carbon held within residual waste can be captured and permanently injected into deep geological storage. Alternatively, the captured CO<sub>2</sub> can be utilised as a valuable resource in other industries or as a feedstock for new products like synthetic fuels, which are currently based on fossil imports such as oil and gas. The negative emissions by a waste to energy plant will help the city of Oslo achieve its decarbonisation objectives.

Wastewater treatment plants may present another opportunity for generating negative emissions when combined with CCS. For example, ARA Bern, a wastewater treatment plant, and Carbfix demonstrated Europe's first cross-border biogenic CO<sub>2</sub> capture, transport and storage value chain by sending CO<sub>2</sub> by rail and ship from Switzerland to Iceland for storage with seawater into basaltic rocks.

# 7.0 CO<sub>2</sub> INFRASTRUCTURE

## Pipelines

Pipelines continue to dominate as a preferred way to transport CO<sub>2</sub> from capture facilities to temporary and then permanent storage. Most pipelines for CO<sub>2</sub> transportation in Europe have been specifically constructed for this purpose. However, the repurposing of existing natural gas pipelines has also been considered. Some estimates suggest that the cost of repurposing could be much lower than the cost of construction of a new pipeline. A detailed assessment of design and construction requirements is needed to assure safe transport of CO<sub>2</sub> by gas pipelines. In addition, dialogues and strategic decisions are needed as existing gas pipelines are still needed to transport gas

and the timing of their decommissioning needs to be agreed on. In addition, the same network is considered for transportation of hydrogen and bio-methane, so there are competing interests for repurposing.

The following pipeline infrastructure projects are currently in development:

- The preparation phase for Aramis (Netherlands) is almost complete. Once the preferred options for the pipeline route and landing location have been determined, the project can enter the FEED phase, after which the FID will be made.
- Belgian gas operator Fluxys is planning a CO<sub>2</sub> network to transport CO<sub>2</sub> inside and out of Belgium to international storage locations [Figure 6].

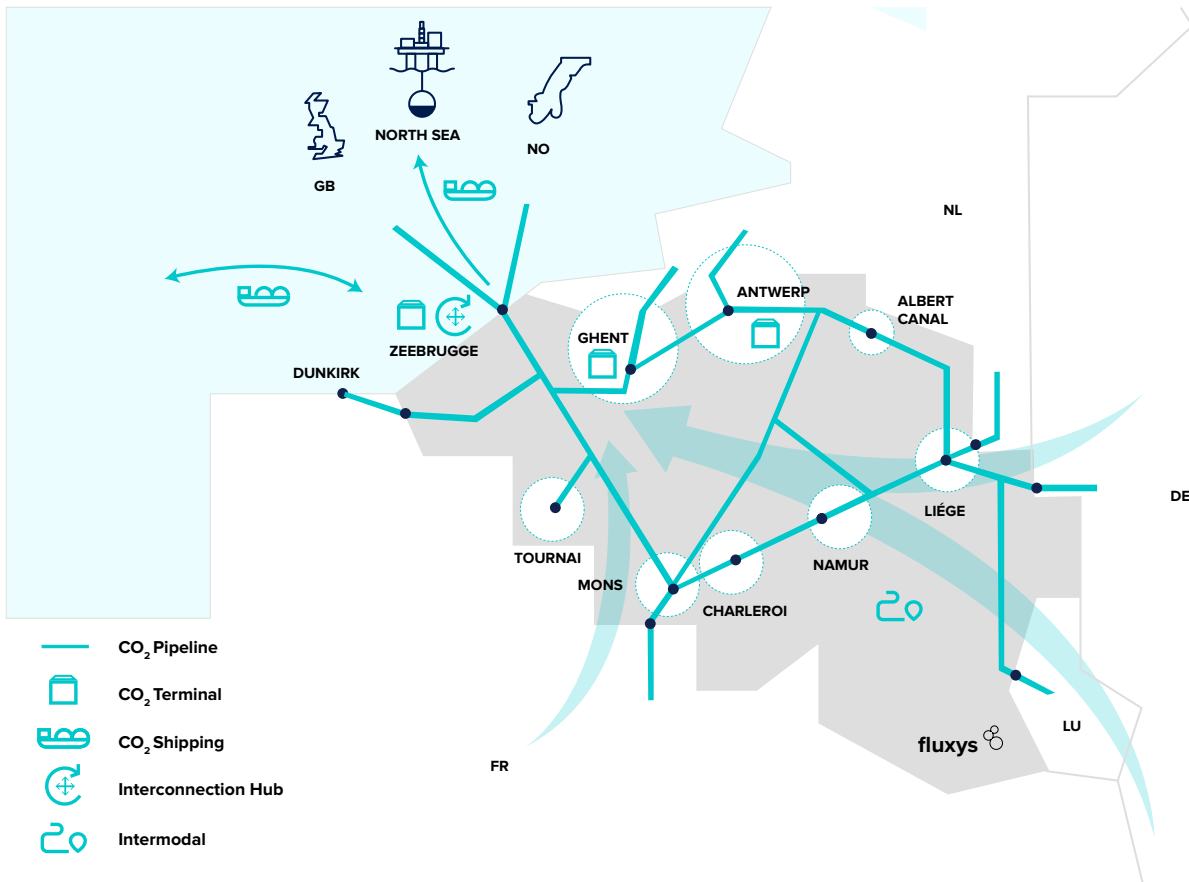


Figure 6: Future CO<sub>2</sub> routes in Belgium based on 5 pillars<sup>44</sup>

<sup>44</sup> Adapted from Fluxys (2022) CO<sub>2</sub>: Preparing to build the network. Available at: <https://www.fluxys.com/en/projects/carbon-preparing-to-build-the-network>



- The Netherlands' Gasunie, Shell, BASF and OGE are in the feasibility stage of a similar network between Rotterdam and the Ruhr area in Germany [Figure 7].
- Equinor and Fluxys have unveiled plans for a CO<sub>2</sub> pipeline from Belgium to Norwegian offshore storage sites.<sup>46</sup>
- Equinor and Wintershall Dea are collaborating on infrastructure for the transportation, injection and storage of CO<sub>2</sub> from Germany to Norway.<sup>47</sup>
- A new 1,000 km onshore pipeline project by OGE in Germany<sup>48</sup> aims to connect industries to the port of Wilhelmshaven.
- The Poland EU CCS Interconnector aims to establish an open access multi-modal CO<sub>2</sub> Export Hub between the port of Gdansk and its hinterland.
- Air Liquide France Industrie and Dunkerque LNG are leading the D'Artagnan project, which aims to transport CO<sub>2</sub> from emitters in an industrial cluster in Dunkirk, France, via an 80-km pipeline to an export terminal for storage in the North Sea [Figure 8].
- Elengy, GRTgaz, Heidelberg Materials, Lafarge, Lhoist and TotalEnergies have announced the launch of the Grand Ouest CO<sub>2</sub> project, in line with France's recently published 2030 CCUS Strategy [Figure 9].

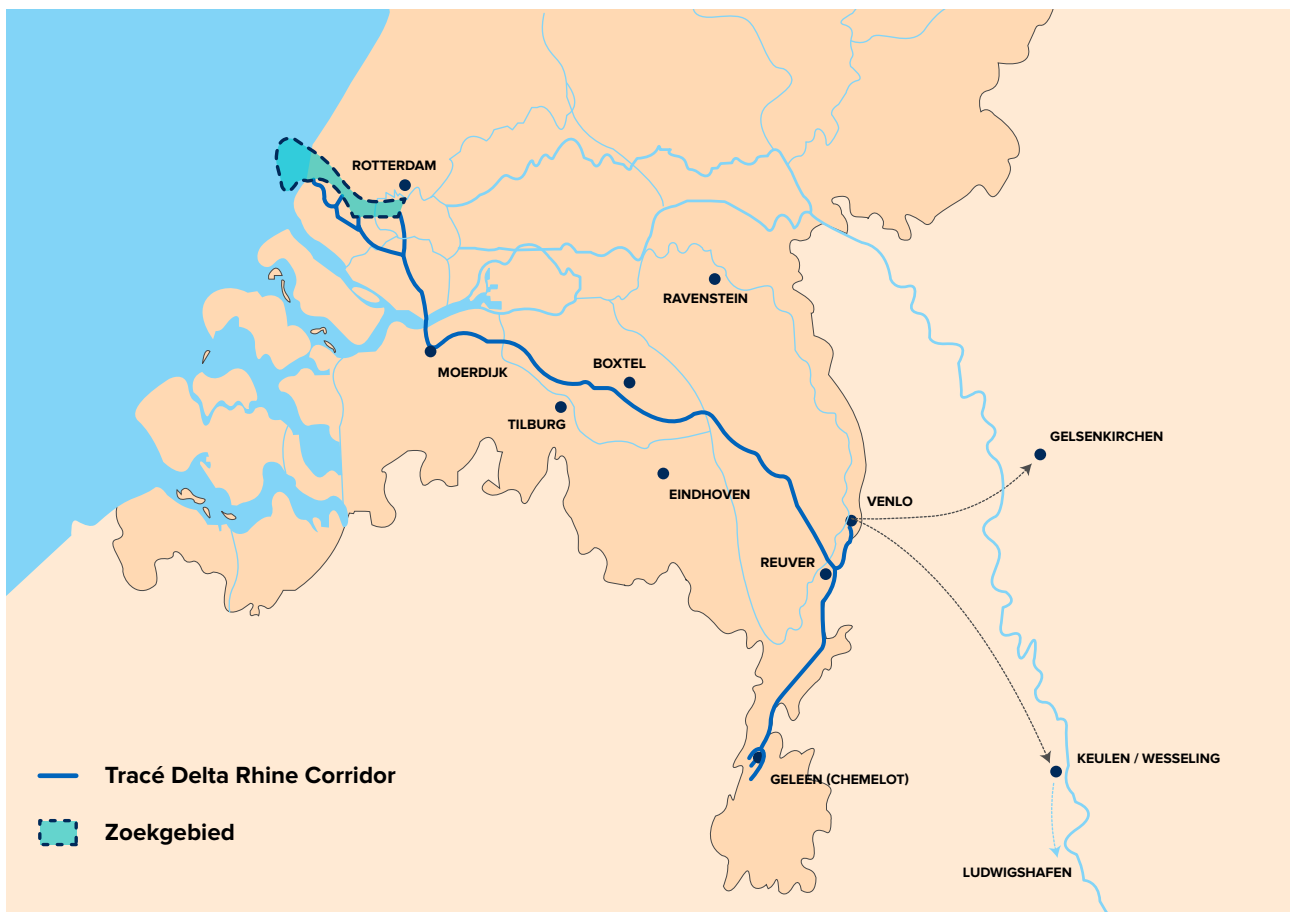


Figure 7: Map of the future Delta Rhine Corridor route <sup>45</sup>

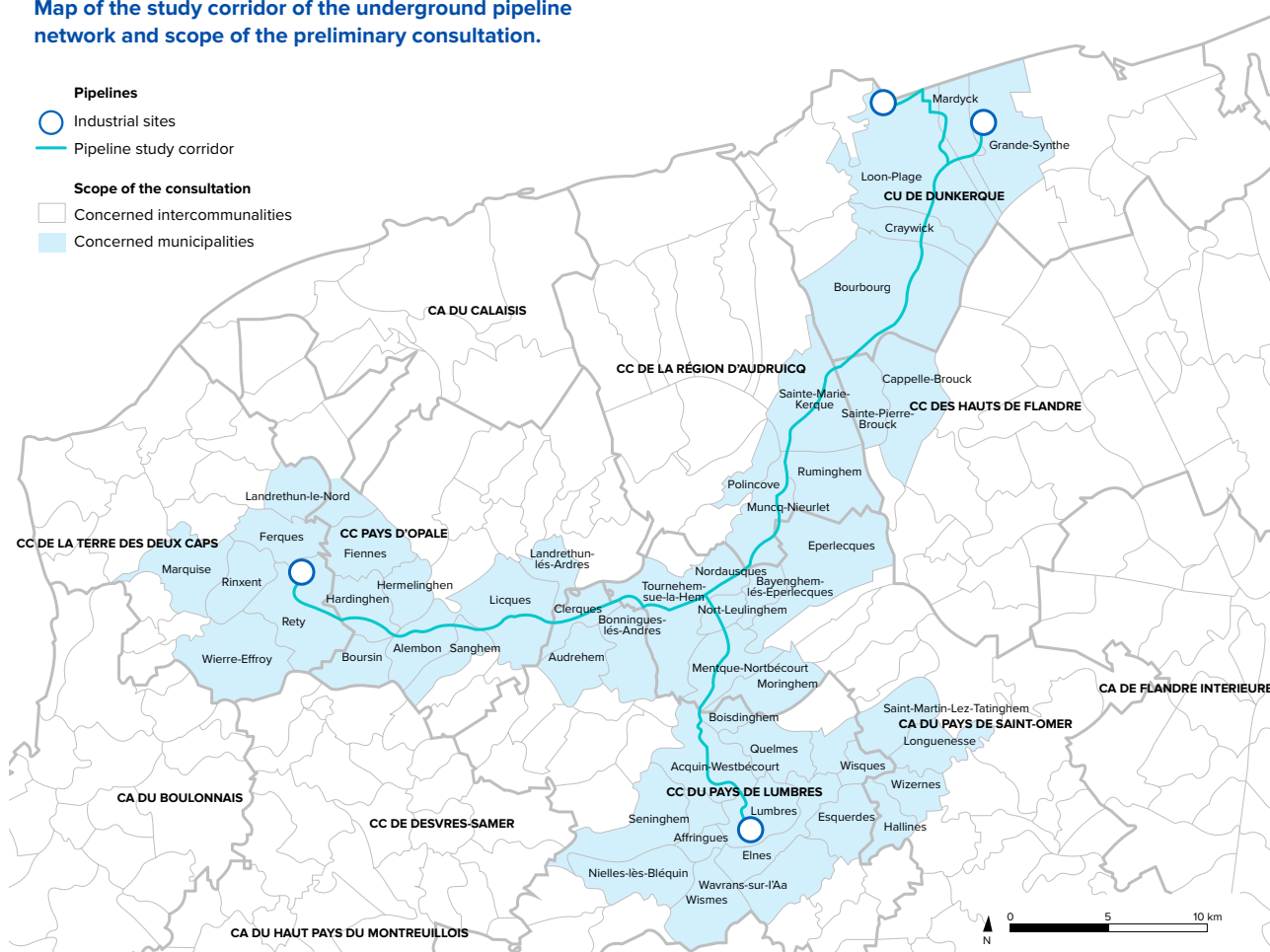
<sup>45</sup> Adapted from Rijksdienst voor Ondernemend Nederland (2023) Delta Rhine Corridor. Available at: <https://www.rvo.nl/onderwerpen/bureau-energieprojecten/lopende-projecten/drc>

<sup>46</sup> Fluxys (2022). Fluxys and Equinor launch solution for large-scale decarbonisation in North-Western Europe. Available at: [https://www.fluxys.com/de/press-releases/fluxys-group/2022/220629\\_press\\_equinor\\_industry\\_decarbonisation](https://www.fluxys.com/de/press-releases/fluxys-group/2022/220629_press_equinor_industry_decarbonisation)

<sup>47</sup> Wintershall Dea (2022). Wintershall Dea and Equinor partner up for large-scale CCS value chain in the North Sea. Available at: [https://wintershalldea.com/sites/default/files/media/files/220830\\_PI-22-19\\_WINTERSHALL%20DEA%20AND%20EQUINOR%20PARTNER%20UP%20FOR%20LARGE-SCALE%20CCS%20VALUE%20CHAIN%20IN%20THE%20NORTH%20SEA.pdf](https://wintershalldea.com/sites/default/files/media/files/220830_PI-22-19_WINTERSHALL%20DEA%20AND%20EQUINOR%20PARTNER%20UP%20FOR%20LARGE-SCALE%20CCS%20VALUE%20CHAIN%20IN%20THE%20NORTH%20SEA.pdf)

<sup>48</sup> OGE (2022) OGE and TES join forces to develop a 1,000 km CO<sub>2</sub> transmission system. Available at: <https://oge.net/en/press-releases/2022/oge-and-tes-join-forces-to-develop-a-1-000-km-co-2-transmission-system>

**Map of the study corridor of the underground pipeline network and scope of the preliminary consultation.**



**Figure 8: Map of the CO<sub>2</sub> network of the D'Artagnan project in France** <sup>49</sup>



<sup>49</sup> Adapted from Cap décarbonation (2022) D'Artagnan : un projet d'infrastructures CO<sub>2</sub> au service des industriels locaux. Available here: <https://cap-decarbonation.fr/fr/le-projet-d-artagnan-dunkerque>

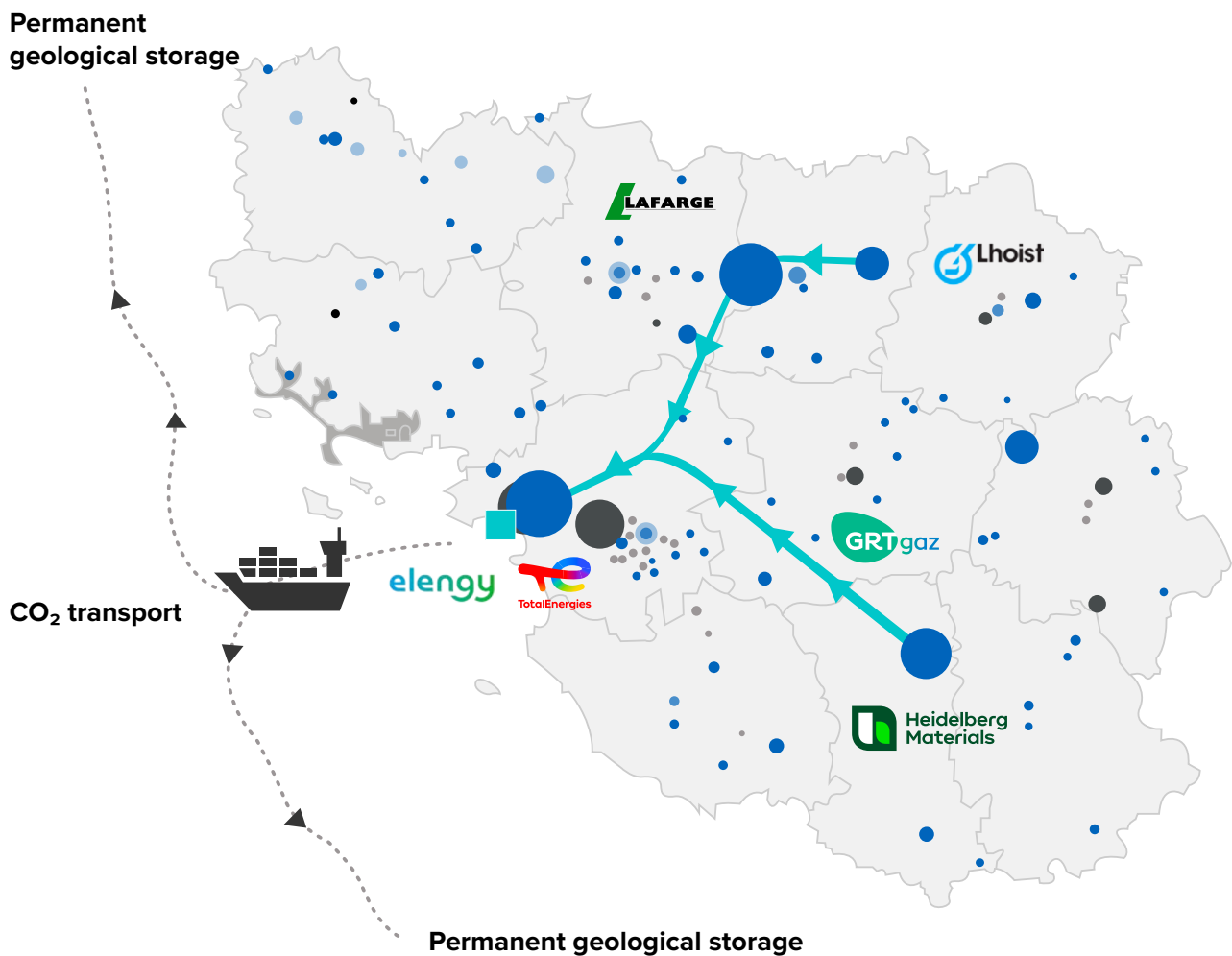


Figure 9: Map of the Grand Ouest CO<sub>2</sub> project in France <sup>50</sup>

## Shipping

Transporting CO<sub>2</sub> by ship is crucial for CCS deployment in Europe. Shipping is emerging as a viable CO<sub>2</sub> transport option both for domestic and cross-border movement of CO<sub>2</sub> for storage. Shipping allows for flexibility in transporting CO<sub>2</sub> from hubs or specific emitters to permanent storage offshore. CO<sub>2</sub> transportation by ship includes both domestic and cross-border CO<sub>2</sub> shipment. Transport of CO<sub>2</sub> by ship has been recognised as essential both at an EU level in the European Taxonomy for Sustainable Activities as well as within the EU ETS Directive and several national programmes<sup>51</sup>.

The Northern Lights CO<sub>2</sub> storage project in Norway, the Aramis CO<sub>2</sub> infrastructure project in the Netherlands and the D'Artagnan and Grand Ouest CO<sub>2</sub> projects in France include ships for CO<sub>2</sub> transportation. Shipping CO<sub>2</sub> has also emerged as a popular project proposal under the last list of PCI and PMI candidates for the CO<sub>2</sub> networks category, with about 15 import or export terminals referenced in proposals.

The Clean Air Task Force reports several emerging projects where CO<sub>2</sub> is planned to be transported by ship, including Total's Bifrost in Denmark.<sup>52</sup> Project Callisto revolves around Italy's long-stalled Ravenna Hub, which seeks to link the hub by ship to the large

<sup>50</sup> Adapted from GRTgaz (2023) The launch of GOCO<sub>2</sub>. Available at: <https://www.grtgaz.com/en/medias/press-releases/launch-goCO2>

<sup>51</sup> Zero Emission Platform (2022) Network Technology Guidance for CO<sub>2</sub> transport by ship, Guidance Note. Available at: <https://zeroemissionsplatform.eu/wp-content/uploads/ZEP-CCSA-Guidance-Note-for-CO2-transport-by-ship-March-2022.pdf>

<sup>52</sup> Clean Air Task Force, February 2023

industrial cluster near Marseille. In Greece, Energean's Prinos storage site based on a depleted gas field (similar to Ravenna in Italy) also sets out its case as a permanent sink for CO<sub>2</sub> in the eastern Mediterranean. With its relatively easy access by ship to the North Sea, the Baltic coast is another emerging area for CO<sub>2</sub> export. Plans for a Gdansk terminal already featured in the 5th PCI list.

CCS project developments in Europe have predominantly occurred through the hub and cluster model. This has been enabled by various government and pan-government policies to support shared transport and storage infrastructure, whether through the TRI model in the United Kingdom or initiatives like the Northern Lights, Porthos, Aramis, Antwerp@C<sup>53</sup> and C4<sup>54</sup> in the EU. Still subject to regulatory alignment for CO<sub>2</sub> quality standards, transport and storage of CO<sub>2</sub> in Europe has been evolving as a service.

### TRANSPORT AND STORAGE-AS-A-SERVICE

Under this model, emitters do not need to take on the responsibility and associated risks of developing T&S operations. Instead, they are contracted to T&S providers for whom the construction and operation of pipelines (ships, trains, etc) and storage assets fall within their core capabilities.

Such a scheme also enables CCS for European countries that do not allow CO<sub>2</sub> storage. Industrial players in these countries are encouraged to develop capture projects while governments sign bilateral agreements or memoranda of understanding (MoUs) with neighbouring countries where CO<sub>2</sub> storage projects are being developed.

Further, this approach also enables smaller emitters with limited financial resources to invest in CCS. In such instances, it may be possible for the entire value chain – carbon capture, transportation and storage – to be offered to them as a service.

There are around 35 CO<sub>2</sub> transport and storage projects in various stages of development in Europe. Several oil and gas companies are also becoming CO<sub>2</sub> transport providers. A few companies in the North Sea and in the Mediterranean are building ships to provide CO<sub>2</sub> shipping services.



<sup>53</sup> Port of Antwerp Bruges (2023) Antwerp@C. Available at: <https://www.portofantwerpbruges.com/en/our-port/climate-and-energy-transition/antwerp>

<sup>54</sup>Carbon Capture Cluster Copenhagen (2023) C4 – Carbon Capture Cluster Copenhagen. Available at: <https://www.c4cph.dk/>

# 8.0 BILATERAL AGREEMENTS

A list of agreements, declarations and memoranda are being developed across the continent. Denmark and Norway are positioning themselves as CO<sub>2</sub> storage hubs for Europe and neighbouring countries are turning to them for CO<sub>2</sub> storage opportunities. Bilateral agreements and MOUs are being signed with the intention to store CO<sub>2</sub> from exporting countries in the North Sea.

Belgium, Germany, the Netherlands and Norway. An agreement between Belgium and Denmark will allow cross-border transport of CO<sub>2</sub> that has been captured at various industrial sites in Belgium for storage in offshore Denmark. Recently, Denmark signed a memorandum of understanding with the United Kingdom on cooperation in the energy transition, including CCUS<sup>55</sup>.

The government of Denmark has signed MoUs with

As part of a bilateral agreement with Germany, Norway will

	BELGIUM	DENMARK	FRANCE	GERMANY	ICELAND	NETHERLANDS	NORWAY	SWEDEN	SWITZERLAND	UK
Belgium		MoU		Agreement		MoU	Negotiations for bilateral agreement			
Denmark	MoU			Declaration of Intent		MoU	MoU			MoU
France						Pact	Letter of Intent			
Germany	Agreement	Declaration of Intent					Declaration to cooperate			
Iceland									Declaration of Intent	
Netherlands	MoU	MoU	Pact				Mou		MoU	
Norway	Negotiations for bilateral agreement	MoU	Letter of Intent	Declaration to cooperate		Mou		MoU	Exploring collaboration	MoU
Sweden							MoU			
Switzerland					Declaration of Intent	MoU	Exploring collaboration			
UK		MoU					MoU			

**Table 2: Current list of bilateral governmental initiatives on CCS in Europe**

<sup>55</sup> Department for Energy Security and Net Zero (2023). MoU between Denmark and the UK on cooperation in the energy transition. Available at: <https://www.gov.uk/government/publications/cooperation-in-the-energy-transition-uk-denmark-memorandum-of-understanding>

## BELGIUM AND THE NETHERLANDS HAVE ALSO OUTLINED PLANS IN THE FORM OF AN MOU FOR THE CROSS-NATIONAL TRANSPORT AND STORAGE OF CO<sub>2</sub>.



inform about the possibilities for capture, transport and long-term storage of CO<sub>2</sub> at the Norwegian continental shelf. The two parties will expand cooperation in the North Sea Basin Task Force and discuss various options for CO<sub>2</sub> infrastructure and value chains, including a CO<sub>2</sub> pipeline from Germany to Norway. In September 2023, the two countries agreed to establish a joint Task Force to follow up the results of an ongoing feasibility study assessing the possibilities to transport hydrogen and CO<sub>2</sub> across borders.

The governments of France and Norway have signed a letter of intent (LoI) to cooperate on the development and deployment of CCS, with the aim of creating a framework for the sharing of technical knowledge, advice, skills and expertise. As part of the cooperation, the two governments will consider and prepare a bilateral agreement to enable cross-border transportation and storage of CO<sub>2</sub>.

Norway and Switzerland will strengthen cooperation on CCS and CDR<sup>56</sup>, including discussing how to enable cross-border market development for CCS and CDR.

The federal government of Belgium, the Walloon region and the Flemish region have now started formal negotiations with Norway for a bilateral agreement on the cross-border transport and storage of CO<sub>2</sub> on the Norwegian Continental Shelf, under the London Protocol.

Belgium and the Netherlands have also outlined plans in the form of an MoU for the cross-national transport and storage of CO<sub>2</sub>.

Belgium and Germany have signed an agreement to work together on hydrogen, carbon capture, electrification and LNG projects as part of efforts to increase energy independence and decarbonise. The Port of Antwerp-Bruges is a focal point for the strategy, where multiple projects centered on building capacity for hydrogen and carbon capture aimed at Belgium and Germany have already been developing. Germany's Wintershall Dea and Belgium's Fluxys have signed an agreement to jointly cooperate on a cross-border CO<sub>2</sub> pipeline network connecting the two countries. Norway signed an agreement with Belgium to drive CO<sub>2</sub> transport efforts with Fluxys.

<sup>56</sup> Norwegian Ministry of Petroleum and Energy (2022) Closer cooperation between Norway and Switzerland on CCS. Available at: <https://www.regjeringen.no/en/aktuelt/closer-cooperation-between-norway-and-switzerland-on-ccs/id2948504/>

# GET IN TOUCH

To find out more about the Global CCS Institute including Membership and our Consultancy services, visit [globalccsinstitute.com](https://globalccsinstitute.com) or contact us.

---

## AMERICAS

Washington DC, United States  
[americasoffice@globalccsinstitute.com](mailto:americasoffice@globalccsinstitute.com)

## AUSTRALIA

Melbourne, Australia  
[info@globalccsinstitute.com](mailto:info@globalccsinstitute.com)

## CHINA

Beijing, China  
[chinaoffice@globalccsinstitute.com](mailto:chinaoffice@globalccsinstitute.com)

## EUROPE

Brussels, Belgium  
[europeoffice@globalccsinstitute.com](mailto:europeoffice@globalccsinstitute.com)

## MIDDLE EAST AND NORTH AFRICA

Abu Dhabi, United Arab Emirates  
[menaregion@globalccsinstitute.com](mailto:menaregion@globalccsinstitute.com)

## UNITED KINGDOM

London, United Kingdom  
[ukoffice@globalccsinstitute.com](mailto:ukoffice@globalccsinstitute.com)

## JAPAN

Tokyo, Japan  
[japanoffice@globalccsinstitute.com](mailto:japanoffice@globalccsinstitute.com)

Copyright © 2023 Global CCS Institute

The Global CCS Institute and the author believe that this document represents a fair representation of the current state of law in the key areas and jurisdictions considered, however its content should not be construed as, or substituted for, professional legal advice. The Global CCS Institute has tried to make information in this publication as accurate as possible. However, it does not guarantee that the information in this publication is totally reliable, accurate or complete. Therefore, the information in this publication should not be relied upon when making investment or commercial decisions or provided to any third party without the written permission of the Global CCS Institute. The Global CCS Institute has no responsibility for the persistence or accuracy of URLs to any external or third-party internet websites referred to in this publication and does not guarantee that any content on such websites is, or will remain, accurate or appropriate. To the maximum extent permitted, the Global CCS Institute, its employees and advisers accept no liability (including for negligence) for any use or reliance on the information in this publication, including any commercial or investment decisions made on the basis of information provided in this publication.