

CCUS projects in Europe

Overview of existing and planned CCUS facilities

BELGIUM

1. Leilac (pilot capture only)
2. Antwerp@C (Port of Antwerp)*
3. Carbon Connect Delta (Port of Ghent)

CROATIA

1. iCORD*
2. **CO₂ EOR Project Croatia***
3. Bio-Refinery Project*

DENMARK

1. Greensand*

FRANCE

1. Lacq*
2. DMX Demonstration in Dunkirk*

GERMANY

1. H2morrow*

ICELAND

1. Orca
2. **Hellisheidi**

ITALY

1. CCS Ravenna Hub*

THE NETHERLANDS

1. Porthos (Port of Rotterdam)*
2. Athos (Ijmond)
3. Aramis (Den Helder)
4. Magnum (Eemshaven)*
5. Carbon Connect Delta (ports of Terneuzen and Vlissingen)

NORWAY

1. **Sleipner CO₂ Storage***
2. **Snøhvit CO₂ Storage***
3. Longship (including Northern Lights)*

REPUBLIC OF IRELAND

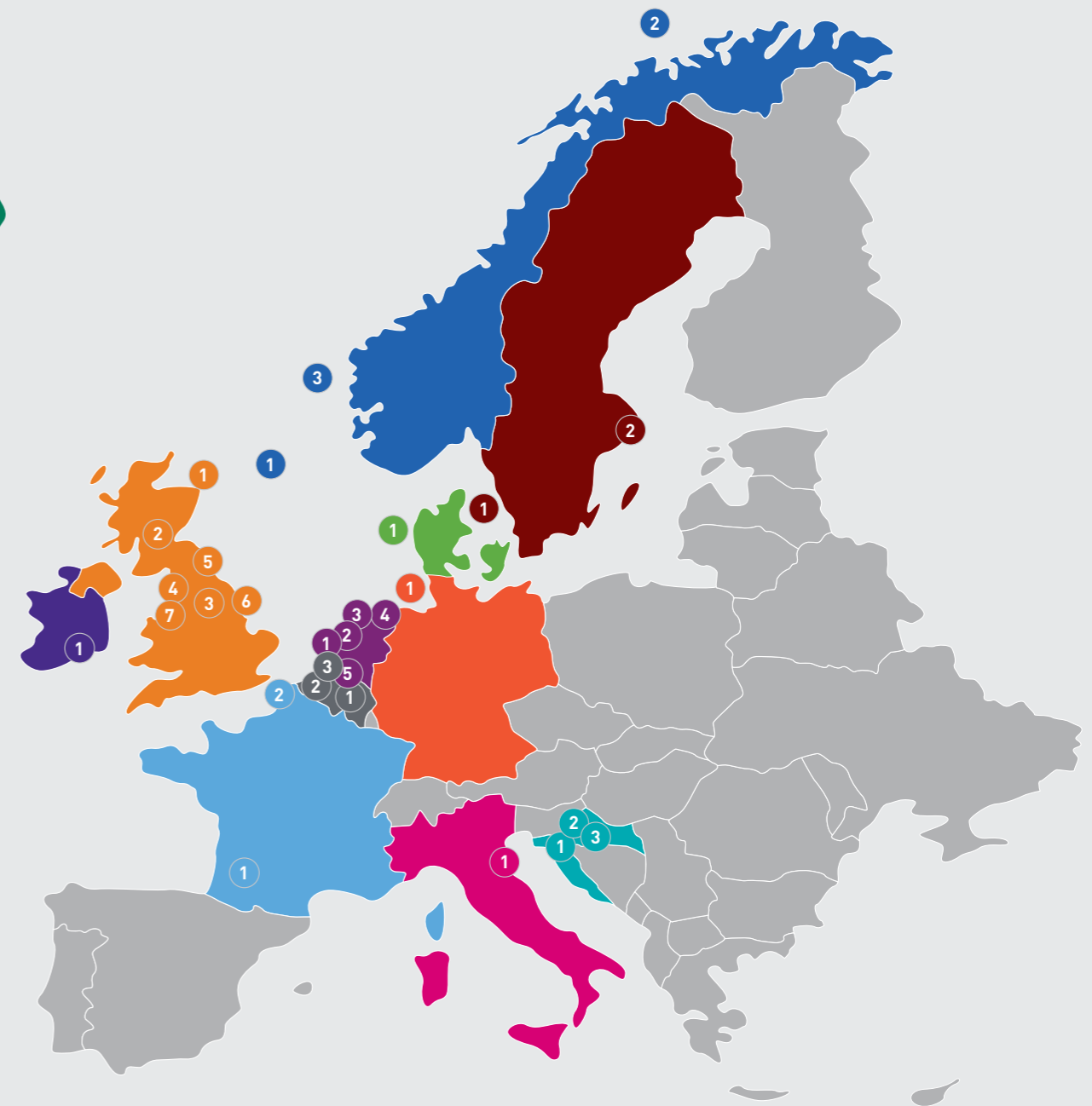
1. ERVIA

SWEDEN

1. Preem CCS*
2. Stockholm Exergi Bio-CCS*

UK

1. Acorn*
2. Caledonia Clean Energy
3. H21 North of England*
4. Liverpool-Manchester Hydrogen Cluster
5. Net Zero Teesside*
6. Humber Zero Carbon Cluster*
7. Liverpool Bay Area CCS Project*



* Project where IOGP members are involved
Projects listed in **bold** are in operation

Total number of projects: **30**
Around 50 MtCO₂/yr stored by 2030

LOCATION	PROJECT NAME	PROJECT TYPE	DESCRIPTION	CO ₂ CAPTURED/YEAR	STARTING DATE (OPERATION)	STATUS OF THE PROJECT	PARTICIPANTS	IOGP MEMBERS INVOLVED
Belgium	Leilac	Industrial Capture	Cement plant carbon capture (pilot project)	N/A	2018-2020	2-year CO ₂ capture test	HeidelbergCement, Calix	
	Antwerp@C (Port of Antwerp)	Industrial Capture	CCS-equipped industrial cluster, CO ₂ transportation and storage in the North Sea and reuse	N/A	N/A	Feasibility study	Air Liquide, BASF, Borealis, INEOS, ExxonMobil, Fluxys, Port of Antwerp and Total	ExxonMobil, Total
Croatia	iCORD	Industrial Capture	Capturing the CO ₂ produced at a fertilizer plant at Location in central Croatia and at a concrete production plant at Location in eastern Croatia, and storing it at Moslavina basin oil fields and Pannonia basin oil fields as part of INA EOR project.	Approx. 1Mt/y	2025	Feasibility Study to be ordered by end of 2019, FS to be prepared by end of Q3 2020.	INA MOL	MOL
	CO₂ EOR Project Croatia	EOR	EOR project started in 2014. Injected 1.400 kt CO ₂ in the EOR fields Ivanić and Žutica near Ivanić Grad (Zagreb County, 41 km from Zagreb) .The pipeline Molve-Ivanić is 88 km long (30 bar)	0,560 Mt/y	2015	In operation	INA MOL	MOL
	Bio-Refinery Project	Industrial Capture	Bio-Refinery plant (bio-Ethanol production) on the Sisak Refinery location (Sisak-Moslavina County, Sisak 60 km from Zagreb). On the existing pipeline route, new pipe of 16 km will be built for CO ₂ storage, for the yearly production of 60 kt of CO ₂ , plus potential 300-400 kt of biogenic CO ₂ from CHP.	0,06 Mt/y (additional potential on location 300-400 kt)	2024	Signing the contracts for basic design and technology selection	INA MOL	MOL
Denmark	Greensand	Capture Storage	Project purpose is to prove that the Paleocene sand in the depleted Danish North Sea oil-and gas fields and the associated infrastructure can be used for safe, long-term storage of CO ₂ . When in operation, the Project will allow for storage of 0.5-1 mill ton/CO ₂ per year.	0.5-1 Mt stored CO ₂ /year	Pilot CO ₂ injection project by 2023; full field by 2025	Phase 1: Feasibility study stage, current TRL 2-3, aim is TRL 6 for launching the pilot (Phase 2)	INEOS Oil & Gas Denmark, Wintershall Dea GmbH, Maersk Drilling	Wintershall Dea
France	Lacq	Capture Storage (Oxy fuel combustion)	CCS Oxy fuel combustion CO ₂ captured and storage in depleted natural gas field at Rouse (Pyrenees)	Approx. total 50,000 tonnes	2009	Capture and storage phase ended on 15/03/2013	Total	Total
	DMX Demonstration in Dunkirk	Industrial Capture	CCS-equipped steel-making plant, CO ₂ transportation and storage in the North Sea	Approx. 1 Mtpa	2025		ArcelorMittal, IFPEN, Axens, Total, ACP, Brevik Engineering, CMI, DTU, Gassco, RWTH, Uetikon	Total
Germany	H2morrow	Natural gas-to-H ₂ (pre-combustion)	Reforming natural gas imported from Norway to hydrogen with CO ₂ capture and storage offshore. Supplying industry and other end users in North Rhine-Westphalia with 8.6 terawatt hours of hydrogen per year from decarbonised natural gas.	N/A	N/A	Feasibility study	Equinor, OGE	Equinor
Iceland	Orca	Direct air capture	Orca will combine Climeworks' direct air capture technology with the underground CO ₂ storage provided by Carbfix, capturing 4,000 tons/yr of CO ₂ - making the largest direct air capture plant to date. The energy required to run the direct air capture process will be provided by ON Power's nearby Hellisheidi Geothermal Power Plant.	4000 tonnes	N/A	Under construction	Carbfix, Climeworks, ON Power	
	Hellisheidi	Industrial capture	The industrial scale capture at the Hellisheidi Geothermal Power Plant in Iceland has significantly reduce CO ₂ and H ₂ S emissions from the power plant since 2014, following successful pilot-scale injections in 2012. The gases are co-captured in a scrubbing tower with annual capacity of about 12,000 tonnes of CO ₂ and 6,000 tonnes of H ₂ S, about 30% and 75% of the plant's emissions respectively. Cost of industrial scale operations at Hellisheidi are less than \$25/ton.	12,000 tonnes	In operation	Under construction	Carbfix, ON Power	

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Italy	CCS Ravenna Hub	Power and capture (post-combustion), Blue Hydrogen	CO ₂ capture in North of Italy (Pianura Padana Area) from Industrial Complex (i.e. Ravenna), transportation and storage exhausted natural gas fields. With a storage capacity of between 300 and 500 million tonnes.	0.04-5,0 Mtpa phased program	2025-2028	Prefeasability Study	Eni	Eni
The Netherlands	Porthos (Port of Rotterdam)	Industrial Capture	CCS-equipped industrial cluster, CO ₂ transportation and storage in the North Sea	Approx. 5 Mtpa	2024	Feasibility study	Gasunie, the Port Authority and EBN	BP, Shell
	Athos (Ijmond)	Industrial Capture	CCUS Network capturing CO ₂ from TATA Steel plant and reusing it or storing it in empty gas fields under the North Sea	7.5 MT CO ₂ per year	2030	Feasibility Study	Gasunie, EBN, Port of Amsterdam and Tata Steel	
	Aramis (Den Helder)	Industrial Capture	CO ₂ supplied by third parties from Den Helder and stored in the North Sea floor. This CO ₂ can be brought to Den Helder by boat or by pipeline (for example from IJmuiden)	N/A	N/A	N/A	N/A	
	Magnum (Eemshaven)	Natural Gas-to-H ₂ (pre-combustion)	CCS-equipped production of hydrogen for power generation, CO ₂ transportation and storage in the North Sea	Approx. 4 Mtpa	2023	Feasibility study	Equinor, Vattenfall, Gasunie, MHPS	Equinor
	Carbon Connect Delta	Industrial capture	With CCUS, CO ₂ emissions can be reduced by 30% in the port area of North Sea Port. A consortium of Belgian and Dutch companies expects to complete the Carbon Connect Delta feasibility study at the end of 2020, after which the project will be further developed for realization. The consortium works simultaneously across industrial sectors (chemicals, petrochemicals and steel), as well as with relevant governments in both countries to create unique synergies and opportunities.	1 Mt by 2023, 6,5 Mt by 2030	2023	Pre-feasibility	Smart Delta Resources, North Sea Port, ArcelorMittal, Dow Benelux, PZEM, Yara, Zeeland Refinery, Gasunie, Fluxys	
Norway	Sleipner CO₂ Storage	Industrial Capture	CCS-equipped natural gas production, CO ₂ directly injected into North Sea reservoirs	Approx. 1 Mtpa, and over 17 million tonnes has been injected since inception to date.	1996	Operational	Equinor (operator) Vår Energi, Total	Equinor, Vår Energi, Total
	Snøhvit CO₂ Storage	Industrial Capture	CCS-equipped LNG facility, CO ₂ transportation and storage in the Barents Sea	0.70 Mtpa	2008	Operational	Equinor (operator) Petoro, Total, Engie, Norsk Hydro, Hess Norge	Equinor, Total, Hess
	Longship (including Northern Lights)	Industrial Capture	Capturing CO ₂ from HeidelbergCement Norcem's cement factory in Brevik and Fortum Oslo Varme's waste incineration facility in Oslo and transporting it for offshore storage in the North Sea basin. Equinor, Shell and Total form the transport and storage consortium of Northern Lights.	0.8 Mtpa from possible 2 industrial plants: cement and waste to energy	2023-2024	Final Investment Decision (FID)	Shell, Equinor, Total	Shell, Equinor, Total
Republic of Ireland	ERVIA	Power & Capture (post-combustion)	CCS-equipped CCGTs and refinery, CO ₂ transportation and storage in the Celtic Sea	2 Mtpa	2028	Feasibility study	ERVIA	
Sweden	Preem CCS	Industrial capture, natural gas-to-H ₂ (pre-combustion)	CCS-equipped hydrogen production unit at a refinery, CO ₂ transportation and storage in the North Sea	500,000 tonnes (at full scale)	2025	Pilot phase	Preem, Chalmers University of Technology, SINTEF Energy Research, Equinor and Aker Solutions	Equinor, Aker Solutions
	Stockholm Exergi Bio-CCS	Power & Capture (post-combustion), BECCS	A pilot plant at the Värtan biomass-fired CHP plant enables the capture of CO ₂ from the biomass fuel in the post-combustion flue gases. The CO ₂ will be compressed into liquid form and stored in underground rock formations. A large-scale facility for BECCS will cover all parts from CO ₂ capture to storage and will create major negative emissions each year.	Est. 0,8 Mt (at full scale)	N/A	Pilot phase	Stockholm Exergi, Northern Lights consortium (Equinor, Shell, Total)	Equinor, Shell, Total

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UK	Acorn	Industrial Capture	CCS-equipped natural gas processing plant, CO ₂ transportation and storage in the North Sea	The Reference Case assumes a flat rate of 200,000T/yr can be captured from one of the gas terminals at St Fergus	2023	Feasibility Study	Project is led by Pale Blue Dot Energy, with funding and support from industry partners (Chrysaor, Shell and Total) the UK and Scottish Governments	Chrysaor, Shell, Total
	Caledonia Clean Energy	Power & Capture (post-combustion)	CCS-equipped natural gas power plant, CO ₂ transportation and storage in the North Sea	3 Mtpa	2023	Feasibility Study	Summit Power	
	H21 North of England	Natural Gas-to-H ₂ (pre-combustion)	Natural gas-to-hydrogen conversion with CCS, CO ₂ transportation and storage in the North Sea and salt caverns	Approx. 3 Mtpa	2020s	Feasibility study	Northern Gas Networks, Cadent and Equinor	Equinor
	Liverpool-Manchester Hydrogen Cluster	Natural Gas-to-H ₂ (pre-combustion)	Natural gas-to-hydrogen conversion with CCS, CO ₂ transportation and storage in the North Sea	1.5 Mtpa (10% H ₂) - 9.5 Mtpa (100% H ₂)	2020s	Feasibility study	CADENT	
	Net Zero Teesside	Power & Capture (post-combustion)	CCS-equipped natural gas power plant, CO ₂ transportation and storage in the North Sea	5 Mtpa	2026	Technical evaluation and business model options	BP, OGCI	BP, ENI, Repsol, Shell, Equinor, Total
	Humber Zero Carbon Cluster	Industrial Capture, Natural Gas-to-H ₂ , Power & Capture	CCS-equipped industrial cluster, CCS-equipped hydrogen production, bioenergy with CCS (BECCS), CO ₂ transportation and storage in the North Sea	N/A	2020s	Technical evaluation and business model options	Drax Group, Equinor, National Grid Ventures	Equinor
	Liverpool Bay Area CCS Project	Carbon Capture Sequestration	CO ₂ capture from the existing industrial facilities and new hydrogen production plant in the North West of England	1-3 Mtpa phased program	2025	Concept Selection Phase	Eni	Eni

Source: [Global CCS Institute](#) and Member companies