Global CCUS projects

Overview of existing and planned CCUS facilities

Number of projects by region

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFRICA</td>
<td>2 projects</td>
</tr>
<tr>
<td>ASIA PACIFIC</td>
<td>27 projects</td>
</tr>
<tr>
<td>CENTRAL AND SOUTH AMERICA</td>
<td>1 project</td>
</tr>
<tr>
<td>EUROPE</td>
<td>30 projects</td>
</tr>
<tr>
<td>MIDDLE EAST</td>
<td>5 projects</td>
</tr>
<tr>
<td>NORTH AMERICA</td>
<td>36 projects</td>
</tr>
</tbody>
</table>

Source: Global CCS Institute and IOGP data
## CCUS projects in ASIA PACIFIC

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PROJECT NAME</th>
<th>PROJECT TYPE</th>
<th>INDUSTRY</th>
<th>DESCRIPTION</th>
<th>CO₂ CAPTURED/ YEAR</th>
<th>STARTING DATE (OPERATION)</th>
<th>STATUS OF THE PROJECT</th>
<th>PARTICIPANTS</th>
<th>IOGP MEMBERS INVOLVED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Australia</td>
<td>Gorgon Carbon Dioxide Injection</td>
<td>Industrial capture</td>
<td>Natural gas processing</td>
<td>Reservoir gas captured from the acid gas removal units at the Gorgon gas processing plant on Barrow Island are captured, compressed, transported by pipeline and injected over 2 km below the earth’s surface into the Dupuy Formation</td>
<td>3.4-4 Mtpa 2019</td>
<td>Operational</td>
<td>Chevron (The Gorgon Project is operated by Chevron Australia and is a joint venture of the Australian subsidiaries of Chevron (47.3%), ExxonMobil (25%), Shell (25%), Osaka Gas (1.25%), Tokyo Gas (1%) and JERA (0.17%))</td>
<td>Chevron, Shell, ExxonMobil</td>
<td></td>
</tr>
<tr>
<td>Victoria</td>
<td>CarbonNet</td>
<td>Under evaluation</td>
<td>Itbd</td>
<td>CCS network from Victoria’s Latrobe Valley, transportation and storage in the underground storage in the Gippsland region</td>
<td>3 Mtpa 2020</td>
<td>Advance development</td>
<td>Government of Victoria, Australia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>South West Hub</td>
<td>South West Hub</td>
<td>Power and capture</td>
<td>Fertilizer production and power generation</td>
<td>CO₂ capture from industrial facility and power plants in Western Australia, transportation and storage in a dedicated site</td>
<td>2.5 Mtpa 2025</td>
<td>Early development</td>
<td>The Department of Mines, Industry Regulation and Safety (DMIRS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>Bridgeport Energy Moonie CCUS project</td>
<td>EOR</td>
<td>Refining</td>
<td>Bridgeport Energy Moonie CCUS project plans to capture and inject 1 million tonnes per annum CO₂ by 2028 for CO₂-enhanced oil recovery at the Moonie Oil Field in Australia.</td>
<td>1 Mtpa 2028</td>
<td>Early development</td>
<td>Bridgeport Energy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTSCo Surat Basin</td>
<td>CTSCo Surat Basin CCS Project</td>
<td>Industrial capture</td>
<td>Power generation</td>
<td>The aim of the CTSCo Surat Basin CCS Project is to demonstrate the technical viability, integration and safe operation of CCS in the Suratan Basin in Queensland, Australia. The project plans to capture 120,000 tonnes per annum CO₂ and the first injection operation will occur around 2023.</td>
<td>0.12 Mtpa 2023</td>
<td>Advanced development</td>
<td>Carbon Transport and Storage Company (CTSCo)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen Energy Supply Chain (HESC)</td>
<td>Hydrogen Energy Supply Chain (HESC) project</td>
<td>Power &amp; capture</td>
<td>Hydrogen production</td>
<td>The aim of HESC is to establish a full-chain commercial-scale low-carbon emission hydrogen supply to Japan. The project will be carried out in 2 phases: pilot phase and commercial phase.</td>
<td>N/A 2020-2021</td>
<td>In construction</td>
<td>Kawasaki Heavy Industries, Ltd (KHI), Electric Power Development Co., Ltd (J-Power), Iwatani Corporation (Iwatani), Marubeni Corporation (Marubeni), AGL Energy (AGL) and Sumitomo Corporation (Sumitomo)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Santos Cooper Basin CCS</td>
<td>Santos Cooper Basin CCS Project</td>
<td>Power &amp; capture</td>
<td>Natural gas processing</td>
<td>Currently in front and engineering design for capture of 1.7 million tonnes per annum CO₂ from the Moomba gas processing plant in South Australia. The captured CO₂ will be reinjected in the depleted hydrocarbon reservoirs at Cooper Basin.</td>
<td>1.7 Mtpa 2023</td>
<td>Advanced development</td>
<td>Santos, Ltd</td>
<td></td>
<td></td>
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<tr>
<td>Wallumbilla</td>
<td>Wallumbilla Renewable Methane Demonstration Project</td>
<td>Power &amp; capture</td>
<td>Industrial application</td>
<td>The project aims to demonstrate the potential of producing renewable methane using renewable hydrogen and CO₂ from solar-powered direct air capture (DAC) technology.</td>
<td>N/A 2021</td>
<td>Advanced development</td>
<td>APA Group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jilin Oil Field CO₂-EOR</td>
<td>Jilin Oil Field CO₂-EOR</td>
<td>Industrial capture</td>
<td>Natural gas processing</td>
<td>CO₂ capture from a natural gas processing plant at the Changling gas field, transportation by pipeline and injection for EOR at the Jilin oil fields</td>
<td>0.6 Mtpa 2018</td>
<td>Operational</td>
<td>CNPC</td>
<td></td>
<td></td>
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<tr>
<td>Sinopec Qilu Petrochemical CCS</td>
<td>Sinopec Qilu Petrochemical CCS</td>
<td>Industrial capture</td>
<td>Chemical production</td>
<td>CCS to retrofit a coking water slurry gasification at a fertilizer plant at Zibo city, transportation to the Shengli oil field for EOR</td>
<td>0.60 Mtpa 2020-2021</td>
<td>Under construction</td>
<td>Sinopec</td>
<td></td>
<td></td>
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<tr>
<td>Yanchang Integrated CCS Demonstration</td>
<td>Yanchang Integrated CCS Demonstration</td>
<td>Industrial capture</td>
<td>Chemical production</td>
<td>Capture at coal-to-chemical plant, storage for EOR in oil fields in the Ordos basin</td>
<td>0.61 Mtpa 2020-2021</td>
<td>Under construction</td>
<td>Yangchang Petroleum</td>
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<tr>
<td>Sinopec Eastern China CCS</td>
<td>Sinopec Eastern China CCS</td>
<td>Industrial capture</td>
<td>Fertilizer production</td>
<td>CO₂ capture from a synthetic ammonia facility and a coal to hydrogen facility in Jiangsu province, transportation to Sinopec oil fields for EOR</td>
<td>0.50 Mtpa 2021</td>
<td>Early development</td>
<td>Sinopec</td>
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</tr>
</tbody>
</table>

* Project where IOGP members are involved

Source: Global CCS Institute and IOGP data
## CCUS projects in ASIA PACIFIC

### 13. China Resource Power (Haifeng) Integrated CCS Demonstration
- **Location:** Guangdong
- **Type:** Power and capture (post-combustion)
- **Industry:** Power generation
- **Description:** CCS-equipped Haifen power plant in Guangdong, storage site under evaluation
- **CO2 Captured/Year:** 1 Mtpa
- **Starting Date:** 2020s
- **Status of the Project:** Early development
- **Participants:** China Resources Power

### 14. Huangang Greengen IGCC
- **Location:** Tianjin
- **Type:** Power and capture (pre-combustion)
- **Industry:** Power generation
- **Description:** IGCC power plant with associated CCS in Tianjin province, transportation and storage under evaluation
- **CO2 Captured/Year:** 2 Mtpa
- **Starting Date:** 2020s
- **Status of the Project:** Early development
- **Participants:** China Huangang Group

### 15. Shenhua Ningxia CTL
- **Location:** Ningxia
- **Type:** Industrial capture
- **Industry:** Coal-to-liquids
- **Description:** CO2 capture from a coal-to-liquids plant in Ningxia province, various storage options under consideration
- **CO2 Captured/Year:** 2 Mtpa
- **Starting Date:** 2020s
- **Status of the Project:** Under evaluation
- **Participants:** Shenhua Group

### 16. N/A

### 17. Sinopec Shengli Power Plant CCS
- **Location:** Sichuan
- **Type:** EOR
- **Industry:** Hydrogen production
- **Description:** CO2 from the hydrogen production units of refineries transported to nearby oil fields by truck, then injected into the ground for EOR. Once at scale, CNPC plans to expand capture to the chemical industry and power, constructing an exclusive carbon dioxide transport pipeline
- **CO2 Captured/Year:** 3 Mtpa
- **Starting Date:** 2025
- **Status of the Project:** Demonstration project
- **Participants:** CNPC

### 18. Huazhong University of Science and Technology Oxy-fuel Demonstration
- **Location:** Hubei
- **Type:** Power & capture
- **Industry:** Power generation
- **Description:** Capture from a thermal power generation plant in Dongying city, transportation to the Shengli oil field for EOR
- **CO2 Captured/Year:** 1 Mtpa
- **Starting Date:** 2020s
- **Status of the Project:** Early development
- **Participants:** Sinopec

### 19. Australia-China Post Combustion Capture (PCC) Feasibility Study Project
- **Location:** Australia-China
- **Type:** Power & capture
- **Industry:** Power generation
- **Description:** World’s largest operational oxy-fuel combustion demonstration facility. This involved the building of a 35 MWe oxy-fuel unit at the Juida Salt Company’s captive power plant. Plans indicate the potential for 100,000 tonnes per annum of CO2 capture in the future.
- **CO2 Captured/Year:** 0.1 Mtpa
- **Starting Date:** 2020s
- **Status of the Project:** In construction
- **Participants:** Huazhong University of Science and Technology, Dongfang Boiler Co Ltd, Sichuan Air Separation Group, Guangdong Electric Power Research Institute, Shenhua Group

### 20. Yanchang Integrated Carbon Capture and Storage Demonstration
- **Location:** Shaanxi
- **Type:** Industrial capture
- **Industry:** Chemical production
- **Description:** Developing CO2 capture facilities at two coal-to-chemical plants. The smaller scale capture source of 0.05 Mtpa CO2 has been in operation since 2012, while the larger CO2 source of 0.36 Mtpa CO2 is currently in construction and may be operational in early 2020. Captured CO2 would be used for EOR in oil fields in the Ordos Basin in central Asia.
- **CO2 Captured/Year:** 0.36 Mtpa
- **Starting Date:** early 2020s
- **Status of the Project:** In construction
- **Participants:** Yanchang Petroleum

### 21. Guohua Jinjie CCS Full Chain Demonstration
- **Location:** Shaanxi
- **Type:** Power & capture
- **Industry:** Power generation
- **Description:** A demonstration-scale CCS facility in a coal-fired power plant. The captured CO2 at a capacity of 150,000 tonnes per annum is to be transported via tanker truck to the existing CO2 injection site from Shenhua Ordos CCS demonstration project.
- **CO2 Captured/Year:** 0.15 Mtpa
- **Starting Date:** 2020s
- **Status of the Project:** In construction
- **Participants:** Shenhua Guohua Jinjie Energy

### 22. Chinese-European Emission-Reducing Solution (CHEERS)
- **Location:** Sichuan
- **Type:** Industrial capture
- **Industry:** Oil refining
- **Description:** The project involves the test and verification of the 2nd generation chemical-looping technology at a demonstration laboratory in Sichuan Province, China. By 2022, the project targets to develop into a 3 MWe demonstration system for decarbonising the petroleum refining sector and other energy-intensive industry.
- **CO2 Captured/Year:** N/A
- **Starting Date:** 2022
- **Status of the Project:** Advanced development
- **Participants:** Total Raffinage Chimie, IFP Energies nouvelles, Bellona Europa AISBL, Sintef AS, Stiftelsen Sintef, Politechnika Slaska, Tsinghua University, Dongfang Boiler Group Co LTD, Zhejiang University

### 23. N/A

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* Project where IOGP members are involved

Source: Global CCS Institute and IOGP data
<table>
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<tr>
<th>LOCATION</th>
<th>PROJECT NAME</th>
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<th>PARTICIPANTS</th>
<th>IOGP MEMBERS INVOLVED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>Gundih CCS Pilot</td>
<td>Power &amp; capture</td>
<td>Natural gas processing</td>
<td>The pilot project would use CO₂ captured from the Gundih gas field and inject around 30 tonnes per day over a two year period for total injection of around 20,000 tonnes into an uneconomic oil and gas reservoir.</td>
<td>0.01 Mtpa</td>
<td>2020s</td>
<td>Advanced development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>Osaki CoolGen Project</td>
<td>Power &amp; capture</td>
<td>Power generation</td>
<td>Project aims to demonstrate a large-scale, oxygen-blow integrated coal gasification combined cycle IGCC technologies, including CO₂ separation and capture technology. Demonstration testing of the oxygen-blown IGCC system Stage 1 commenced in late March 2017 and continued for two years. Stage 2, which involved the addition of CO₂ capture and separation facilities at the capture capacity of 100,000 to 150,000 tonnes per annum, is planned for later in the decade.</td>
<td>0.1-0.15 Mtpa</td>
<td>2020</td>
<td>In construction</td>
<td>Chugoku Electric Power Co Inc., J-POWER</td>
<td></td>
</tr>
<tr>
<td>New Zealand</td>
<td>Project Pouakai Hydrogen Production with CCS</td>
<td>Industrial capture</td>
<td>Various</td>
<td>Under development to build clean hydrogen, fertilizer, and power generation industrial complex in the Taranaki Region, with near-zero CO₂ GHG emissions using CCS.</td>
<td>1 Mtpa</td>
<td>2024</td>
<td>Early development</td>
<td>8 Rivers, Toshiba, McDermott, Exelon, Oxy</td>
<td></td>
</tr>
<tr>
<td>South Korea</td>
<td>Korea-CCS 1 &amp; 2</td>
<td>Power and capture (post-combustion)</td>
<td>Power generation</td>
<td>CO₂ capture from a power plant, transportation and storage under evaluation</td>
<td>1 Mtpa</td>
<td>2020s</td>
<td>Early development</td>
<td>Korea Carbon Capture and Sequestration R&amp;D Center [KCRC]</td>
<td></td>
</tr>
</tbody>
</table>

* Project where IOGP members are involved

Source: Global CCS Institute and IOGP data
### CCUS projects in Europe

**1. Leilac**
- **Location:** Belgium
- **Project Name:** Leilac
- **Project Type:** Industrial Capture
- **Industry:** Cement
- **Description:** Cement plant carbon capture (pilot project)
- **CO₂ Captured/Year:** N/A
- **Starting Date:** 2018-2020
- **Status of the Project:** 2-year CO₂ capture test
- **Participants:** HeidelbergCement, Calix
- **IOGP Members Involved:**

**2. Antwerp@C (Port of Antwerp)**
- **Location:** Belgium
- **Project Name:** Antwerp@C (Port of Antwerp)
- **Project Type:** Industrial capture
- **Industry:** N/A
- **Description:** CCS-equipped industrial cluster, CO₂ transportation and storage in the North Sea and reuse
- **CO₂ Captured/Year:** N/A
- **Starting Date:** N/A
- **Status of the Project:** Feasibility study
- **Participants:** Air Liquide, BASF, Bonalco, INEOS, ExxonMobil, Flixbus, Port of Antwerp and Total
- **IOGP Members Involved:** ExxonMobil, Total

**3. iCORD**
- **Location:** Croatia
- **Project Name:** iCORD
- **Project Type:** Industrial capture
- **Industry:** Fertiliser
- **Description:** Capturing the CO₂ produced at a fertilizer plant located in central Croatia and at a concrete production plant located in eastern Croatia, and storing it at Moslavina basin oil fields and Pannonia basin oil fields as part of INA EOR project.
- **CO₂ Captured/Year:** Approx. 1Mton/year
- **Starting Date:** 2025
- **Status of the Project:** Feasibility Study to be ordered by end of 2019, FS to be prepared by end of Q3 2020.
- **Participants:** INA MOL
- **IOGP Members Involved:** MOL

**4. CO₂ EOR Project Croatia**
- **Location:** Croatia
- **Project Name:** CO₂ EOR Project Croatia
- **Project Type:** EOR
- **Industry:** N/A
- **Description:** EOR project started in 2014. Injected 1,400 kt CO₂ in the EOR fields Ivanjic and Zutica near Ivanic Grad (Zagreb County, 41 km from Zagreb). The pipeline Moline-Ivanjic is 88 km long (30 bar).
- **CO₂ Captured/Year:** 0.56 Mton/year
- **Starting Date:** 2015
- **Status of the Project:** In operation
- **Participants:** INA MOL
- **IOGP Members Involved:** MOL

**5. Bio-Refinery Project**
- **Location:** Croatia
- **Project Name:** Bio-Refinery plant (bio-Ethanol production)
- **Project Type:** Industrial capture
- **Industry:** Bioethanol
- **Description:** 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 pipes of 16 km will be built for CO₂ storage, for the yearly production of 60 kt of CO₂ and potential 300-400 kt of biogenic CO₂ from CHP.
- **CO₂ Captured/Year:** 0.06 Mt/year (additional potential on location 300-400 kt)
- **Starting Date:** 2024
- **Status of the Project:** Signing the contracts for basic design and technology selection
- **Participants:** INA MOL
- **IOGP Members Involved:** MOL

**6. Greensand**
- **Location:** Denmark
- **Project Name:** Greensand
- **Project Type:** Capture Storage
- **Industry:** N/A
- **Description:** 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 CO₂. When in operation, the Project will allow for storage of 0.5-1 million tons CO₂ per year.
- **CO₂ Captured/Year:** 0.5-1 Mt stored CO₂/year
- **Starting Date:** Pilot CO₂ injection project by 2023; full field by 2025
- **Status of the Project:** Phase 1: Feasibility study stage, current TRL 2-3, aim TRL 4 for launching the pilot (Phase 2)
- **Participants:** INEOS Oil & Gas Denmark, Wintershall Dea Drilling
- **IOGP Members Involved:** Wintershall Dea

**7. Lacq**
- **Location:** France
- **Project Name:** Lacq
- **Project Type:** Capture Storage (Oxy fuel combustion)
- **Industry:** Natural gas
- **Description:** CCS Oxy fuel combustion CO₂ captured and storage in depleted natural gas field at Rousse (Pyrenees)
- **CO₂ Captured/Year:** Approx. total: 50,000 tonnes
- **Starting Date:** 2019
- **Status of the Project:** Capture and storage phase ended on 15/03/2013
- **Participants:** Total
- **IOGP Members Involved:** Total

**8. DMX Demonstration in Dunkirk**
- **Location:** France
- **Project Name:** DMX Demonstration in Dunkirk
- **Project Type:** Industrial capture
- **Industry:** Steammaking
- **Description:** CCS-equipped steam-making plant, CO₂ transportation and storage in the North Sea
- **CO₂ Captured/Year:** Approx. 1 Mtpa
- **Starting Date:** 2025
- **Status of the Project:** Feasibility study
- **Participants:** AncelorMittal, IFPEN, Asensi, Total, ACP, Broek Engineering, CMI, CMI, Gassco, RWTH, Uetikon
- **IOGP Members Involved:** Total

**9. H2morrow**
- **Location:** Germany
- **Project Name:** H2morrow
- **Project Type:** Natural gas-to-H₂ (pre-combustion)
- **Industry:** Reforming natural gas imported from Norway to hydrogen with CO₂ 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.
- **CO₂ Captured/Year:** N/A
- **Starting Date:** Feasibility study
- **Status of the Project:** Equinor, OSE
- **Participants:** Equinor
- **IOGP Members Involved:** Equinor

**10. Orca**
- **Location:** Iceland
- **Project Name:** Orca
- **Project Type:** Direct air capture
- **Industry:** N/A
- **Description:** Orca will combine Climeworks direct air capture technology with the underground CO₂ storage provided by Carbfix, capturing 4,000 tonnes of CO₂ - 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 Hellisheiði Geothermal Power Plant.
- **CO₂ Captured/Year:** 4,000 tonnes
- **Starting Date:** N/A
- **Status of the Project:** Under construction
- **Participants:** Carbfix, Climeworks, ON Power
- **IOGP Members Involved:**

**11. Hellisheiði**
- **Location:** Iceland
- **Project Name:** Industrial capture
- **Project Type:** N/A
- **Industry:** The industrial scale capture at the Hellisheiði Geothermal Power Plant in Iceland has significantly reduced CO₂ and H₂S 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 CO₂ and 8,000 tonnes of H₂S, about 30% and 75% of the plant’s emissions respectively. Cost of industrial scale operations at Hellisheiði are less than $25/ton.
- **CO₂ Captured/Year:** 12,000 tonnes
- **Starting Date:** In operation
- **Status of the Project:** Under construction
- **Participants:** N/A
- **IOGP Members Involved:**

*Project where IOGP members are involved*
<table>
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<th>STARTING DATE (OPERATION)</th>
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<th>PARTICIPANTS</th>
<th>IOGP MEMBERS INVOLVED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ireland</td>
<td>ERVIA</td>
<td>Power &amp; Capture (post-combustion)</td>
<td>Natural gas</td>
<td>CCS-equipped CCSFs and refinery, CO₂ transportation and storage in the Celtic Sea</td>
<td>2 Mtpa, 2028</td>
<td>Feasibility study</td>
<td>ERVIA</td>
<td></td>
<td></td>
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<tr>
<td>Italy</td>
<td>CCS Ravenna Hub</td>
<td>Power and capture (post-combustion), Blue Hydrogen</td>
<td>CO₂ 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 200 and 500 million tonnes.</td>
<td>0.04–5.0 Mtpa phased program, 2025–2028</td>
<td>Pre-feasibility Study</td>
<td>Eni</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Netherlands</td>
<td>Porthos</td>
<td>Industrial capture</td>
<td>Chemical, refining</td>
<td>CCS-equipped industrial cluster, CO₂ transportation and storage in the North Sea</td>
<td>Approx. 5 Mtpa, 2024</td>
<td>Feasibility study</td>
<td>Gasunie, the Port Authority and EBN</td>
<td></td>
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<tr>
<td>The Netherlands</td>
<td>Athos</td>
<td>Industrial capture</td>
<td>Steammaking</td>
<td>CCS Network capturing CO₂ from TATA Steel plant and reusing it or storing it in empty gas fields under the North Sea</td>
<td>7.5 Mtpa, 2030</td>
<td>Feasibility study</td>
<td>Gasunie, EBN, Port of Amsterdam and Tata Steel</td>
<td></td>
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<tr>
<td>The Netherlands</td>
<td>Den Helder</td>
<td>Industrial Capture</td>
<td>CO₂ supplied by third parties from Den Helder and stored in the North Sea flo</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>The Netherlands</td>
<td>Eemshaven</td>
<td>Magnum</td>
<td>Power &amp; Capture</td>
<td>Hydrogen production</td>
<td>Approx. 4 Mtpa, 2023</td>
<td>Feasibility study</td>
<td>Equinor, Vattenfall, Gasunie, MHP5</td>
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<tr>
<td>The Netherlands</td>
<td>Carbon Connect Delta</td>
<td>Industrial capture</td>
<td>With CCUS, CO₂ 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.</td>
<td>1 Mt by 2023, 6.5 Mt by 2030</td>
<td>Pre-feasibility Study</td>
<td>Smart Delta Resources, North Sea Port, ArcelorMittal, Dow Benelux, PZEM, Vara, Zeeland Refinery, Gasunie, Fluxys</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norway North Sea</td>
<td>Sleipner CO₂ Storage</td>
<td>Industrial Capture</td>
<td>Natural gas</td>
<td>CCS-equipped natural gas production, CO₂ directly injected into North Sea reservoir</td>
<td>Approx. 1 Mtpa, and over 17 million tonnes has been injected since inception to date, 1996</td>
<td>Operational</td>
<td>Equinor (operator), Vår Energi, Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norway Barents Sea</td>
<td>Snøhvit CO₂ Storage</td>
<td>Industrial Capture</td>
<td>LNG facility</td>
<td>CCS-equipped LNG facility, CO₂ transportation and storage in the Barents Sea</td>
<td>0.70 Mtpa, 2008</td>
<td>Operational</td>
<td>Equinor (operator), Petoro, Total, Energi, Norsk Hydro, HESS Norge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norway Norwegian Continental Shelf (NCS)</td>
<td>Longship (including Northern Lights)</td>
<td>Industrial capture</td>
<td>Cement and waste-to-energy</td>
<td>Capturing CO₂ 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.</td>
<td>0.8 Mtpa from possible 2 industrial plants: cement and waste to energy, 2023–2024</td>
<td>Final Investment Decision (FID)</td>
<td>Shell, Equinor, Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>Pweem CCS</td>
<td>Industrial capture, natural gas-to-H₂ (pre-combustion)</td>
<td>Refining</td>
<td>CCS-equipped hydrogen production unit at a refinery, CO₂ transportation and storage in the North Sea</td>
<td>500,000 tonnes (at full scale), 2025</td>
<td>Pilot phase</td>
<td>Pweem, Chalmers University of Technology, SINTEF Energy Research, Equinor and Aker Solutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>Stockholm Exergi Bio-CCS</td>
<td>Power &amp; Capture (post-combustion), BECCS</td>
<td>A pilot plant at the Vartan biomass-fired CHP plant enables the capture of CO₂ from the biomass fuel in the post-combustion flue gases. The CO₂ will be compressed into liquid form and stored in underground rock formations. A large-scale facility for BECCS will cover all parts from CO₂ capture to storage and will create major negative emissions each year.</td>
<td>Est. 0.8 M (at full scale), N/A</td>
<td>Pilot phase</td>
<td>Stockholm Exergi, Northern Lights consortium (Equinor, Shell, Total)</td>
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</tbody>
</table>

Source: Global CCS Institute and IOGP data

- Project where IOGP members are involved

CCUS projects in EUROPE

12. ERVIA
13. CCS Ravenna Hub*
14. Porthos (Port of Rotterdam)*
15. Athos (Ijmmond)*
16. Aramis (Den Helder)
17. Magnum (Eemshaven)*
18. Carbon Connect Delta
19. Sleipner CO₂ Storage*
20. Snøhvit CO₂ Storage*
21. Longship (including Northern Lights)*
22. Pweem CCS*
23. Stockholm Exergi Bio-CCS*
## CCUS projects in Europe

### 24. Acorn

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<thead>
<tr>
<th>LOCATION</th>
<th>PROJECT NAME</th>
<th>PROJECT TYPE</th>
<th>INDUSTRY</th>
<th>DESCRIPTION</th>
<th>CO₂ CAPTURED/ YEAR</th>
<th>STARTING DATE (OPERATION)</th>
<th>STATUS OF THE PROJECT</th>
<th>PARTICIPANTS</th>
<th>IOGP MEMBERS INVOLVED</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>St Fergus</td>
<td>Industrial Capture</td>
<td>Natural Gas power</td>
<td>CCS-equipped natural gas processing plant, CO₂ transportation and storage in the North Sea</td>
<td>The Reference Case assumes a flat rate of 200,000 T/yr can be captured from one of the gas terminals at St Fergus</td>
<td>2023</td>
<td>Feasibility Study</td>
<td>Project is led by Pale Blue Dot Energy, with funding and support from industry partners (Chrysaor, Shell and Total) the UK and Scottish Governments</td>
<td>Chrysaor, Shell, Total</td>
</tr>
<tr>
<td>UK</td>
<td>Caledonia Clean Energy</td>
<td>Power &amp; Capture (post-combustion)</td>
<td>Natural gas power</td>
<td>CCS-equipped natural gas power plant, CO₂ transportation and storage in the North Sea</td>
<td>3 Mtpa</td>
<td>2023</td>
<td>Feasibility Study</td>
<td>Summit Power</td>
<td></td>
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<tr>
<td>UK</td>
<td>H21 North of England</td>
<td>Natural Gas-to-H₂ (pre-combustion)</td>
<td>Hydrogen production</td>
<td>Natural gas-to-hydrogen conversion with CCS, CO₂ transportation and storage in the North Sea and salt caverns</td>
<td>Approx. 3 Mtpa</td>
<td>2020s</td>
<td>Feasibility study</td>
<td>Northern Gas Networks, Cadent and Equinor</td>
<td>Equinor</td>
</tr>
<tr>
<td>UK</td>
<td>Liverpool-Manchester</td>
<td>Natural Gas-to-H₂ (pre-combustion)</td>
<td>Hydrogen production</td>
<td>Natural gas-to-hydrogen conversion with CCS, CO₂ transportation and storage in the North Sea</td>
<td>1.5 Mtpa (10% H₂) - 9.5 Mtpa (100% H₂)</td>
<td>2020s</td>
<td>Feasibility study</td>
<td>CADENT</td>
<td></td>
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<tr>
<td>UK</td>
<td>Net Zero Teesside</td>
<td>Power &amp; Capture (post-combustion)</td>
<td>Natural gas power</td>
<td>CCS-equipped natural gas power plant, CO₂ transportation and storage in the North Sea</td>
<td>5 Mtpa</td>
<td>2026</td>
<td>Technical evaluation and business model options</td>
<td>BP, OGCI</td>
<td>BP, ENI, Repsol, Shell, Total</td>
</tr>
<tr>
<td>UK</td>
<td>Humber Zero Carbon Cluster</td>
<td>Industrial Capture, Natural Gas-to-H₂, Power &amp; Capture</td>
<td>Hydrogen production, bioenergy</td>
<td>CCS-equipped industrial cluster; CCS-equipped hydrogen production, bioenergy with CCS (BECCS), CO₂ transportation and storage in the North Sea</td>
<td>N/A</td>
<td>2000s</td>
<td>Technical evaluation and business model options</td>
<td>Drax Group, Equinor, National Grid Ventures</td>
<td>Equinor</td>
</tr>
<tr>
<td>UK</td>
<td>Liverpool Bay Area CCS Project</td>
<td>Carbon Capture Sequestration</td>
<td>Chemical, refining, Hydrogen production</td>
<td>CO₂ capture from the existing industrial facilities and new hydrogen production plant in the North West of England</td>
<td>1-3 Mtpa phased program</td>
<td>2025</td>
<td>Concept Selection Phase</td>
<td>Eri</td>
<td>Eri</td>
</tr>
</tbody>
</table>

* Project where IOGP members are involved

Source: Global CCS Institute and IOGP data
<table>
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<tr>
<th>LOCATION</th>
<th>PROJECT NAME</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Canada Alberta</td>
<td>Quest</td>
<td>Industrial capture, EOR</td>
<td>Hydrogen production for oil refining</td>
<td>Retrofit CO₂ capture facility to steam methane reformers, transportation via pipeline to a dedicated geological storage.</td>
<td>1 Mtpa</td>
<td>2015</td>
<td>Operational</td>
<td>Shell</td>
<td>Shell</td>
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<tr>
<td>Canada Saskatchewan</td>
<td>Boundary Dam CCS</td>
<td>Power and capture (post-combustion), EOR</td>
<td>Power generation</td>
<td>It combines post-combustion CCS with coal-fired power generation, some captured CO₂ goes for EOR use in the Weyburn oil unit, a portion of the CO₂ is stored permanently under the ground at the Aquatrace project.</td>
<td>1 Mtpa</td>
<td>2014</td>
<td>Operational</td>
<td>SaskPower</td>
<td></td>
</tr>
<tr>
<td>Canada Alberta</td>
<td>Alberta Carbon Trunk Line (ACTL) with North West Redwater Partnership’s Sturgeon Refinery CO₂ Stream</td>
<td>Industrial capture, EOR</td>
<td>Oil refining</td>
<td>Carbon dioxide captured from Agrim’s Redwater fertiliser plant and the North West Redwater Partnership’s Sturgeon refinery. CO₂ recovered from the fertiliser plant’s emission streams put through inlet cooling, separation, compression, dehydration and refrigeration to produce liquefied CO₂. The project plans to transport CO₂ from a number of sources in the future coming from Alberta’s Industrial Heartland.</td>
<td>1.2-1.4 Mtpa</td>
<td>2020</td>
<td>Operational</td>
<td>Enhance Energy Inc. (and - North West Redwater Partnership)</td>
<td></td>
</tr>
<tr>
<td>Canada Alberta</td>
<td>Lehigh’s Edmonton plant</td>
<td>Industrial capture</td>
<td>Cement industry</td>
<td>Capture the majority of the carbon dioxide (CO₂) from the flue gas of Lehigh’s Edmonton, Alberta cement plant.</td>
<td>Estimated 600,000 tonnes annually</td>
<td>Feasibility study</td>
<td>Lehigh Cement and the International CCS Knowledge Centre</td>
<td></td>
<td></td>
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<tr>
<td>Canada Alberta</td>
<td>Alberta Carbon Trunk Line (ACTL) with Agrim CO₂ Stream</td>
<td>Industrial capture</td>
<td>Fertiliser production</td>
<td>At the NWR refinery, CO₂ will be captured within the gasification hydrogen supply unit, which will use unconverted petroleum bottoms (asphaltene) as feedstock to create synthesis gas (syngas).</td>
<td>0.3-0.6 Mtpa</td>
<td>2020</td>
<td>Operational</td>
<td>Enhance Energy Inc.</td>
<td></td>
</tr>
<tr>
<td>USA Illinois</td>
<td>Illinois Industrial Carbon Capture and Storage (ICCS)</td>
<td>Industrial capture</td>
<td>Ethanol production</td>
<td>CO₂ captured from the fermentation process used to produce ethanol at an industrial corn processing complex in Decatur, Illinois, Transportation to a dedicated geological storage site.</td>
<td>1 Mtpa</td>
<td>2017</td>
<td>Operational</td>
<td>Administered by the U.S. Department of Energy’s Office of Fossil Energy and managed by the National Energy Technology Laboratory and by a cost share agreement with the Archer Daniels Midland Company, University of Illinois through the Illinois State Geological Survey, Schumberger Carbon Services, and Richland Community College</td>
<td></td>
</tr>
<tr>
<td>USA Texas</td>
<td>Petra Nova</td>
<td>Power and capture (post-combustion), EOR</td>
<td>Power generation</td>
<td>Texas power plant retrofitted with post-combustion CO₂ capture facility, transportation near Houston for EOR.</td>
<td>1.4 Mtpa</td>
<td>2017</td>
<td>Operational</td>
<td>NRG Energy and JX Nippon Oil</td>
<td></td>
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<tr>
<td>USA Kansas</td>
<td>Coffeyville Gasification Plant</td>
<td>Industrial capture</td>
<td>Fertiliser production</td>
<td>Fertilizer plant in Coffeyville retrofitted with CO₂ compression and dehydration facilities, oil delivery to the North Burbank oil unit in Osage county, Oklahoma for EOR</td>
<td>1 Mtpa</td>
<td>2013</td>
<td>Operational</td>
<td>Coffeyville Resources Nitrogen Fertilizers, LLC, Chapparal Energy and Blue Source</td>
<td></td>
</tr>
<tr>
<td>USA Texas</td>
<td>Air Products Steam Methane Reformer</td>
<td>Industrial capture</td>
<td>Hydrogen production for oil refining</td>
<td>Air products retrofitted of steam methane reformer within a refinery at Port Arthur, Texas, transportation to oil field in Texas for EOR</td>
<td>1 Mtpa</td>
<td>2013</td>
<td>Operational</td>
<td>Air Products, Covestro</td>
<td></td>
</tr>
<tr>
<td>USA Wyoming</td>
<td>Lost Cabin Gas Plant</td>
<td>Industrial capture</td>
<td>Natural gas processing</td>
<td>Gas plant in Wyoming supplies CO₂ to compression facility, transport and delivery via pipeline to the Bell Creek oil field in Montana for EOR</td>
<td>Approx. 1 Mtpa</td>
<td>2013</td>
<td>Operational</td>
<td>ConocoPhillips</td>
<td>ConocoPhillips</td>
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<tr>
<td>USA Texas</td>
<td>Century Plant</td>
<td>Industrial capture, EOR</td>
<td>Natural gas processing</td>
<td>Natural gas treatment facility in Texas, transportation via pipeline for EOR</td>
<td>8.4 Mtpa</td>
<td>2010</td>
<td>Operational</td>
<td>Occidental Petroleum</td>
<td></td>
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<tr>
<td>USA North Dakota</td>
<td>Great Plains Synfuels Plant and Weyburn-Midale</td>
<td>Industrial capture (pre-combustion), EOR</td>
<td>Natural gas processing</td>
<td>The plant in North Dakota produces CO₂ as part of a coal gasification process, transportation to the Weyburn and Midale oil units for EOR</td>
<td>3 Mtpa</td>
<td>2008</td>
<td>Operational</td>
<td>Dakota Gasification Company</td>
<td></td>
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<tr>
<td>USA Wyoming</td>
<td>Shute Creek Gas Processing Plant</td>
<td>Industrial capture, EOR</td>
<td>Natural gas processing</td>
<td>Gas treating facility in Wyoming, some CO₂ injected for sequestration/disposal, some for EOR</td>
<td>7 Mtpa</td>
<td>1986</td>
<td>Operational</td>
<td>ExxonMobil</td>
<td>ExxonMobil</td>
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</tbody>
</table>

* Project where IOGP members are involved

Source: Global CCS Institute and IOGP data
<table>
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<tr>
<th>LOCATION</th>
<th>PROJECT NAME</th>
<th>PROJECT TYPE</th>
<th>INDUSTRY</th>
<th>DESCRIPTION</th>
<th>CO2 CAPTURED/YEAR</th>
<th>STARTING DATE (OPERATION)</th>
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<tbody>
<tr>
<td>USA</td>
<td>Enid Fertilizer</td>
<td>Industrial capture, fertilizer production, EOR</td>
<td>Fertilizer production</td>
<td>CO2 captured from the manufacture of fertilizer, transportation for use in EOR at the Golden Trend oilfield and the Sko-Vol-Tum oilfield, south of Oklahoma City</td>
<td>0.7 Mtpa</td>
<td>1982</td>
<td>Operational</td>
<td>Koch Nitrogen Company</td>
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<tr>
<td>USA</td>
<td>Terrell Natural Gas Processing Plant (formerly Del Verde)</td>
<td>Industrial capture, EOR</td>
<td>Natural gas processing</td>
<td>CO2 capture at natural gas processing plant, CO2 transportation via Valero pipeline to Mcаемy, Texas, and the Canyon Reef Carriers CRC pipeline and the Pecos pipeline, CO2 for EOR</td>
<td>Approx 0.5 Mtpa</td>
<td>1972</td>
<td>Operational</td>
<td>Blue Source and others</td>
<td></td>
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<tr>
<td>USA</td>
<td>Wabash CO2 Sequestration</td>
<td>Industrial capture</td>
<td>Fertilizer production</td>
<td>Gasification plant in Indiana to be converted into an anhydrous ammonia production plant and CCS plant, dedicated geological storage in the Wabash carbonSAFE CO2 storage hub</td>
<td>1.5-1.75 Mtpa</td>
<td>2022</td>
<td>Advance development</td>
<td>WABASH Valley Resources (WVR)</td>
<td></td>
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<tr>
<td>USA</td>
<td>Lake Charles Methanol</td>
<td>Industrial capture, EOR</td>
<td>Chemical production</td>
<td>Gasification facility in Louisiana capturing from synthetic gas gases to make methanol and other products, captured CO2s to be used for EOR in Texas</td>
<td>Approx 4 Mtpa</td>
<td>2026</td>
<td>Advance development</td>
<td>Leucadia Energy</td>
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<tr>
<td>USA</td>
<td>Dry Fork Integrated Commercial CCS</td>
<td>Power and Capture (post-combustion), EOR</td>
<td>Power generation</td>
<td>Dry Fork coal-fired power station in Wyoming, targeting adjacent geological storage formations currently under study, EOR under consideration</td>
<td>3 Mtpa</td>
<td>2025</td>
<td>Advance development</td>
<td>The Basin Electric Power Cooperative</td>
<td></td>
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<tr>
<td>USA</td>
<td>CarbonSAFE Illinois-Macon County</td>
<td>Power and industrial capture (post-combustion), EOR</td>
<td>Power generation and ethanol production</td>
<td>CCS integration of a compression and dehydration facilities to an ethanol plant, transportation and injection in a dedicated geological storage</td>
<td>2-5 Mtpa</td>
<td>2025</td>
<td>Advance development</td>
<td>Carbon Storage Assurance Facility Enterprise (CarbonSAFE) of the U.S. Department of Energy National Energy Technology Laboratory (DOE-NETL)</td>
<td></td>
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<tr>
<td>USA</td>
<td>Project Tundra</td>
<td>Power and capture (post-combustion), EOR</td>
<td>Power generation</td>
<td>Retrofit CO2 capture plant to the Milton R. Young coal fire power station in North Dakota with a dedicated storage site. EOR under study</td>
<td>3.1-3.6 Mtpa</td>
<td>2025-2026</td>
<td>Advance development</td>
<td>Minnkota Power Cooperative</td>
<td></td>
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<tr>
<td>USA</td>
<td>Integrated Mid-Continent Stacked Carbon Storage Hub</td>
<td>Ethanol production, power generation and/or refinery, EOR</td>
<td>Ethanol production</td>
<td>CO2 collection from ethanal plants, power plants and refineries with integrated storage in Kansas and Nebraska</td>
<td>Approx 2 Mtpa</td>
<td>2025-2035</td>
<td>Advance development</td>
<td>Schlumberger</td>
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<tr>
<td>USA</td>
<td>Oxy and White Energy Ethanol EOR Facility</td>
<td>Industrial capture, EOR</td>
<td>Ethanol production</td>
<td>CO2 capture from two ethanal facilities in Hereford and Plainview, Texas. The captured CO2s will be stored via EOR at Occidental’s oil fields in Premian basin</td>
<td>0.6-0.7 Mtpa</td>
<td>2021</td>
<td>Early development</td>
<td>Occidental Petroleum Corporation and White Energy</td>
<td></td>
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<tr>
<td>USA</td>
<td>Oxy and Carbon Engineering Direct Air Capture and Eor Facility</td>
<td>Direct air capture</td>
<td>N/A</td>
<td>CO2 capture from an Occidental oil field in the Permian Basin, and used for ESR</td>
<td>1 Mtpa</td>
<td>2025</td>
<td>Early development</td>
<td>Oxy Low Carbon Ventures and Carbon Engineering Ltd</td>
<td></td>
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<tr>
<td>USA</td>
<td>Project ECOS: Early CO2 Storage Complex in Kemper County</td>
<td>Under evaluation</td>
<td>N/A</td>
<td>Regional CO2 storage hub near the Keper County Energy Facility in Mississippi from power and industrial sources</td>
<td>3 Mtpa</td>
<td>2026</td>
<td>Early development</td>
<td>In identification (capture) - Project ECOS, a DOE-supported CarbonSAFE program</td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>Cal Capture</td>
<td>Power &amp; capture</td>
<td>Power generation</td>
<td>The project is planned to capture CO2s from 550MW natural gas combined cycle plant with a total of 1.6 million tonnes per annum captured and stored. Electric Power Research Institute, California Resources Corporation, and Fluor are working together on a Front-End Engineering and Design (FEED) study based on Fluor’s amine-based Ecomamine FG Plus process. The captured CO2s will be either stored or used for EOR in the nearby Elk Hills Oil Field</td>
<td>1.6 Mtpa</td>
<td>mid 2026</td>
<td>Advanced development</td>
<td>Ictric Power Research Institute, California Resources Corporation, Fluor.</td>
<td></td>
</tr>
</tbody>
</table>

* Project where IOGP members are involved

Source: Global CCS Institute and IOGP data
### CCUS projects in NORTH AMERICA

27. LafargeHolcim Cement Carbon Capture* 
28. Prairie State Generating Station Carbon Capture
29. The Illinois Clean Fuels Project
30. Plant Daniel Carbon Capture
31. Velocys’ Bayou Fuels Negative Emission Project
32. Gerald Gentleman Station Carbon Capture
33. San Juan Generating Station Carbon Capture
34. Red Trail Energy BECCS Project
35. Mustang Station of Golden Spread Electric Cooperative Carbon Capture
36. The ZEROS Project

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#### Table: CCUS Projects in NORTH AMERICA

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<th>LOCATION</th>
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<tr>
<td>USA California</td>
<td>Clean Energy Systems Carbon Negative Energy Plant - Central Valley</td>
<td>Power &amp; capture</td>
<td>Power &amp; hydrogen production</td>
<td>Clean Energy Systems is developing its commercial Carbon Negative Energy plant in an existing biomass gasification plant, part of an existing biomass gasification plant, in the Central Valley by 2025, capturing around 0.35 million tonnes per annum CO₂ via bio-energy with CCS.</td>
<td>0.35 Mtpa</td>
<td>2025</td>
<td>Early development</td>
<td>Clean Energy Systems</td>
<td></td>
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<tr>
<td>USA Colorado</td>
<td>LafargeHolcim Cement Carbon Capture</td>
<td>Industrial capture</td>
<td>Cement production</td>
<td></td>
<td>0.725 Mtpa</td>
<td>mid 2020s</td>
<td>Early development</td>
<td>Sravie, LafargeHolcim, Oxy Low Carbon Ventures and Total</td>
<td>Total</td>
</tr>
<tr>
<td>USA Illinois</td>
<td>Prairie State Generating Station Carbon Capture</td>
<td>Power &amp; capture</td>
<td>Power generation</td>
<td>The University of Illinois was awarded a project by the U.S. Department of Energy to perform a front-end engineering and design (FEED) study to capture 5.6 million tonnes per annum CO₂ from the 814 MW coal-fired unit of Prairie State Energy Campus. Mitsubishi Heavy Industries’ new KS-2T and Advanced KM CDR Process will be evaluated as the key technology for carbon capture.</td>
<td>5.6 Mtpa</td>
<td>mid 2020s</td>
<td>Advanced development</td>
<td>The University of Illinois</td>
<td></td>
</tr>
<tr>
<td>USA Illinois</td>
<td>The Illinois Clean Fuels Project</td>
<td>Industrial capture</td>
<td>Chemical production</td>
<td>The project is in development to produce sustainable aviation fuel and renewable diesel from municipal solid waste with a deeply negative lifecycle carbon intensity via capturing 2.7 Mtpa CO₂ in the initial phase.</td>
<td>2.7 Mtpa</td>
<td>2025</td>
<td>Early development</td>
<td></td>
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<tr>
<td>USA Mississippi</td>
<td>Plant Daniel Carbon Capture</td>
<td>Power &amp; capture</td>
<td>Power generation</td>
<td>A carbon capture plant retrofit Front-End Engineering and Design (FEED) study using the Southern Company subsidiary Mississippi Power’s Plant Daniel existing natural gas-fired combined cycle power plant, as a basis is currently underway by Southern Company Services and Linde-BASF.</td>
<td>N/A</td>
<td>mid 2020s</td>
<td>Advanced development</td>
<td>Southern Company Services and Linde-BASF</td>
<td></td>
</tr>
<tr>
<td>USA Mississippi</td>
<td>Velocys’ Bayou Fuels Negative Emission Project</td>
<td>Industrial capture</td>
<td>Chemical production</td>
<td>Oxy Low Carbon Ventures, LLC is planning to take transport and store CO₂ captured from the Velocys’ proposed Bayou Fuels biomass-to-fuels facility. When in operation in 2024, the plant will capture 0.3 to 0.5 million tonnes CO₂ per annum while enabling the production of negative emission transportation fuels.</td>
<td>0.3-0.5 Mtpa</td>
<td>2024</td>
<td>Early development</td>
<td>Oxy Low Carbon LLC</td>
<td></td>
</tr>
<tr>
<td>USA Nebraska</td>
<td>Gerald Gentleman Station Carbon Capture</td>
<td>Power &amp; capture</td>
<td>Power generation</td>
<td>The project plans to capture up to 3.8 million tonnes per annum CO₂ from the 700 MW Gerald Gentleman Station Unit 2. The project is currently in Front-End Engineering and Design (FEED) study awarded by the US DOE.</td>
<td>3.8 Mtpa</td>
<td>mid 2020s</td>
<td>Advanced development</td>
<td>ION Clean Energy Inc</td>
<td></td>
</tr>
<tr>
<td>USA New Mexico</td>
<td>San Juan Generating Station Carbon Capture</td>
<td>Power &amp; capture</td>
<td>Power generation</td>
<td>Enchert Energy proposes to capture up to 6 million metric tonnes per annum CO₂ from the SJGS Unit 1 [340 MW] and Unit 6 [307 MW]. Captured CO₂ will be used for EOR in the Permian Basin. Additional CO₂ sequestration options, including an EPA-certified Class VI injection well, are under examination funded through a $17.5 million DOE CarbonSAFE award. The SJGS retrofit project FEED study awarded by the US DOE is underway.</td>
<td>6 Mtpa</td>
<td>2023</td>
<td>Advanced development</td>
<td>Enchert Energy</td>
<td></td>
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<tr>
<td>USA North Dakota</td>
<td>Red Trail Energy BECCS Project</td>
<td>Industrial capture</td>
<td>Ethanol production</td>
<td>Red Trail Energy has undertaken a preliminary feasibility study in building a CCS facility including a site-specific geological evaluation, capturing around 0.18 Mtpa CO₂ from its ethanol production facility.</td>
<td>0.18 Mtpa</td>
<td>2025</td>
<td>Early development</td>
<td>Red Trail Energy</td>
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<tr>
<td>USA Texas</td>
<td>Mustang Station of Golden Spread Electric Cooperative Carbon Capture</td>
<td>Power &amp; capture</td>
<td>Power generation</td>
<td>The University of Texas at Austin is conducting a Front-End Engineering and Design study for CO₂ captures at the Mustang Station using Piperaivane Advanced Stripper (PZAS) process. The Mustang Station is a 400 MW natural gas-fired combined cycle power plant.</td>
<td>N/A</td>
<td>mid 2020s</td>
<td>Advanced development</td>
<td>The University of Texas</td>
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<tr>
<td>USA Texas</td>
<td>The ZEROS Project</td>
<td>Power &amp; capture</td>
<td>Power generation</td>
<td>The ZEROS project is a proposed two-plant project designed to gasify and combust waste fuels in an oxyfuel-based process. This ensures high CO₂ concentrations in fuel gas, suitable for capture and storage.</td>
<td>N/A</td>
<td>late 2020s</td>
<td>In construction</td>
<td>Summit Power</td>
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</tbody>
</table>

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* Project where IOGP members are involved

Source: Global CCS Institute and IOGP data
### CCUS projects in CENTRAL AND SOUTH AMERICA

1. Petrobras Santos Basin Pre-salt Oil Field CCS*

### CCUS projects in MIDDLE EAST

1. N/A
2. Qatar LNG CCS*
3. Uthmaniyah CO2-EOR Demonstration*
4. Abu Dhabi CCS (Phase 1 being Emirates Steel Cindustries)*
5. Abu Dhabi CCS Phase 2 - Natural Gas Processing Plant*

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**Source:** Global CCS Institute and IOGP data

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<tr>
<th>LOCATION</th>
<th>PROJECT NAME</th>
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<th>INDUSTRY</th>
<th>DESCRIPTION</th>
<th>CO2 CAPTURED/YEAR</th>
<th>STARTING DATE (OPERATION)</th>
<th>STATUS OF THE PROJECT</th>
<th>PARTICIPANTS</th>
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<td>Brazil</td>
<td>Petrobras Santos Basin Pre-salt Oil Field CCS</td>
<td>Industrial capture</td>
<td>Natural gas processing</td>
<td>CO2 separation and injection systems on board four floating production storage and offloading (FPSO) vessels. The CO2 is separated on site as part of the natural gas processing and injected for EOR.</td>
<td>3 Mtpa</td>
<td>2013</td>
<td>Operational</td>
<td>Petrobras</td>
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<td>MIDDLE EAST</td>
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<td>2013</td>
<td>Operational</td>
<td>Petrobras</td>
<td>Petrobras</td>
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<tr>
<td>Qatar</td>
<td>Ras Laffan</td>
<td>EOR</td>
<td>Natural gas processing</td>
<td>CO2 sequestration from Ras Laffan LNG facilities</td>
<td>2.1 Mtpa (3 Mtpa by 2025)</td>
<td>2013</td>
<td>Operational</td>
<td>Qatar Petroleum</td>
<td></td>
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<tr>
<td>Qatar</td>
<td>Qatar LNG CCS</td>
<td>Power &amp; capture</td>
<td>Natural gas processing</td>
<td>Qatar currently separate CO2 in the Ras Laffan production from its North Field. The CO2 capture and storage capacity is approximately 2.1 million tonnes per annum.</td>
<td>2.1 Mtpa</td>
<td>2019</td>
<td>Operational</td>
<td>Qatar Gas</td>
<td>Qatar Gas</td>
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<td>Saudi Arabia</td>
<td>Uthmaniyah CO2-EOR Demonstration</td>
<td>Industrial capture</td>
<td>Natural gas processing</td>
<td>CO2 capture at the Hawiyah gas plant, transportation to Uthmaniyah in the Ghawar field</td>
<td>0.8 Mtpa</td>
<td>2015</td>
<td>Operational</td>
<td>Saudi Aramco</td>
<td>Saudi Aramco</td>
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<tr>
<td>United Arab Emirates Mussafah</td>
<td>Abu Dhabi CCS (Phase 1 being Emirates Steel Cindustries)</td>
<td>Industrial capture</td>
<td>Natural gas processing</td>
<td>CO2 capture from the iron and steel industry in Mussafah, transportation to ADNOC oil reserves for EOR.</td>
<td>0.8 Mtpa</td>
<td>2016</td>
<td>Operational</td>
<td>Abu Dhabi National Oil Company (ADNOC)</td>
<td>ADNOC</td>
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<tr>
<td>United Arab Emirates Mussafah</td>
<td>Abu Dhabi CCS Phase 2 - Natural Gas Processing Plant</td>
<td>Industrial capture</td>
<td>Iron and steel production</td>
<td>CO2 capture from gas processing plant for EOR. Both phase 1 and 2 will store CO2 in the same reservoir.</td>
<td>1.9-2.3 Mtpa</td>
<td>2025</td>
<td>Advanced development</td>
<td>Abu Dhabi National Oil Company (ADNOC)</td>
<td>ADNOC</td>
</tr>
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### CCUS projects in AFRICA

1. Mellitah Complex CO2 Management*
2. Pilot Carbon Storage Project (PCSP)

* Project where IOGP members are involved

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<td>Libya</td>
<td>Mellitah Complex CO2 Management</td>
<td>CO2 separation from raw gas</td>
<td>Natural gas production and processing</td>
<td>CO2 (process) is separated from the raw gas produced by several reservoirs and treated at onshore facilities. CO2 is injected into offshore depleted reservoirs</td>
<td>3 Mtpa</td>
<td>2023-2025 FEED</td>
<td>Under evaluation</td>
<td>Eni, National Oil Company</td>
<td>Ene</td>
</tr>
<tr>
<td>South Africa</td>
<td>Zululand Basin Pilot Carbon Storage Project (PCSP)</td>
<td>N/A</td>
<td>Under evaluation</td>
<td>The PCSP constitutes the next critical phase of CCS development in South Africa. The project will constitute a proof of concept for CCS as well as capacity building in the country and is an important step in South Africa’s CCS roadmap. The project involves the injection, storage and monitoring of 10,000-50,000 tonnes of supercritical CO2 in an onshore deep saline formation with the target being the onshore Zululand Basin.</td>
<td>0.01-0.05 Mtpa</td>
<td>2020 Advanced development</td>
<td>Under evaluation</td>
<td>Eni, National Oil Company</td>
<td>Ene</td>
</tr>
</tbody>
</table>