GLOBAL CCS INSTITUTE

TECHNICAL REPORT

STATE OF THE ART: CCS TECHNOLOGIES 2026

HUGH BARLOW, Senior Carbon Capture Technology Lead

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FOREWORD

Carbon capture and storage (CCS) is a crucial tool in addressing global greenhouse gas emissions and tackling climate change. Scaled deployment of advanced CCS technologies is urgently needed to meet emissions targets across industries such as cement, steel, chemicals, natural gas, and power generation.

CCS project activity continues to grow, with new projects under construction and in operation that use advanced technologies across the value chain. The uptake of these technologies, however, must continue to accelerate to address today's sources of emissions and the removal of CO_2 from the atmosphere.

The 2026 *"State of the Art: CCS Technologies"* compendium continues the aim of our past editions: connecting technology developers and providers with decision-makers, project developers, and designers. Technology firms across the CCS landscape are represented, emerging and established, all seeking to further drive innovation in performance, reliability, energy efficiency, and, most importantly, cost. The entries in this edition cover a range of methods in capture, transport, and storage to accelerate the development of the full CCS value chain.

The *"State of the Art: CCS Technologies"* compendium showcases the breadth and depth of CCS technology ready for deployment and already deployed today, as well as technologies in the process of reaching full commercial readiness.

The current CCS technological capabilities and upcoming future developments submitted here show the strong capabilities ready to support the scale-up of CCS to meet our decarbonisation targets and accelerate the overall deployment of CCS globally. We hope you find this publication useful in your endeavours, as designers, developers, or advocates.

Hugh Barlow
Global CCS Institute
July 2026

Acknowledgements

We are grateful for the contributions and support of all the submitters who have provided content to this publication.

We are also grateful for the Members of the Global CCS Institute, whose Membership enables the Institute to develop catalytic thought leadership pieces, publications such as this Technology Compendium, our annual Global Status Report and a variety of other publications that can be found on *our website.*

Special mentions of acknowledgment go to Aishah Hatta, Alex Zapantis, Carlo Maccherini, Chris Consoli, David Kearns, Elena Leva, Hannah Galbraith-Olive, Hiroshi Nambo, Jess Oglesby, Jessica Raines, Kazuko Miyashita, Maryem El Farsaoui, Matt Bright, Mohammad Abu Zahra, Mojtaba Seyyedi, Richard Leese, Ruth Gebremedhin, Traci Rodosta, Xiaoliang Yang, Yasuo Murakami, Yi Wu and many more across the Institute for their time, efforts, and care with developing this publication.

EDITOR'S NOTES

The Global CCS Institute ("The Institute") is an international think tank whose mission is to accelerate the deployment of carbon capture and storage, a suite of technologies to tackle climate change and deliver climate neutrality.

The Institute produces the *State of the Art: CCS Technologies* ("The Technology Compendium") annually to provide a platform for technology owners and providers to share their solutions, and allow developers, proponents, and interested parties to discover the field's state-of-the-art offerings. This is in accordance with our mission to accelerate the deployment of CCS globally.

The Technology Compendium is a free-to-enter publication, and technology providers collaborate with the Institute to provide their information to the Technology Compendium for review and publication. The technologies presented in the 2026 Technology Compendium represent a non-exhaustive picture of the overall landscape of CCS technologies. Where there has been no submission received for the 2026 Technology Compendium, there is no presence within the Compendium. The Institute is aware of other CCS technologies not mentioned in this Technology Compendium, established and emerging, and we are working to include these technologies in future editions.

If you wish to make a submission to the next edition of the Technology Compendium, please contact us via *techcompendium@globalccsinstitute.com.*

Technology Readiness Level (TRL)

In this publication, the TRL of various technologies has been reported as a part of the submission. The guidance provided to submitters for TRL assessment is provided in Table 1. For inclusion in the 2026 Technology Compendium, a Technology must have a TRL of 5 or above.

Table 1: TRL Guidance Provided for 2026 Technology Compendium Submissions

CATEGORY	TRL	DESCRIPTION
Demonstration	9	Normal Commercial Service
	8	Commercial demonstration, full-scale deployment in final form
	7	Sub-scale demonstration, fully functional prototype
Development	6	Fully integrated pilot tested in a relevant environment
	5	Sub-system validation in a relevant environment
	4	System validation in a laboratory environment
Research	3	Proof-of-concept tests, component level
	2	Formulation of the application
	1	Basic principles, observed, initial concept

Key Data Table

The Key Data Table is a section of the Technology Submission Template used to outline the capabilities of individual technologies presented on parameters of interest. For Capture Technologies, the parameters are fixed, however for Capture Enabling, Transport, and Storage Technologies the parameters can be adjusted to better reflect the parameters of interest for each technology. The only required parameter across all submissions is the TRL, assessed against the guidance in Table 1.

Definitions of Note for the Key Data Table:

Capture Percentage (%): This is the percentage of CO_2 captured from the inlet stream to a capture technology. A facility may have more than one source of CO_2 emissions – when considering capture percentages, only the specific source directed to a capture plant is considered.

Source CO_2 Purity Range: This is the range of CO_2 concentrations for which a technology is suitable for deployment. This is generally in mol%.

Energy Consumption (GJ or kWh(e)/tCO_2): This is the energy involved in the operation of a technology across the entire system of capture. This can be electric power. This value may include the net effect of waste heat recovery systems or other energy integration. Where these systems may have an impact, but the impact depends on the host site, this is noted.

Specific Regen. Energy (GJ or kWh(e)/tCO_2): This is the "specific regeneration energy". This data point is the amount of energy required to capture CO_2 and regenerate a technology for continuous operation. No waste heat recovery or other energy recovery is included in this data point. No pretreatment upstream or post-treatment downstream of a capture unit is included in this data point.

Front Cover Image: The Ravenna CCS plant at the Casalborsetti Gas Plant, Italy. Image courtesy of Eni / Snam

Foreword Image: The Glacier Gas Plant in Alberta, Canada. Image courtesy of Entropy.

BASF
We create chemistry

BASF OASE® GAS TREATING EXCELLENCE

OASE® white

SUMMARY

At BASF, we create chemistry for a sustainable future. With more than 50 years of experience and 500+ reference plants worldwide, BASF offers customers amine-based gas treating solutions under the OASE® brand name for a variety of applications.

OASE® white is a proven technology for removing CO_2 and H_2S from synthesis gas (syngas). It has been widely used in industrial ammonia, hydrogen and syngas production. Known for its versatility and reliability, OASE® white consistently meets the requirements across a wide range of feed compositions. OASE® white also plays a key role in **low carbon energy** solutions, supporting blue hydrogen and blue ammonia production through highly efficient CO_2 capture rate up to 99.99 mol% while meeting the CO_2 purity requirement for carbon capture and storage (CCS). With its superior energy consumption and flexible design configurations, OASE® white remains a leading choice for large-scale production.

BENEFITS

- Collaboration with reputable technology licensors and engineering partners, integrated into their technology packages with performance warranties
- Proven track records in diverse applications i.e. steam methane reforming (SMR), autothermal reforming (ATR), partial oxidation (POX), pressure swing adsorption (PSA) tail gas, direct reduction iron (DRI), gasification and specialty chemicals
- Experience with revamps for plant debottlenecking and energy optimization
- Customised solution with CAPEX and OPEX optimised designs enabled by OASE® connect digital platform
- **Innovation: Low-low pressure (LLP) flash configuration with even better energy efficiency than best-in-class two-stage absorption process**

REFERENCES

Demonstration

- Tomakomai CCS Demonstration Project, Japan

Operational

- Multiple world scale SMR based ammonia plants, including capacity >3000 mtpd
- DRI steel plants in India, Saudi Arabia and UAE

Under Construction

- World scale ATR based ammonia and hydrogen projects in Australia and USA respectively

Front End Engineering Design (FEED)

- HyNet Low Carbon Hydrogen Production Plant (HPP1), UK

KEY DATA

TRL	9	Capture Rate Range (tpd)	20 - 4,000+	Capture Efficiency (%)	99.9
Source CO_2 Feed Range (vol%)	3 - 40%+	System Energy (GJ/tCO_2)	-	Specific Regen. Energy (GJ/tCO_2)	0.6 - 3.6*
Number of Commercial Plants	300+	Number of Pilot Plants	-	Modular (Y/N)	Yes
Target Industries	Ammonia, Hydrogen, Syngas, Steel, Low carbon fuels				

*Process and configuration specific

BASF
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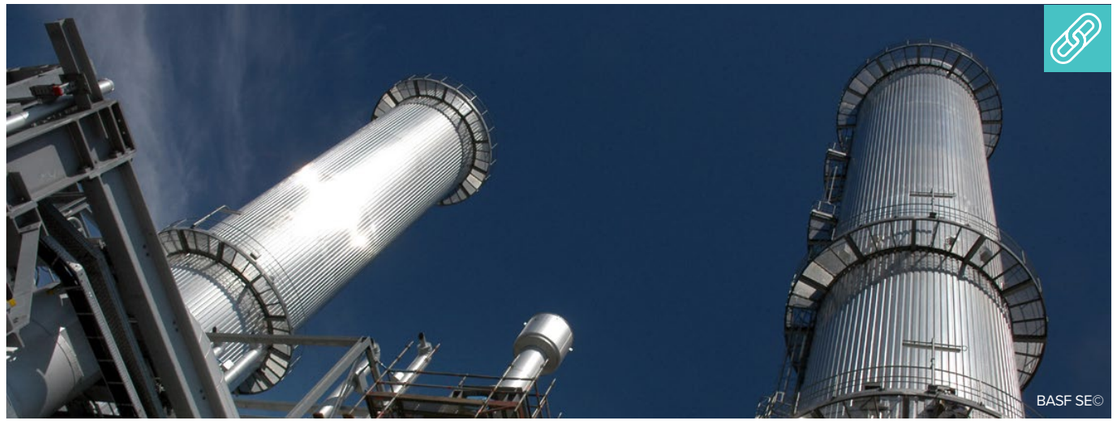
BASF OASE® GAS TREATING EXCELLENCE

OASE® blue



SUMMARY

At BASF, we create chemistry for a sustainable future. With more than 50 years of experience and 500+ reference plants worldwide, BASF offers customers amine-based gas treating solutions under the OASE® brand name for a variety of applications.

OASE® blue is a proven post combustion CO_2 capture technology based on innovative BASF's chemistry. Its **advanced solvent** demonstrates low energy consumption, low solvent losses and an exceptionally flexible operating range for flue gas with a wide range of composition, making it well-suited for both carbon capture storage and utilization (CCUS) applications.

BENEFITS

- **Project execution and commercial flexibility:** Non-exclusivity, plant design and troubleshooting, performance warranties
- **Global solvent supply:** In house solvent production and robust global supply chain to ensure consistent availability and quality
- **Customised solution:** CAPEX and OPEX optimised designs enabled by OASE® connect digital platform
- **Digitalization:** Solvent health monitoring with OASE® digilab
- **Environmental management:** Equipped with patented OASE® aerozone® design to reduce aerosol & vapor driven emission and amine losses

REFERENCES

Pilot & Demonstration

- RWE Niederaussem, Germany
- National Carbon Capture Center, USA
- CSSC Power (Group) Corporation Limited (CPGC), China: CO_2 capture pilot unit for marine engine exhaust gas
- City, Water, Light & Power (CWLP), USA: One of the largest CO_2 capture demonstration units for coal based power plant (200 tpd)

Operational: Commercial CCU Application

- Solvay-SIAD, Italy: Lime kiln and Process gas
- Messer, Austria: Lime kiln
- Linde-Heidelberg Materials CAP2U, Germany: Cement

Front End Engineering Design (FEED) Studies

- Southern Company's Natural Gas Combined Cycle and CO_2 capture project in USA, in joint collaboration with GE Vernova, Linde and Kiewit
- Kredsløb Waste-to-Energy and Biomass Power Plant CO_2 capture project in Denmark with ANDRITZ
- Forestal del Atlántico's Triskelion e-MeOH project in Spain

KEY DATA

TRL	9	Capture Rate Range (tpd)	10 - 10,000	Capture Efficiency (%)	>95
Source CO_2 Purity Range	3 - 40%+	System Energy (GJ/tCO_2)	-	Specific Regen. Energy (GJ/tCO_2)	as of 2.2*
Number of Commercial Plants	3	Number of Pilot Plants	4	Modular (Y/N)	Yes
Target Industries	Cement, Power Generation (Coal/Natural Gas), Blue Hydrogen/Ammonia, E-fuels, Waste-to-Energy, Marine				

*Excluding any waste heat recovered at CO_2 compression or flue gas upstream CO_2 Absorber

CAPTURE

BASF
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BASF OASE® GAS TREATING EXCELLENCE

OASE® green

SUMMARY

At BASF, we create chemistry for a sustainable future. With more than 50 years of experience and 500+ reference plants worldwide, BASF offers customers amine-based gas treating solutions under the OASE® brand name for a variety of applications.

OASE® green is a proven technology for capturing CO_2 for biogas application i.e conventional biogas upgrading with a targeted CO_2 slip of 2-5 vol.% CO_2 in the treated gas as well as for bio-LNG (liquefied biomethane) with a targeted CO_2 slip of <50 ppmv in the treated gas.

The design and configuration of the OASE® green unit can be customised depending on the customer's requirements, both CAPEX and OPEX optimised designs are possible. All designs are energy-efficient and show **very low methane losses and high CO_2 purity.**

BENEFITS

BASF provides:

- Non-exclusive access to OASE® green technology for customers and engineering companies
- Unique licensing model integrated with OASE® solvent sales produced and supplied by BASF
- Customised design, operating and analytical manuals
- Performance warranties
- OASE® connect digital platform for plant design and performance monitoring
- OASE® digilab with the capability to analyse the composition of OASE® green solvent in near real time

Latest Improvements

- BASF has recently re-engineered the formulation of the OASE® green solvent as well as optimised the technology to offer more operational benefits

REFERENCES

Operational

Feed gas capacity: 3000-6000 Nm^3/h

- Biogas upgrading plant in India: Produced from agricultural residues for use as compressed biogas (CBG)
- Biogas upgrading plant in Germany and USA: Produced from biomass for use in biorefinery

KEY DATA

TRL	9	Capture Rate Range (tpd)	-	Capture Efficiency (%)	>99
Source CO_2 Purity Range	40 - 50%+	System Energy (GJ/tCO_2)	-	Specific Regen. Energy (GJ/tCO_2)	2.0 - 2.5*
Number of Commercial Plants	8	Number of Pilot Plants	-	Modular (Y/N)	Yes
Target Industries	Biogas upgrading*, Bio-LNG				

* Process and configuration specific.

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BASF OASE® GAS TREATING EXCELLENCE

OASE® purple

At BASF, we create chemistry for a sustainable future. With more than 50 years of experience and 500+ reference plants worldwide, BASF offers customers amine-based gas treating solutions under the OASE® brand name for a variety of applications.

OASE® purple technology has proven its versatility and reliability in natural-gas applications, where it is used for the removal of acid gases such as CO_2 and H_2S. It offers broad range of solutions, including bulk and selective acid gas removal for sales gas and deep acid gas removal for liquefied natural gas (LNG) applications. Leveraging BASF's extensive technical experience and reference plants in these applications, OASE® purple designs can be **tailored to a wide range** of feed gas and product specifications; while optimizing CAPEX and OPEX in line with project requirements. BASF's design capabilities also extend to **floating** application, supported by established operational references.

BENEFITS

- Designed to handle CO_2, H_2S, COS and mercaptans removal with high operational flexibility
- Customised solution for greenfield, revamp, debottlenecking and solvent swap projects, supported by OASE® connect digital platform
- Flexible collaboration with engineering partners, contractors and customers for project delivery
- Superior energy efficiency and performance warranties
- Global solvent availability and technical support
- Operational knowhow in plant troubleshooting
- Quick solvent health monitoring with OASE® digilab
- Maximizing operational benefits with BASF Durasorb® adsorbents for efficient removal of contaminants
- Expertise in Computational Fluid Dynamics (CFD) and marinized design for floating application

REFERENCES

Operational

- Acid gas removal unit (AGRU) integrated with one of the world largest carbon capture and storage (CCS) sequestration sites
- Global presence and proven track records in mega LNG plants with >7 mtpa LNG per train
- Floating application: PETRONAS PFLNG DUA, Malaysia and Eni Coral South FLNG, Mozambique

Under Construction

- Several large scale LNG and sales gas plants in Africa, Asia and North America
- Qatar Energy North Field Expansion Project
- Nearshore and deep-sea FLNG plants

KEY DATA

TRL	9	Capture Rate Range (tpd)	up to 7,000+	Capture Efficiency (%)	99.9
Source CO_2 Feed Range (vol%)	0.05 - 40%+	System Energy (GJ/tCO_2)	-	Specific Regen. Energy (GJ/tCO_2)	0.7 - 4.0*
Number of Commercial Plants	160+	Number of Pilot Plants	-	Modular (Y/N)	Yes
Target Industries	Sales gas, LNG, Floating Liquefied Natural Gas (FLNG), Floating Production, Storage, and Offloading (FPSO)				

*Process and configuration specific

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To find out more about the Global CCS Institute including Membership and our Consultancy services, visit globalccsinstitute.com or contact us.

AMERICAS

Washington DC, United States

americasoffice@globalccsinstitute.com

AUSTRALIA

Melbourne, Australia

info@globalccsinstitute.com

CHINA

Beijing, China

chinaoffice@globalccsinstitute.com

JAPAN

Tokyo, Japan

japanoffice@globalccsinstitute.com

MIDDLE EAST AND NORTH AFRICA

Abu Dhabi, United Arab Emirates

menaregion@globalccsinstitute.com

UNITED KINGDOM

London, United Kingdom

ukoffice@globalccsinstitute.com