

# Carbon Capture and Storage (CCS) For Natural Gas Power

A Primer for Corporate Energy Buyers



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# Executive Summary

Energy buyers have many decisions to weigh when it comes to decarbonizing their operations. This primer presents the considerations for using carbon capture and storage (CCS) to mitigate emissions from natural gas-fueled power generation, an important electricity source in the U.S. and globally.

Though not yet deployed at scale with natural gas generation, CCS is a mature and proven suite of technologies expected to be capable of reducing CO<sub>2</sub> stack emissions from natural gas power plants by 90% or more. CCS projects at natural gas-fired power plants are now under construction and expected to come online between 2028 and 2030. However, these projects remain economically challenging, absent from a combination of long-term offtake, supportive market structures, and policy incentives. With rising energy demand and enhanced 45Q tax incentives, energy buyers have a timely opportunity to play a decisive role in enabling early CCS deployment and accelerating cost reductions over time.

## AUTHORS & ACKNOWLEDGMENTS

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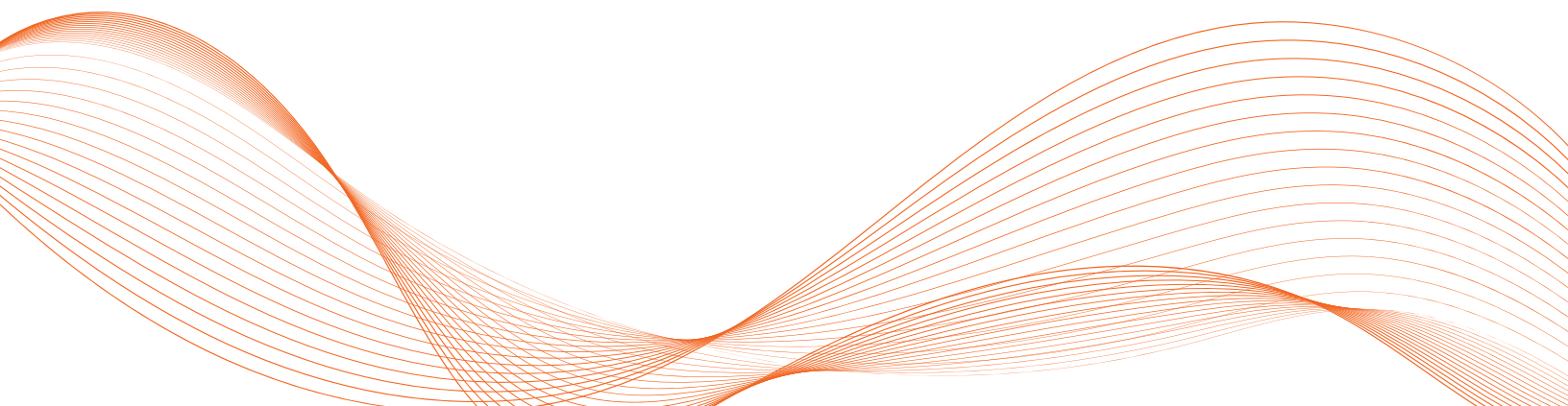
# Key Takeaways

- **Natural Gas Is a Significant Power Source:** It represents a large portion of existing and new generation capacity. Without mitigation, it will contribute to additional carbon emissions.
- **CCS Offers Clean Firm Power:** Natural gas remains important because it can generate power at any time of day and year, and combined cycle natural gas turbines provide that steady output. CCS addresses natural gas's CO<sub>2</sub> emissions, transforming gas from "firm" to "clean firm."
- **There Is Broad Geographic Feasibility:** Although it is not appropriate everywhere, CCS is feasible across multiple U.S. regions with CO<sub>2</sub> transportation and/or storage infrastructure.
- **Customers Can Act Now:** Contracting CCS projects can help cover the cost premium of CCS deployment and unlock systemwide climate benefits.
- **Carbon Accounting Tools Exist:** Mechanisms under the GHG Protocol's Scope 2 framework allow buyers to account for emissions reductions from electricity sources with CCS.



## This Primer Covers

- A clear explanation of CCS technologies and applications
- An overview of carbon accounting considerations for corporate buyers
- Strategic factors to evaluate CCS in your energy portfolio



# Why Corporate Buyers Should Consider CCS

Corporate buyers have been instrumental in driving clean energy innovation, leading the deployment of renewables, and pioneering contract structures like the virtual power purchase agreement (VPPA). But today, the landscape is shifting.

Electricity demand is growing at the fastest rate in three decades, driven by sectors like:



**DATA CENTERS AND AI**



**ADVANCED MANUFACTURING**



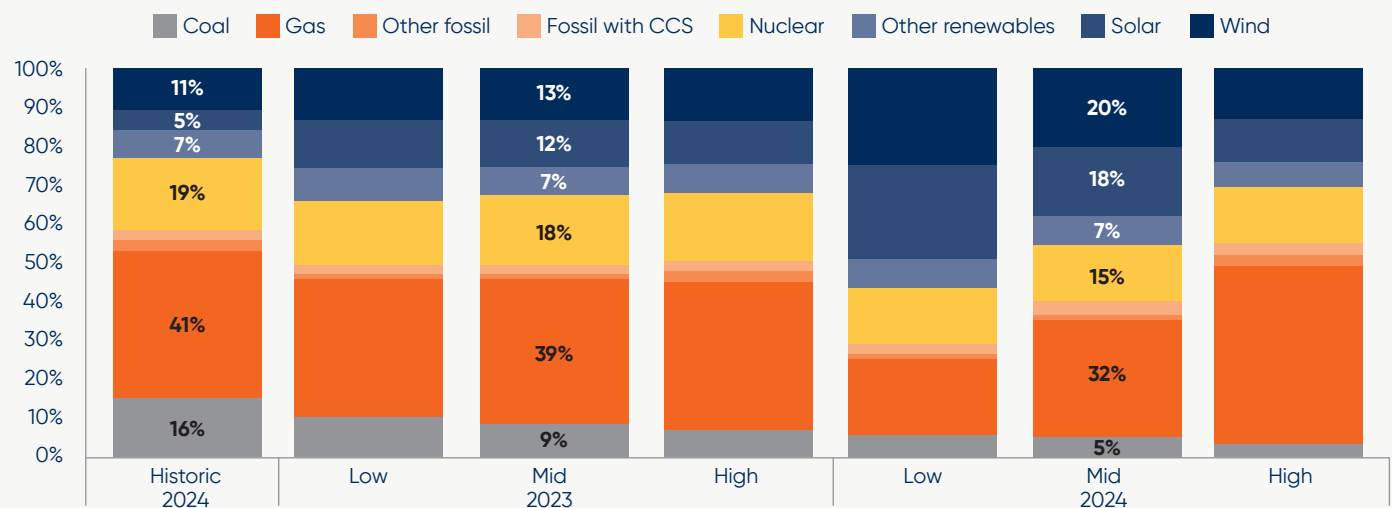
**ELECTRIFICATION OF TRANSPORT AND HEATING**

EIA (via its Short-Term Energy Outlook) projects that U.S. electricity consumption will grow in both 2025 and 2026 – with industry demand rising about 2% in 2025 and about 3% in 2026 – marking the first multiyear period of sustained growth after years of flat demand, with sustained growth through 2050.<sup>1</sup> Digital infrastructure alone is expected to see energy demands increase from 4.4% of total U.S. electricity use in 2023 to 6.7%–12% in 2028.<sup>2</sup>

Despite the growth of renewables, natural gas is projected to supply between 30%–50% of U.S. electricity through 2040, as depicted in this Rhodium Group analysis graph.

## Power Sector generation shares by fuel type

Percent of total generation



Source: Rhodium Group<sup>3</sup>

Note: The high, mid, and low ranges reflect uncertainty around future fossil fuel prices, economic growth, clean energy technology costs, and growth in LNG export capacity.

<sup>1</sup> U.S. Energy Information Administration, *Short-Term Energy Outlook (2025)*, [https://www.eia.gov/outlooks/steo/pdf/steo\\_full.pdf](https://www.eia.gov/outlooks/steo/pdf/steo_full.pdf).

<sup>2</sup> Lawrence Berkeley National Laboratory, *United States Data Center Energy Usage Report (2024)*, <https://escholarship.org/uc/item/32d6m0d1>.

<sup>3</sup> Rhodium Group, *Taking Stock 2025: US Energy and Emissions Outlook*, <https://rhg.com/research/taking-stock-2025/>.

CCS offers an opportunity for buyers with clean energy goals to expand their impact. This primer includes technology details and considerations for a corporate energy buyer to consider how CCS fits into the portfolio of decarbonization solutions. While the prices and regulatory structure presented in this paper are focused on the U.S., there are transferable technologies and considerations.



### KEY TERMS

**Carbon capture and storage (CCS):** Technologies that either prevent CO<sub>2</sub> from being released from a point source into the atmosphere or remove it directly from the atmosphere. Separated into three segments: capture, transport, and storage.

**Carbon dioxide emissions (CO<sub>2</sub>):** Per unit of electricity produced (kg CO<sub>2</sub>/MWh). For reference, a modern, high-efficiency natural gas-fired power plant without CCS produces around 400 kg CO<sub>2</sub>/MWh.<sup>4</sup>

**Carbon capture, utilization, and storage (CCUS):** CCS with added use of captured CO<sub>2</sub>. Uses include embodiment within products such as cement or for oil extraction (EOR).

**Enhanced oil recovery (EOR):** Injecting CO<sub>2</sub> into partially depleted oil reservoirs to extract additional oil and gas. CO<sub>2</sub> used in EOR remains stored in the reservoir.

**Natural gas-fired generation with carbon capture and storage (NG+CCS):** An electricity power plant fueled by natural gas and integrated with CCS.

**Class VI well:** U.S. Environmental Protection Agency (EPA)-permitted injection well for storing CO<sub>2</sub> geologically.

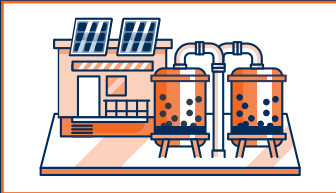
**First of a kind (FOAK):** A first-of-a-kind project is the first commercial-scale deployment of new technology, design, or process. It's the step between small pilots and widespread adoption. FOAK projects prove that technology works in the real world, at full scale, with real customers and real operational demands.

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<sup>4</sup> U.S. Department of Energy, *Environmental Baseline, Volume 1: Greenhouse Gas Emissions from the U.S. Power Sector* (2016), <https://www.energy.gov/sites/prod/files/2017/01/f34/Environment%20Baseline%20Vol.%201--Greenhouse%20Gas%20Emissions%20from%20the%20U.S.%20Power%20Sector.pdf>.

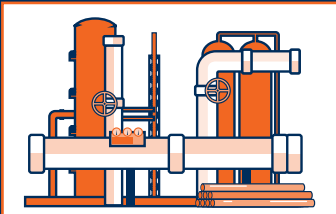
# CSS Technology Basics

Carbon capture and storage (CCS) is a suite of technologies that address carbon dioxide (CO<sub>2</sub>) emissions. The technologies offer a three-step process to prevent CO<sub>2</sub> from entering the atmosphere:



## 1. CAPTURE

**Capture:** CO<sub>2</sub> is separated from other gases produced during industrial processes or power generation. For natural gas-fired electricity generators, this typically involves using specialized chemical solvents such as amines that selectively absorb CO<sub>2</sub> from the exhaust stream and then desorb to produce a high-purity stream of CO<sub>2</sub> (i.e., flue gas). Systems can be designed to achieve capture rates as high as 90%–99%, which represent a balance between the imperative to reduce emissions and the high costs of near-100% abatement.



## 2. CO<sub>2</sub> TRANSPORT

**CO<sub>2</sub> transport:** Once captured, CO<sub>2</sub> is compressed into a dense supercritical state and moved, usually via CO<sub>2</sub> pipelines, to a storage site. Supercritical means the CO<sub>2</sub> is pressurized to the point it exhibits properties of both liquid and gas. CO<sub>2</sub> pipelines are primarily underground and made with high-grade steel with anti-corrosive coatings and have a diameter between 4 and 24 inches.<sup>5</sup> Currently, the U.S. has approximately 5,300 miles of CO<sub>2</sub> pipelines in place<sup>6</sup> (for comparison, the natural gas pipeline network is about 3 million miles).<sup>7</sup> Alternatively, the CO<sub>2</sub> can be moved by truck, rail, or ship.



## 3. CO<sub>2</sub> STORAGE

**CO<sub>2</sub> storage:** After transport to a storage site, compressed CO<sub>2</sub> is injected underground into deep saline aquifers or other porous rock formations. Impermeable, overlying rock layers trap CO<sub>2</sub>, and over time, the pore structure, dissolution processes, and chemical reactions increasingly stabilize the system. As CO<sub>2</sub> becomes increasingly immobilized through physical and chemical trapping mechanisms, the system provides durable storage for thousands of years. Storage locations are heavily vetted by expert geologists and engineers to ensure their long-term containment capacity and are extensively monitored to ensure permanence and compliance.

<sup>5</sup> "Carbon Dioxide Pipelines 101," ClearPath, accessed February 12, 2026, <https://clearpath.org/tech-101/carbon-dioxide-pipelines-101/>.

<sup>6</sup> U.S. Library of Congress, *Carbon Dioxide (CO<sub>2</sub>) Pipelines: Safety, Siting, and Eminent Domain* (June 2025), <https://www.congress.gov/crs-product/IN12575>.

<sup>7</sup> "Natural Gas Pipelines," U.S. Energy Information Administration (EIA), accessed February 12, 2026, <https://www.eia.gov/energyexplained/natural-gas/natural-gas-pipelines.php#:~:text=The%20U.S.%20natural%20gas%20pipeline.and%20storage%20facilities%20with%20consumers>.

## CCS STATUS

As of 2025, there were 77 CCS projects operational globally, with 10 in the power sector. Technologies that separate CO<sub>2</sub> from other gas streams have been used for over 50 years in chemical and natural gas processing industries. Likewise, geologic CO<sub>2</sub> storage is a mature, safe practice with decades of successful deployment. CO<sub>2</sub> injection operations for permanent geological storage have successfully taken place at a commercial scale in the U.S., Europe, and Australia.

Now with some corporate engagement, the early full-scale NG+CCS projects are likely to begin delivering decarbonized electricity between 2028 and 2030, with several more projects coming online in the early 2030s. These projects have the potential to contribute substantial quantities of clean power to Texas and the Gulf Coast (ERCOT + MISO South + SERC), the Mountain West (WECC), and some areas of the Midwest (MISO). The various projects in the U.S. that are more advanced in their development cycle have a wide range of capacities, representing between 250 MW and more than 2,000 MW each.

Currently, power providers are adding natural gas-fired generation to the grid to keep up with rapidly growing demand for firm capacity. Some of these plants are characterized as “capture-ready,” meaning that they are designed with the necessary interfaces and have reserved additional land and infrastructure access to build a capture system in the future.

While a capture-ready plant is preferable to one that has no potential for CCS, it is necessary for a project to secure offtake of clean firm power at a price that supports construction and operation of the CCS system, so they can place orders for capture equipment and work with CO<sub>2</sub> transportation and storage projects as soon as possible.



## CASE STUDY

# Google Invests in CCS

As part of its strategy to build a reliable, affordable, and clean energy future, Google has invested in a broad portfolio of emerging energy technologies. Recognizing that achieving decarbonization requires both renewable and firm power sources, the company identified advanced geothermal, advanced nuclear, long-duration energy storage, and natural gas with carbon capture and storage (CCS) as critical components of its energy strategy.

CCS was highlighted as a technology capable of delivering clean, baseload electricity while mitigating carbon emissions from natural gas-fired power plants. Google set stringent safety, environmental, and operational criteria for potential CCS projects, emphasizing the need for scalable, verifiable, and responsibly managed deployments.

### **Project Overview:**

#### **Broadwing Energy, Decatur, Illinois**

In a first-of-its-kind corporate agreement, Google is supporting the development of a natural gas power plant equipped with CCS at Broadwing Energy, in Decatur, Illinois. The project will capture and permanently store approximately 90% of its CO<sub>2</sub> emissions, providing a new source of clean, firm power for the regional grid that supports Google's data centers.

This project is the first phase of a longer-term collaboration with project developer Low Carbon Infrastructure (LCI), a portfolio company of leading infrastructure investor I Squared Capital. The partnership aims to demonstrate the commercial viability of CCS for power generation and to accelerate deployment of future facilities.

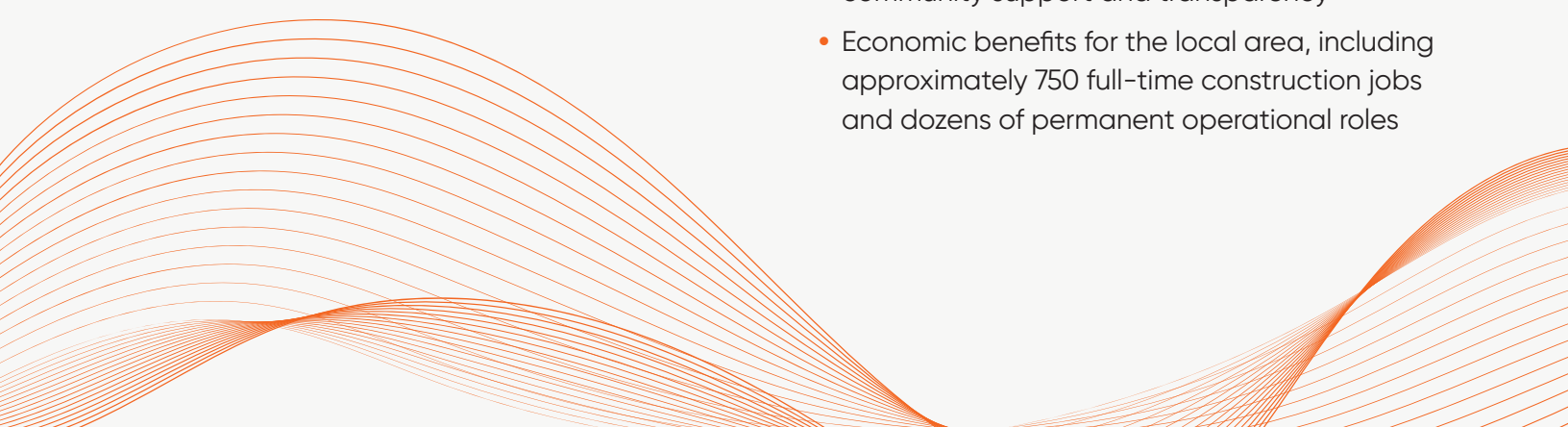
### **Technical Implementation:**

#### **How Broadwing Works**

The Broadwing project leverages existing industrial CO<sub>2</sub> storage expertise at Archer Daniels Midland (ADM), which has safely stored CO<sub>2</sub> from ethanol production for nearly a decade. The new plant will have over 400 MW of generating capacity, and the CO<sub>2</sub> produced will be permanently sequestered in EPA-approved Class VI storage facilities located more than a mile underground. The project is expected to achieve commercial operation by early 2030.

### **Key Project Design Features Include:**

- Rigorous safety and environmental standards for both plant operations and CO<sub>2</sub> storage
- Integration with ADM's existing CO<sub>2</sub> sequestration infrastructure
- Engagement with local stakeholders to ensure community support and transparency
- Economic benefits for the local area, including approximately 750 full-time construction jobs and dozens of permanent operational roles



## STRATEGIC AND MARKET IMPLICATIONS

By entering into a long-term agreement to purchase most of the electricity generated, Google is helping to de-risk the project and demonstrate the viability of CCS as a scalable solution for clean, firm power. The collaboration underscores the role of corporate buyers in accelerating first-of-a-kind projects and shaping emerging energy markets. Lessons from the Broadwing project are expected to inform:

- Technical improvements, including increasing CO<sub>2</sub> capture rates and optimizing system performance
- Financial models that make early CCS deployments commercially viable
- Standardized approaches to quantifying emissions reductions, including the use of CCS-specific Energy Attribute Certificates (EACs) for market-based accounting

## BROADER IMPACT AND FUTURE OUTLOOK

Broadwing Energy represents a model for integrating CCS into the electricity grid in a way that is safe, transparent, and economically feasible. By supporting this project, Google and its partners aim to:

- Make CCS more accessible and affordable for future deployments
- Expand clean firm generating capacity while reducing emissions from natural gas
- Establish operational and reporting standards that can be replicated globally

Alongside investments in renewables, advanced nuclear, and long-duration storage, CCS is positioned as a critical tool for achieving deep decarbonization and ensuring reliable energy supply for high-demand sectors like data centers, industrial manufacturing, and AI infrastructure.

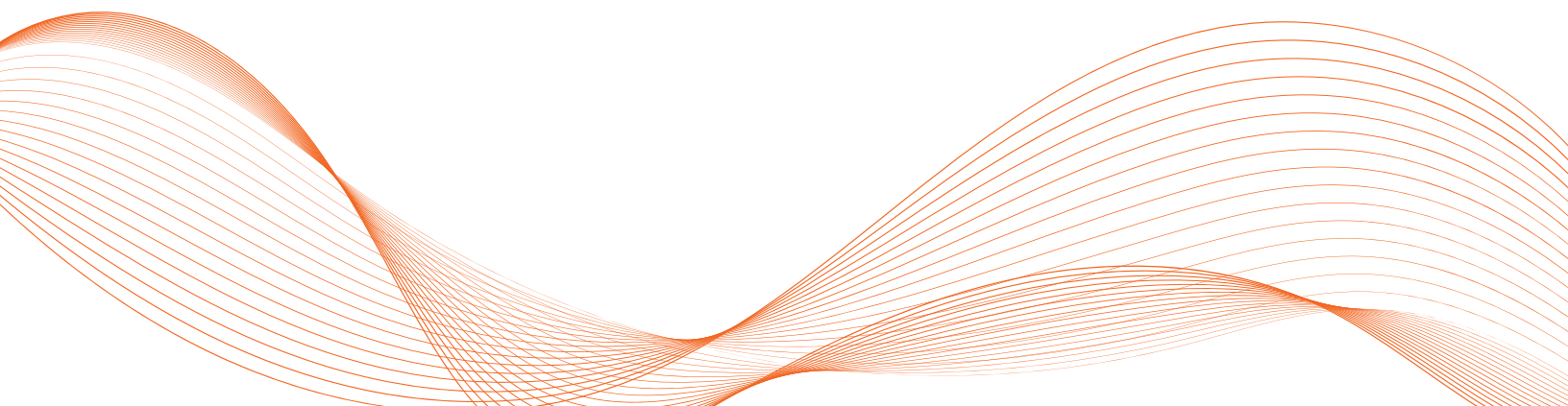
# Technology Considerations for Buyers

Understanding how CCS works helps buyers evaluate where it fits into a clean energy portfolio. As an energy buyer, there is a suite of solutions to meet decarbonization objectives. CCS might be a suitable consideration for buyers bringing new load to the grid. NG+CCS provides a clean, firm, and dispatchable power source – mirroring the reliability of traditional natural gas generation, but with significantly reduced emissions.

Carbon capture technologies work best on plants that:

<b>01</b>	<b>Operate many hours per year (have a high-capacity factor)</b>
<b>02</b>	<b>Have steady, predictable exhaust streams</b>
<b>03</b>	<b>Produce consistent volumes of CO<sub>2</sub></b>

A combined cycle gas turbine (CCGT) generally meets these criteria better than a peaker plant, which only runs during periods of high demand. Because CCGT operates more frequently and with steadier output, the carbon capture equipment can run continuously. That higher utilization helps justify the capital investment required for the capture system.





### **BENEFITS:**

- **Near-term availability:** Available today and deployable across a wide range of geographies.
- **Scalable:** CCS is a scalable solution ranging from hundreds of megawatts to gigawatts, supporting medium- to large-scale capacity needs.
- **Time to power:** NG+CCS projects can be designed, permitted, and built in 3–5 years, aligning with timelines for new natural gas capacity.
- **Source firming:** CCS enables natural gas to mitigate emissions and complement variable renewables like wind and solar, helping grids balance supply.
- **Geographic feasibility:** NG+CCS is viable in regions with growing energy demands, including California, the Great Plains, the Gulf Coast, the Midwest, the Mountain West, and Texas. However, NG+CCS cannot be deployed everywhere, particularly in locations far from underground storage sites or transport.
- **Retrofit potential:** CCS can be added to existing natural gas plants, allowing continued operation with lower emissions.

# Risks

CCS systems require energy to operate – typically consuming 10%-30% of the base plant's energy to run capture and compression equipment.<sup>8</sup> This parasitic load reduces efficiency, increases fuel use, and significantly raises operating costs compared to unmitigated natural gas. As a result, CCS introduces both technology risks (performance, scalability, reliability) and financial risks (higher costs, lower revenues, exposure to fuel prices, and heavy dependence on incentives). These factors are central to evaluating the viability of CCS in a buyer's strategy.

Like all major energy infrastructure, NG+CCS projects affect nearby communities through siting, construction, and supporting infrastructure such as pipelines. Developers should go beyond minimum regulatory requirements by engaging communities early, transparently, and consistently.

While CCS is proven in other sectors, deploying it at scale for natural gas-fired power involves first-of-a-kind (FOAK) risks and challenges.



## TECHNOLOGY RISKS

**Compound projects:** While capture, transport, and storage technologies each have track records in their respective domains, integrating all three with large-scale natural gas generation adds complexity. Delays or issues in any one component can cause cost or schedule overruns in the full project.

**Performance uncertainty:** Early full-scale capture systems on natural gas combined cycle (NGCC) units may experience underperformance, downtime, or tuning issues, which are normal for FOAK deployments. These challenges may affect capacity factors, delivery of electricity, and the timing or quantity of environmental attributes.

<sup>8</sup> National Energy Technology Laboratory, *Cost and Performance Baseline for Fossil Energy Plants Volume 1: Bituminous Coal and Natural Gas to Electricity* (May 2025), Exhibit ES-4

## FINANCIAL RISKS

**High capital costs:** CCS projects often require \$1 billion+ investments, driven by their economy of scale at hundreds of megawatts, and the need to manage hundreds of thousands of tonnes of CO<sub>2</sub> annually. For a buyer in 2025, CCS projects can represent a 30% cost premium over unabated firm gas power and a 50% cost premium over clean intermittent solar and wind power.<sup>9</sup> These costs are likely to decrease over time as FOAK risks are retired and technology matures.

**Scale dependency:** Cost-effectiveness improves with scale. Large projects may depend on multiple fractional offtakes or a collaboration/consortium of clean energy buyers.

**Fuel price exposure:** Buyers entering power purchasing agreements (PPAs) may need to negotiate how fuel and operational risks are allocated.

## REPUTATIONAL RISKS

**Market unfamiliarity:** NG+CCS is still new to many clean energy buyers and their stakeholders.

**Mixed perceptions:** Although attitudes are evolving, some stakeholders remain skeptical of fossil-based climate solutions, especially projects that use captured CO<sub>2</sub> for enhanced oil recovery (EOR).



<sup>9</sup> National Energy Technology Laboratory, *Cost and Performance Baseline for Fossil Energy Plants Volume 1: Bituminous Coal and Natural Gas to Electricity* (May 2025), Exhibit ES-4

# Regulatory Overview

Buyers are indirectly impacted by regulatory risks, with energy developers taking the primary responsibility. Therefore, as with other investments, buyers should understand the regulatory regime, as it might impact the speed to market for CCS solutions or present potential barriers to supporting decarbonization goals.

The transportation and storage of CO<sub>2</sub> is regulated at the federal level, with some state-level responsibility for permitting and siting.



## FEDERAL CO<sub>2</sub> PIPELINE REGULATIONS:

The federal government regulates CO<sub>2</sub> pipeline construction and safety standards through the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA). U.S. states retain primary authority over pipeline siting, permitting, rights-of-way, and eminent domain decisions.



## FEDERAL CARBON STORAGE REGULATIONS:

The federal government oversees a regulatory framework for CCS in accordance with provisions of the Safe Drinking Water Act and Clean Air Act. The EPA's Underground Injection Control (UIC) program establishes requirements for operating CO<sub>2</sub> injection and storage sites – permitting Class II wells for EOR and Class VI for saline aquifers. The EPA's Greenhouse Gas Reporting Program establishes requirements for monitoring, reporting, and verification (MRV). CCS projects claiming the 45Q tax credit may pursue storage via Class II or Class VI wells but must submit MRV plans to the EPA.



## STATE PERMITTING AND REGULATIONS FOR CCS:

States are responsible for permitting and siting CO<sub>2</sub> transport and CO<sub>2</sub> storage projects. States may also apply to the EPA to assume responsibility for administering UIC well permitting but must adhere to federal requirements. Many states have already applied to the EPA and received authority to administer Class II wells for EOR, but only a few states have done so for the Class VI wells needed for CCS (primacy).<sup>10</sup>

<sup>10</sup> Arizona, Louisiana, North Dakota, Texas, West Virginia, and Wyoming have received primacy from the EPA to directly administer Class VI well permits for CO<sub>2</sub> injection and storage as of early 2026.

# Economics & Incentives

CCS systems consume heat and electricity to run capture and compression equipment. This cost premium reflects the role that early adopters will play in proving and scaling the technology. Costs are expected to come down as deployment grows.

## Key Cost Drivers

Adding a carbon capture system to an NGCC plant is a capital-intensive process that increases both up-front and operational costs. Primary cost drivers include:



**Capital expenditure:** The cost of the capture equipment itself is projected to be the largest driver in most projects. This includes large equipment like absorber and stripper columns, compressors, and dehydration units.



**Operating expenses:** Capturing and compressing CO<sub>2</sub> is an energy-intensive process. This creates an energy penalty, meaning the plant requires more energy input to produce the same net electricity output, increasing its fuel costs.



**Transportation and storage:** The costs associated with transporting captured CO<sub>2</sub> and permanently sequestering it in a geologic formation add to the overall expense.



Pricing reports show the levelized cost of energy for a new NGCC plant without capture and storage is between \$48 and \$109/MWh. Collectively, the cost drivers described here will increase that cost by 50%.<sup>11</sup> Retrofitting existing plants will incur a cost penalty over a lower levelized energy cost.

<sup>11</sup> Lazard, *Lazard Levelized Cost of Energy Report* (June 2025), <https://www.lazard.com/media/5t1bhyla/lazards-lcoeplus-june-2025-vf.pdf>, page 8.

## BRIDGING THE FINANCIAL GAP: THE NG+CCS REVENUE STACK

The cost premium for NG+CCS is significant, but a combination of federal incentives and offtaker commitments can make these projects financially viable. No project in the U.S. is currently able to justify deployment with tax credits alone; they require committed offtake at a premium to close the financial gap. The revenue stack is typically composed of two main pillars: the Section 45Q tax credit and a corporate energy customer.

**45Q tax credit:** This federal incentive is the backbone of the business case for CCS in the U.S., valued at \$85 per metric tonne of CO<sub>2</sub> for permanent geologic storage. For a typical NG+CCS plant, this credit translates to a value of approximately \$30–\$40/MWh. This incentive covers a meaningful portion of the cost premium associated with CCS; however, customers should still expect to pay a premium of ~\$30/MWh for the first generation of NG+CCS plants. The Section 45Q tax credit allows both direct pay and transferability.<sup>12</sup>

**Clean, firm premium:** Because the 45Q credit may not cover the entire cost, especially for FOAK projects or those with high transportation costs, a clean, firm premium paid by the energy customer is required. Recent deals for low-carbon, firm power have demonstrated a market willingness to pay such a premium.

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<sup>12</sup> Transferability allows a 45Q claimant to transfer the credits to other taxpaying entities, while direct pay allows claimants to elect to receive a cash payment in lieu of claiming the credit on their tax returns. For-profit entities are eligible for direct pay for five years, while nonprofit entities, which include electric co-ops and municipal utilities, are eligible for 12 years.

# Procurement and Commercial Models for Buys

Corporate energy buyers have a unique opportunity to shape the emerging market for NG+CCS, just as they did with renewables. While long-term offtake structures remain foundational, new mechanisms are evolving to support broader participation and address the challenges of scaling FOAK projects.

## Existing Procurement Pathways

Like the path of traditional renewable market development, creditworthy buyers will have the option to use long-term offtake structures, while the development of a robust environmental attribute certificates (EACs)-CCS market will hopefully reduce barriers for broader market participation. Buyers can engage with NG+CCS through a variety of commercial structures:

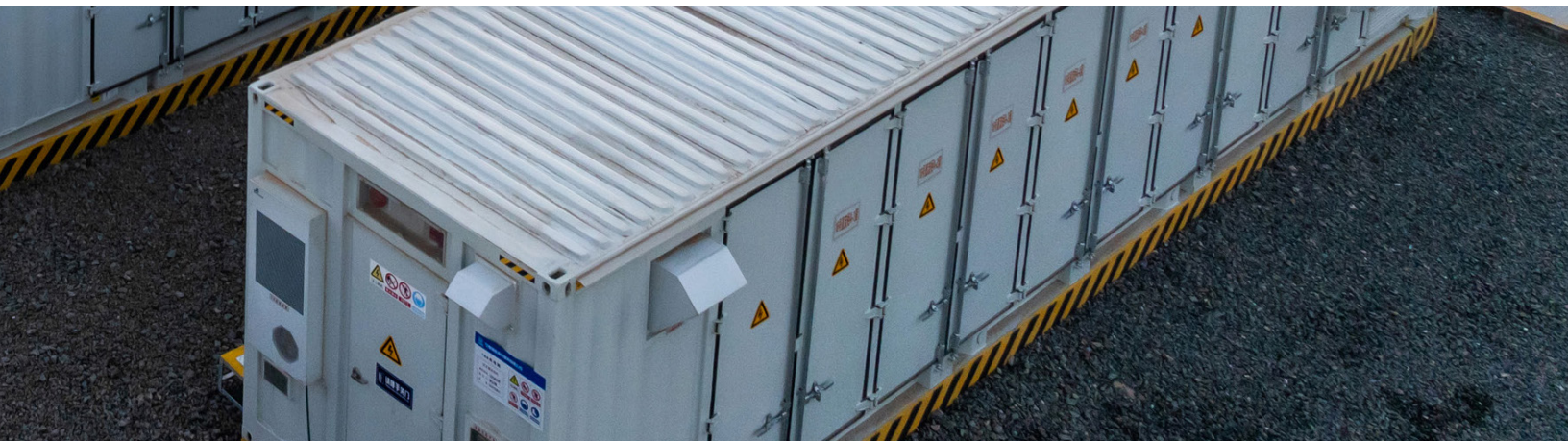
- **PPAs and VPPAs:** Long-term contracts for electricity and environmental attributes
- **Clean energy tariffs:** Utility or supplier programs that offer CCS-backed electricity
- **Attribute-only transactions:** Purchase of EACs decoupled from electricity delivery, enabling flexible participation and emissions accounting

As the EAC market for NG+CCS matures, it will provide buyers with familiar tools to reduce Scope 2 emissions and demonstrate climate leadership.

## Innovative Commercial Models

To address FOAK risks and scale challenges, buyers may consider nontraditional structures, such as:

- **Advance market commitments (AMCs):** Buyers commit to future purchases to de-risk early projects.
- **Pooled offtake agreements:** Multiple buyers aggregate demand to support a single project.
- **Private capital funds:** Investment vehicles that enable buyers to participate in CCS deployment without direct project ownership.



# Carbon Accounting Considerations

Buyers that include CCS in their portfolio of approaches may need to align CCS transactions with carbon accounting frameworks. The Greenhouse Gas (GHG) Protocol's Scope 2 Guidance provides mechanisms for recognizing emissions reductions from purchased electricity and attributes. As the CCS market matures, accounting practices will become more familiar, helping buyers demonstrate climate impact with confidence.

## How CCS Fits Within Scope 2

Scope 2 accounting for NG+CCS shares many similarities with renewables but also includes important differences. The GHG Protocol's current Scope 2 Guidance allows buyers to reduce their Scope 2 emissions through CCS offtake. The development of EACs for CCS will expand buyer options and align with familiar renewable energy practices. Future updates to Scope 2 Guidance may inform how to account for each emissions source along the capture, transport, and storage process as a buyer's Scope 2 or Scope 3, but as of today, CCS offtake can reduce a buyer's Scope 2.

While today, NG+CCS can be integrated into Scope 2 inventories similarly to renewables, there are key distinctions:

- **No zero-emissions rate:** Unlike renewables, NG+CCS generation retains a residual emissions rate, typically reflecting 90%–95% CO<sub>2</sub> capture. Buyers must account for these remaining emissions in their Scope 2 reporting.
- **No standardized EACs – yet:** Renewable energy buyers rely on RECs to document emissions inventory reductions. NG+CCS currently lacks a widely available equivalent, though development is underway. [More information on the draft methodology.](#)
- **Energy penalty and on-site emissions:** Operating the capture system consumes energy, potentially increasing fuel use and emissions at the generating site. The GHG Protocol has yet to indicate how to account for each source of on-site emissions, but such emissions may be captured by the plant's overall emissions rate.
- **Scope 3 implications:** CO<sub>2</sub> transport and injection emissions, which fall outside the control of the generator and buyer, are typically classified as Scope 3 emissions.

**An EAC is a market-based, tradable instrument that represents the environmental and non-power attributes associated with a unit of energy. A Renewable Energy Certificate (REC) represents 1 MWh of generation with zero emissions. A CCS EAC would convey the verified emissions rate from CCS-equipped natural gas-fired generation facility. For example, a 90% capture rate would yield an EAC with emissions 90% lower than those from an unabated gas plant, but not zero.**

**The boundaries of Scope 2 emissions include generation of energy and capture of the CO<sub>2</sub>.**

# Potential Updates and Implications for Buyers

## GHG Protocol

As of early 2026, there is little to no explicit reference to CCS in the GHG Protocol's current guidance. The Protocol's Scope 2 Guidance addresses how buyers can rely on other mechanisms – including PPAs, utility tariffs, and retail supply agreements – when EACs are not available.<sup>13</sup> Under current guidance, upstream methane emissions from natural gas extraction and transport are Scope 3 emissions, regardless of whether the generation facility uses CCS. Revised GHG Protocol guidance could more explicitly address how to calculate an emissions rate for NG+CCS generation and how to allocate emissions across the different scopes.<sup>14</sup>

As of February 2026, the Protocol is reviewing its Scope 2 Guidance, which shapes how companies account for purchased electricity and associated emissions. While the revisions are still in development, several potential changes could influence how buyers recognize and report electricity from NG+CCS.

Understanding these potential updates can help buyers plan for how NG+CCS fits into a forward-looking decarbonization and reporting strategy.

## Time and Location Matching

- **What may change:** Updated guidance could require that electricity purchases align more closely with when and where generation occurs – often referred to as hourly or locational matching.
- **Why it matters:** Because NG+CCS facilities can generate consistent power at high-capacity factors, they can provide low-carbon electricity at all hours.
- **What buyers can do:** Evaluate NG+CCS as a tool for meeting potential hourly or regional matching requirements, and consider how NG+CCS could provide around-the-clock, low-carbon power.

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<sup>13</sup> The GHG Protocol's current Scope 2 Guidance places EACs at the top of its hierarchy of options to use in market-based reporting, since they convey granular information and can be tracked and retired on behalf of individual buyers. However, the hierarchy lists additional transaction types that can be used in market-based accounting, provided that they meet the Scope 2 Guidance Quality Criteria. After EACs, contracts like PPAs and "supplier/utility emissions rates," which may be conveyed through a retail supply agreement or a green tariff, may be used to recognize Scope 2 reductions.

<sup>14</sup> The GHG Protocol's draft Land Sector Guidance proposes that emissions beyond the facility fence line, such as those associated with the transport and injection of CO<sub>2</sub>, should be considered as part of that facility's Scope 3 emissions. The draft guidance also proposes that emissions from oil and gas produced using EOR should be treated as the NG+CCS facility's Scope 3 emissions.

## Consequential Accounting and Additionality

- **What may change:** The GHG Protocol is exploring a new consequential ledger to recognize the real-world impact of bringing new clean energy projects online, along with strengthened additionality criteria.
- **Why it matters:** NG+CCS projects – particularly FOAK or retrofit installations – can demonstrate clear additionality when buyer participation enables capture and storage systems that would not otherwise be built.
- **What buyers can do:** Prioritize early projects where commitment directly enables CCS deployment. Additionally, track and document how procurement supports new low-carbon capacity.

## Development of CCS EACs for Voluntary Markets

- **What may change:** Initial efforts are underway to develop EACs for NG+CCS, similar to Renewable Energy Certificates (RECs), to document verified emissions reductions from captured CO<sub>2</sub>.
- **Why it matters:** EACs would give buyers a standardized instrument to use in Scope 2 accounting to claim and report emissions benefits from NG+CCS electricity, enhancing transparency and flexibility in transacting and in market-based accounting.
- **What buyers can do:** Engage in emerging standard-setting efforts to help define credible EACs for CCS. Request clear documentation of emissions rates and verification practices from suppliers.

## Treatment of CCS Project On-Site and Upstream and Downstream Emissions

- **What may change:** New guidance may clarify how to account for all emissions that occur on-site at an NG+CCS project. Under current rules, stack emissions and emissions from operating capture equipment or compressing CO<sub>2</sub> on-site would likely be Scope 2 for a buyer. Emissions from outside the fence line, such as emissions from the natural gas supply chain, would likely be considered Scope 3. New GHG Protocol guidance could confirm, contradict, or be silent on this accounting treatment.
- **Why it matters:** Even with 90%–95% capture, small amounts of CO<sub>2</sub> remain. Under the GHG Protocol, upstream methane is typically categorized as Scope 3. Transparent accounting will remain essential.
- **What buyers can do:** Factor emissions that are not captured from the power generation process into Scope 2 inventories and communicate them clearly. Continue to account for upstream natural gas extraction and processing emissions in Scope 3. Assume that downstream emissions from transport and injection will be treated as Scope 3.

## What This Means for Corporate Buyers

These potential updates could strengthen the role of NG+CCS as a credible, firm, and low-carbon complement to renewables.

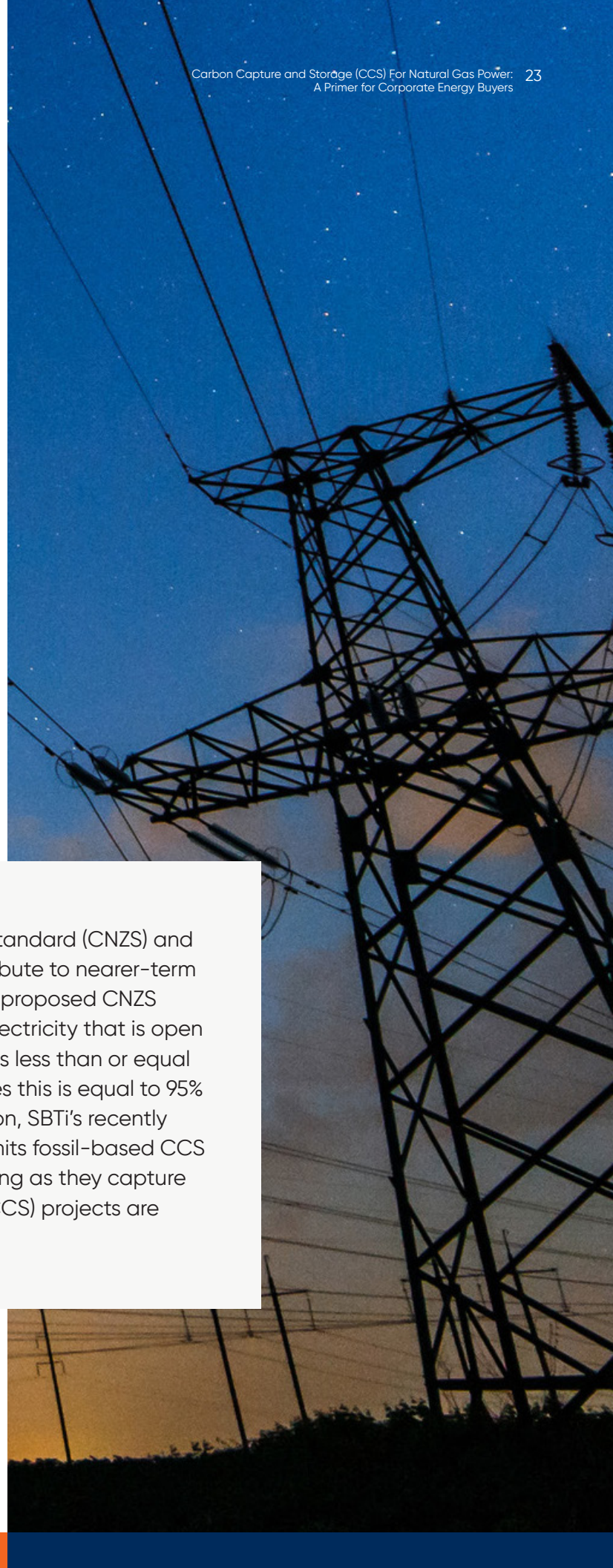
Corporate buyers can prepare by:

- Monitoring Scope 2 updates and evaluating how NG+CCS aligns with their emissions reduction goals
- Supporting the development of transparent EACs and consistent reporting standards
- Considering pilot or early-market opportunities that demonstrate leadership and build familiarity with CCS-backed electricity

As accounting frameworks evolve, early engagement will help buyers ensure their clean energy strategies remain credible, flexible, and impactful.

### SCIENCE BASED TARGETS INITIATIVE (SBTi):

In 2025, SBTi began revising its Corporate Net-Zero Standard (CNZS) and defining what types of resources are eligible to contribute to nearer-term and net-zero targets. Under the second version of its proposed CNZS update, SBTi proposes a definition of “low-carbon” electricity that is open to CCS so long as a given project has direct emissions less than or equal to 0.024 kg CO<sub>2</sub>/kWh (24 kg CO<sub>2</sub>/MWh) (SBTi indicates this is equal to 95% capture at a natural gas CCS power plant). In addition, SBTi’s recently proposed standard for power sector companies permits fossil-based CCS projects to contribute to science-based targets so long as they capture 95% of potential emissions, and bio-energy CCS (BECCS) projects are eligible if they use sustainable biomass feedstocks.



# What Buyers Can Do Now

Clean energy buyers have a timely opportunity to shape the next phase of decarbonization by supporting firm, dispatchable power from natural gas paired with carbon capture and storage (NG+CCS). With a near-term 45Q qualification window and forecasts of significant new natural gas power plant build-out, buyer engagement now can meaningfully influence project design and deployment. By participating early, buyers can accelerate CCS deployment, help drive down costs over time, and ensure projects meet high standards for both climate integrity and community performance.



## Take leadership positions in early projects.

Large energy buyers can play a catalytic role by entering into PPAs or EAC contracts that help bring FOAK NG+CCS projects to market. The terms negotiated in the next few years will set important precedents for how NG+CCS projects are structured, priced, and verified, shaping both market confidence and long-term climate outcomes.



## Signal market demand through EAC commitments.

Smaller buyers or those without direct access to PPAs can also contribute by committing to purchase EACs from NG+CCS facilities as they become available. These early signals of market demand will demonstrate broad corporate interest in clean, firm electricity and help build a foundation for scalable, standardized markets.



## Elevate standards for quality and impact.

Across all buyer types, careful diligence can help ensure projects deliver genuine emissions reductions and community benefits. Buyers can encourage developers to adopt transparent accounting practices, rigorous monitoring and verification, and responsible siting and engagement practices.



## Recognize and plan for a clean, firm premium.

As with renewables in their early days, buyers should expect to pay a premium for clean, firm power that delivers reliability alongside emissions reductions. These early commitments will help de-risk the technology and expand access over time.



## Consider this inflection point for corporate leadership.

Corporate buyers transformed the renewable energy market through early, bold action. NG+CCS represents a similar opportunity, one that extends clean energy leadership into the realm of firm, low-carbon power. Early participation by buyers will help determine how quickly and credibly this new class of clean electricity takes hold.



# Appendix

## Frequently Asked Questions on CCS

### 1. What is clean firm energy?

Clean firm energy refers to energy sources that can provide consistent, low-carbon or carbon emissions-free power on demand. This includes technologies such as conventional nuclear energy, geothermal energy, advanced nuclear technologies, hydropower, carbon capture and storage, and long-duration energy storage. Clean firm energy is essential for ensuring system reliability and reducing dependence on carbon-emitting fuels, as it can be deployed whenever needed, making it a crucial component of a decarbonized energy system.

### 2. Where does CCS fit with clean firm?

CCS is not a power type, but a technology applied to fossil fuel generation or industrial processes to significantly reduce emissions. A natural gas plant with CCS (NG+CCS) can function as a clean firm resource providing consistent/dispatchable power. It does not need to operate 24/7 and can follow load depending on plant design and configuration.

### 3. Does CCS prolong the use of fossil fuels?

Globally, demand for energy and electricity continues to rise, and the use of natural gas continues to grow alongside the deployment of renewable and other carbon emissions-free energy resources. Purchasing electricity from natural gas plants fitted with CCS is one way to manage emissions from fossil generators that would otherwise run unabated without clean energy buyer involvement.

Every successful CCS deployment on a gas plant will make it increasingly difficult for utilities and other developers to justify construction without carbon abatement technologies.

### 4. Does CCS availability mean buyers should stop buying renewables?

No. Renewable generation has proven to be scalable, affordable, critical for managing fluctuations in the energy system, and an effective part of grid decarbonization. Deep decarbonization of a reliable grid will also require climate-compatible, firm, dispatchable generation. CCS can help address the need for all of the above clean energy resources.



## 5. What about upstream methane emissions?

Upstream emissions are about 20% of gas plant lifecycle emissions. Importantly, these emissions occur regardless of whether a gas plant installs CCS or not. Methane emissions from upstream natural gas supply chains are today considered Scope 3 emissions to consumers of natural gas-fired generation.

A buyer can mitigate methane leaks in contracts by demanding verifiable, low-methane gas through certifications, incentivizing suppliers with premium pricing, requiring advanced leak detection and repair (LDAR), and using financial tools like fees or emissions charges, all supported by transparent, measurement-based reporting to ensure accountability and drive down methane emissions.

## 6. How effective is carbon storage for the long term?

Geological CO<sub>2</sub> storage has been practiced for over 30 years with a strong safety record and extremely low leakage rates. The U.S. regulatory framework – including the Safe Drinking Water Act and the Clean Air Act – ensures protection of groundwater, long-term monitoring, and verification of long-duration storage. Other solid or hazardous wastes and associated water generated during the capture, processing, or operation of the CCS facility (e.g., from the capture process or monitoring activities) are regulated under the Resource Conservation and Recovery Act and relevant state laws. Projects claiming the 45Q federal tax credit must develop and follow a rigorous monitoring, reporting, and verification (MRV) plan approved by the U.S. Environmental Protection Agency (EPA).

## 7. What about pipeline safety?

Pipelines are regulated by the Pipeline and Hazardous Materials Safety Administration (PHMSA) under the Department of Transportation. As summarized by the Carbon Capture Coalition, “CO<sub>2</sub> pipelines have a strong overall safety record, ... but serious accidents are still possible, necessitating continued advancement of safety standards and oversight by PHMSA.”

Further analysis: [Carbon dioxide pipelines: A statistical analysis of historical accidents – ScienceDirect](#)

### 7a. What about the reported leak at a sequestration well below Lake Decatur in Illinois?

In 2024, a Class VI well operated by Archer Daniels Midland for CO<sub>2</sub> storage had injected fluid migrate into other underground spaces roughly 5,000 feet below the surface. No leak occurred above the surface. The EPA assessed that there was no impact on surface or groundwater sources nor a threat to public health. The well was capped.

### 7b. What about the CO<sub>2</sub> pipeline rupture in Mississippi?

In 2020, a CO<sub>2</sub> pipeline operated by Denbury Gulf Coast Pipelines LLC ruptured in Mississippi, releasing over 31,000 barrels of liquified CO<sub>2</sub>. The reported cause was due to “heavy rains that resulted in a landslide, creating excessive axial strain on a pipeline weld,” according to the Pipeline and Hazardous Materials Safety Administration, which oversees the nation’s pipeline system. From the DOT report on the rupture, “Carbon dioxide is considered minimally toxic by inhalation and is classified as an asphyxiant, displacing the oxygen in air.”

## 8. What consequences will a buyer of NG+CCS face if downstream leaks?

Legal liability for a downstream CO<sub>2</sub> leak would generally rest with the owner and operator of the pipeline or storage site, as defined in offtake and transport agreements. From a carbon accounting perspective, however, a buyer of NG+CCS would need to consider responsibility for emissions associated with the generation, capture, transport, and storage of CO<sub>2</sub>, including how any leakage is treated under applicable accounting frameworks. Beyond legal and accounting considerations, buyers may also face community impacts and reputational risk. Because corporate offtake of NG+CCS is still emerging, expectations around risk allocation and emissions accounting continue to evolve and will be updated as market practice develops.

## 9. What is the difference between CCS and carbon dioxide removal (CDR)?

CCS captures CO<sub>2</sub> at the point of emission (e.g., either at a power plant's stack or prior to combustion if relying upon integrated gasification technology), while CDR removes CO<sub>2</sub> directly from the atmosphere. Both are part of net-zero pathways, but CCS sequesters new emissions rather than reversing past ones.

## 10. How would EACs for gas + CCS differ from RECs?

An Energy Attribute Certificate (EAC) is a market-based, tradable instrument that represents the environmental and non-power attributes associated with a unit of energy. A Renewable Energy Certificate (REC) is a type of EAC and represents 1 MWh of generation with zero emissions.

A CCS EAC could represent the verified emissions rate from a gas + CCS facility. For example, a 90% capture rate would yield an EAC with emissions 90% lower than those from an unabated gas plant, but not zero.

Read more: [Proposed CCS EAC Methodology](#) from NorthBridge Consultants.



## 11. What are the considerations for buyers on CCS vs. CCUS?

CCS refers to technologies that capture, transport, and permanently store CO<sub>2</sub> deep underground in geological formations such as saline aquifers or depleted oil and gas reservoirs. CCUS includes all of the above steps but adds an additional element: utilization. One option for utilization is for enhanced oil recovery (EOR) – using CO<sub>2</sub> to extract additional oil from depleted reservoirs. Captured CO<sub>2</sub> can also be embedded in construction materials via a process called mineralization. These are alternatives to long-term storage of CO<sub>2</sub>. In the case of using captured CO<sub>2</sub> for EOR, the CO<sub>2</sub> used displaces naturally occurring CO<sub>2</sub> that would have been pulled from the ground.

Whether the CO<sub>2</sub> is stored in a deep saline aquifer or used for enhanced oil recovery, the climate impact is similar. However, buyers may want to know how the CO<sub>2</sub> is being managed to understand how it fits with their organizational decarbonization strategy. A primary consideration will be around EOR, and therefore, here are a few considerations when looking at CCS vs. CCUS with EOR:

- **Reputation:** Some NGOs have voiced their position that using captured CO<sub>2</sub> to produce more oil (EOR) is inconsistent with the overall objective of reducing fossil CO<sub>2</sub> emissions.
- **Carbon storage and EOR:** EOR is a mature industry that uses a closed-loop system where CO<sub>2</sub> becomes permanently sequestered in the oil reservoir. For CCS projects claiming 45Q, an EOR well operator must meet MRV requirements that are like those required for injecting CO<sub>2</sub> into a saline aquifer via a Class VI well.

- **EOR and aggregate emissions impact:**

A barrel of oil produced via EOR generally displaces another barrel produced without CO<sub>2</sub> sequestration that would have used naturally occurring CO<sub>2</sub> already in the ground and does not increase total supply.

## 12. Why would a buyer procure from an NG+CCS project if the power and EACs are more expensive than the power and recs from a wind or solar plant?

At least in the near term, power and attributes from an NG+CCS plant will likely be more expensive than power and RECs from wind and solar. NG+CCS provides firm, dispatchable electricity, which is valuable in the market. System-level attributes like 24/7 availability, minimal curtailment risk, and price stability for ratepayers are not currently valued in wind and solar RECs. These benefits are increasingly important for companies that create new large loads that seek an uninterrupted flow of power and face scrutiny for increasing electricity demand.

Today, rising demand for firm and dispatchable power is being met with increasing development of unabated natural gas generation. In addition, the avoided emissions impact of incremental renewables is going down over time in some grids as renewables penetration increases. Furthermore, emerging carbon accounting standards that require time and location-matched emissions reporting will favor NG+CCS for buyers with continuous load requirements.

### 13. What are the carbon accounting boundaries for NG+CCS?

A CCS project has emissions at different points of the capture, transport, and storage process. How those emissions are classified across a buyer's Scopes 2 and 3 is not yet specifically addressed in the GHG Protocol Corporate Standard or Scope 2 Guidance.

The most straightforward interpretation of existing guidance would suggest:

- CCS project emissions (to be treated as Scope 1 to the generation plant and Scope 2 to the buyer): any CO<sub>2</sub> remaining in flue gas after capture and any emissions associated with on-site CO<sub>2</sub> capture, treatment, and compression
- Scope 3: emissions related to upstream natural gas production and transport, and downstream CO<sub>2</sub> transport, injection, and storage

The GHG Protocol's draft Land Sector Guidance agrees that transport and storage emissions are a CCS project's Scope 3 emissions (and likely Scope 3 to a buyer). In comparison, at least one developing proposed methodology for creating EACs for CCS could be ready to classify such emissions as within a buyer's Scope 2.

Emissions from the ultimate combustion of petroleum products produced via EOR using captured CO<sub>2</sub> are another possible Scope 3 category. Again, upstream emissions of CO<sub>2</sub> and methane from natural gas supply remain part of the buyer's Scope 3 inventory regardless of CCS deployment.

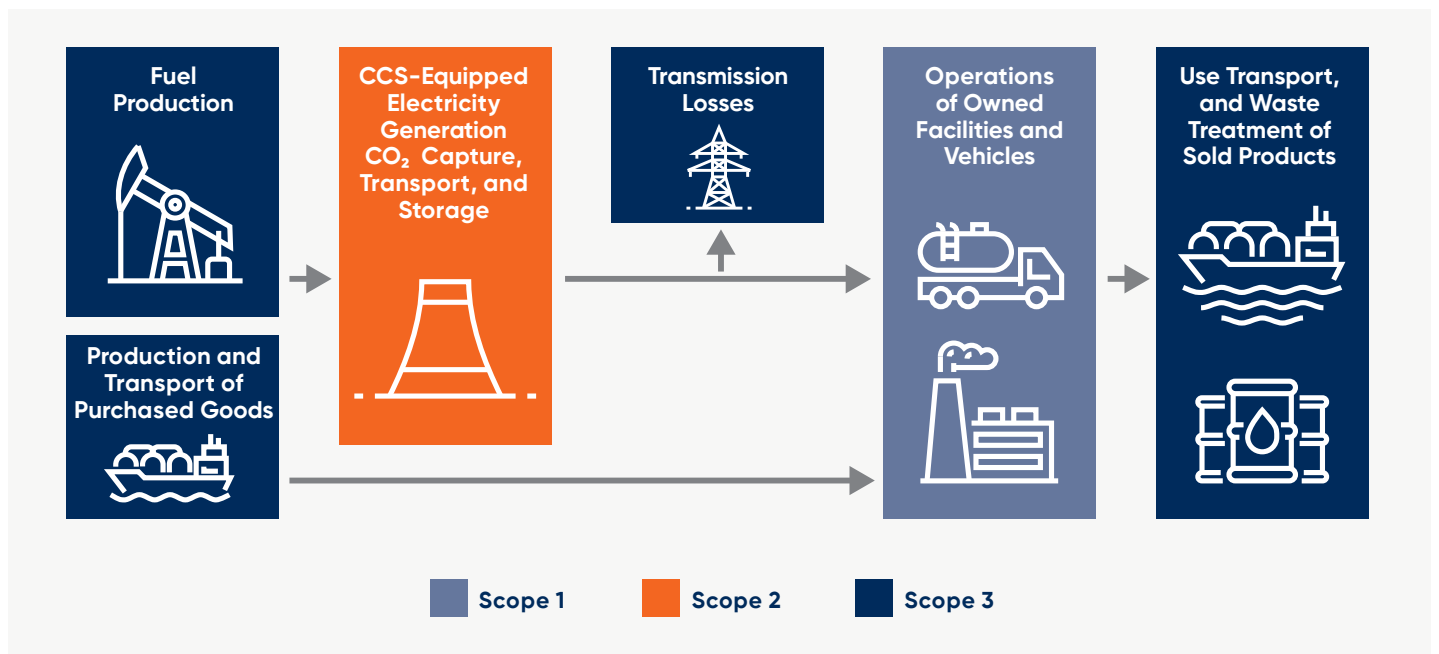


Figure 1. Buyers GHGP Scope Boundary Conditions as defined by "Carbon Capture and Storage Energy Attribute Certificates Standard"

#### **14. How do I think about a natural gas-fired power plant retrofitted with CCS compared to a new plant with CCS built in?**

Retrofitting an existing gas plant with CCS reduces emissions from an operating facility without adding new generating capacity; however, the facility will produce less electricity for export as more of the power produced is used to operate the carbon capture equipment. Because the plant infrastructure is already in place, a retrofit can often deliver lower-cost abatement and may be best suited for regions that already have sufficient capacity.

A new-build NG+CCS facility, by contrast, adds capacity to the grid and can integrate carbon capture technology more efficiently from the design stage. These plants typically achieve higher capture rates and operational efficiencies than retrofits but involve higher up-front capital costs and longer development timelines.

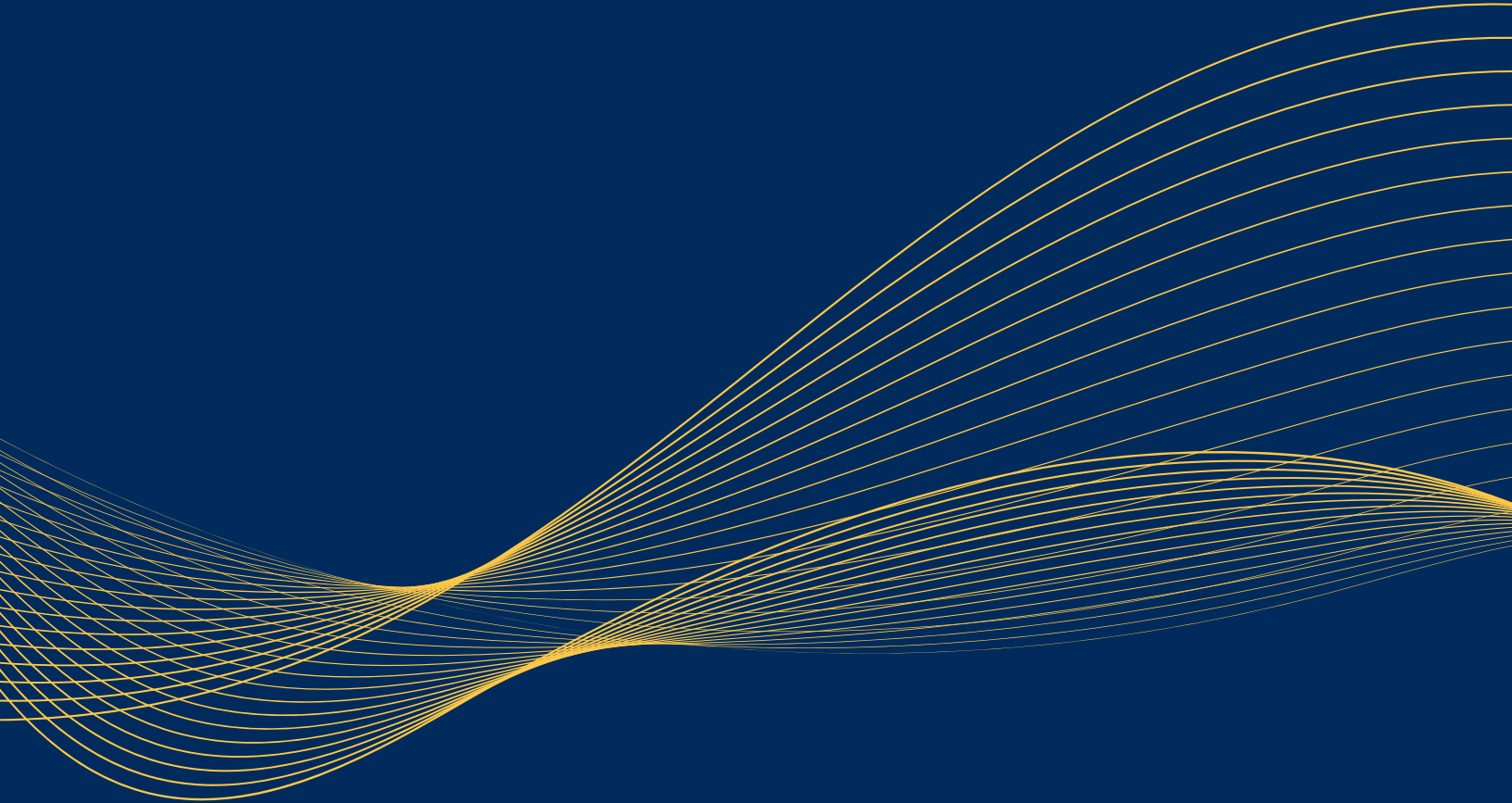
#### **15. If a buyer has a net-zero goal, how does NG+CCS help meet that goal if the emissions rate from the facility is not zero?**

A net-zero goal is a commitment to deeply reduce emissions across different scopes and to match remaining emissions with carbon removal. NG+CCS can help significantly reduce market-based Scope 2 emissions. Any non-zero Scope 2 emissions from NG+CCS procurement would be treated as remaining emissions and ultimately would need to be matched with removals.

#### **16. How does NG+CCS impact communities?**

Most new energy infrastructure impacts communities through activities associated with siting, construction, and transmission. NG+CCS adds another element in the form of CO<sub>2</sub> pipelines and storage reservoirs. Beyond existing regulatory frameworks designed to protect communities, best practices for developing an NG+CCS project should include extra-regulatory consideration of, and engagement with, communities to understand the local needs and interests related to the project.





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