

## **Maximizing The Potential of 45Q:**

*Untapped opportunities in existing carbon capture incentives*

### **Introduction**

The bipartisan Section 45Q tax credit (“45Q”) represents an opportunity to repurpose an existing mechanism to create new markets for U.S. natural gas, accelerate domestic energy innovation, and upgrade American infrastructure. With refined language, this tax credit will make America more competitive and drive growth across the economy. One key example that can unlock these opportunities is the emergence of technologies that crack natural gas into valuable hydrogen and useful solid carbon. Importantly, the credit does not cover this or other innovative processes – some of which may not yet be invented – but this untapped potential can unlock American ingenuity and entrepreneurship for maximal nationwide benefit.

### **History**

45Q was created as part of the Energy Improvement and Extension Act of 2008 and sponsored by the then-chairs and ranking members of the Senate Finance Committee (Baucus D-MT and Grassley R-IA) and the House Ways and Means Committee (Rangel D-NY and Camp R-MI). With bipartisan support, it was incorporated into the broader Emergency Economic Stabilization Act of 2008<sup>1</sup> that was signed into law by President George W. Bush.

In 2018, 45Q was expanded to broaden eligibility and increase credit values, with bipartisan sponsorship from Senators Barrasso (R-WY), Capito (R-WV), Portman (R-OH), Heitkamp (D-ND), Manchin (D-WV), and Whitehouse (D-RI) under the FUTURE Act<sup>2</sup> signed into law by President Trump. President Biden further expanded 45Q in the Inflation Reduction Act of 2022.<sup>3</sup>

Over time, the usefulness of 45Q tax credit has been surpassed by the continuing pace of American innovation. Increased recognition for Carbon Capture Utilization and Storage (CCUS) and technological advances have led to novel methods unforeseeable even a decade ago, such as extracting solid carbon directly from natural gas. In the light of these innovative achievements, revising 45Q once again is a bipartisan opportunity to unlock enormous potential for U.S. energy and infrastructure and make America more competitive.

With renewed interest in 2025, there is an opportunity to again revise 45Q to improve its fairness, establish parity among qualifying technologies, and unleash further innovation beyond what was conceived as possible when the credit was first established. The Trump Administration and 119<sup>th</sup> Congress can leverage 45Q to continue to accelerate energy innovation, upgrade American infrastructure, and create new energy wealth by creating multiple new markets.

## Scope and Scale

45Q is a well-intentioned policy facing growing limitations. The law provides a performance-based objective that is not overly specific in where and how the “carbon oxide” (CO<sub>x</sub>) is removed, so long as it is “measured at the source of capture and verified at the point of disposal, injection, or utilization.”<sup>4</sup> While the law includes minimum thresholds for the amount of carbon removed, it also lacks parity in the benefits offered to different types of carbon capture without accounting for the energy-intensity and cost associated with them.<sup>5</sup>

Among the most limiting oversights – and compelling opportunities – is the narrow focus on the specific form of carbon that is recognized. 45Q focuses almost exclusively on *gaseous* carbon dioxide and other “qualified carbon oxides.”<sup>6</sup> While considering this policy through the lens of the greenhouse effect and atmospheric composition, this makes sense. However, it precludes processes that American entrepreneurs have developed that deliver alternative forms of carbon.

Simply allowing additional forms of carbon to qualify would signal to innovators that everything is on the table. Processes are possible today that were inconceivable when the policy was created but which nevertheless deliver higher value decarbonization, improved energy outcomes, and even produce critical materials capable of bolstering American infrastructure and generating circular economies. Solid, liquid, and gaseous forms of carbon should be eligible to maximize what is currently possible and help future-proof this credit in a way that invites and encourages unbridled innovation and competition in the CCUS and energy-technology sectors.

To illustrate an unexpected innovation that has emerged since the creation of 45Q, an entire sub-industry has pioneered cracking methane under high heat in the absence of oxygen, an approach known as pyrolysis.<sup>7,8</sup> This example leverages natural gas, produces clean hydrogen, and produces solid carbon that is being built directly into roadways and construction projects.

Federal laws promote innovation most effectively when they articulate performance objectives without being overly prescriptive. While 45Q is somewhat flexible, it is held back by a failure of imagination in excluding non-gaseous forms of carbon. With the right reframing, 45Q can be improved into a more robust performance-based incentive.

Finally, the current differing benefits within the 45Q tax credit are unbalanced and offer opportunity to bolster competition so that technology can compete based on its economic and environmental performance. Federal policy should promote the development of the most efficient and scalable solutions without bias or imposition, offering incentives for innovation and performance.

## **Opportunity for Improvement**

With minor technical changes, the 45Q tax credit could become a powerful catalyst for energy innovation and infrastructure investment. To do so, the qualified forms of carbon need to be broadened. Instead of favoring any one approach, form of matter, or technological pathway, the policy can offer proportionate benefits for capturing and utilizing carbon most efficiently.

Innovators and investors can continue to see benefits and credits from critical capture projects like Direct Air Capture (DAC) or utilizations like Enhanced Oil Recovery (EOR), while others can pioneer methods that deliver new value. Senator Barrasso (R-WY), one of the original sponsors of the 2018 update to 45Q, introduced a bill on February 5, 2025, to create parity between capture, utilization, and storage of carbon oxide.<sup>9</sup> Although the bill has not yet passed, this reform demonstrates a valuable modification that promotes regulatory fairness.

To improve parity further, the law should discontinue the false impression that gaseous carbon is the only type of CCUS worth incentivizing. Revising the language of “carbon oxides” to a term like “carbon products,” which includes gaseous, liquid, and solid forms of carbon would unlock currently untapped potential and bring the credit in line with the state of innovation that has taken place since its inception. This change would help proven methods scale while opening the door for innovators to develop novel forms of carbon capture, utilization, or storage.

**Simply stated, there is no reason 45Q credits should only be available for gaseous carbon oxides. The performance requirement can maintain its goal of keeping CO<sub>x</sub> out of the atmosphere while creating new markets for more varied forms of carbon capture as well as utilization and storage that makes America products competitive globally and turns them into domestic resources.**

To visualize its economy-wide benefits, updating 45Q would increase competitive, performance-oriented projects like DAC and EOR that reduce atmospheric CO<sub>x</sub> or boost domestic industry, while accelerating deployment of newer technologies like natural gas pyrolysis to crack conventional methane into valuable hydrogen and useful solid carbon. Solutions like this offer multiple concurrent benefits well beyond mitigation of carbon oxides. New opportunities for hydrogen, for instance, represent an important input for chemicals and fertilizer, as well as serving as a clean fuel that adds value to America’s existing pipeline networks. Non-gaseous forms of carbon can be utilized in products ranging from tires and batteries to asphalt for roofs and roads.

Optimizing benefits and creating parity between different forms of CCUS ensures competition that achieves the greatest results. Economic competition between different forms of carbon capture technology promotes efficiency, while the tax credit can uplift these innovative solutions in equal measure and invite new market entry.

## **Conclusion**

With a new Congress and Administration, the federal government is in a state of transformation. Incoming policymakers should be careful not to overlook opportunities in the course of this recalibration. With an eye toward streamlining the economy and promoting efficiency while expanding and building American infrastructure, the Trump administration can turn an outdated tax incentive program into a key tool to accomplish its primary agendas of U.S. energy dominance and infrastructure investment.

The advancement of CCUS technology is a worthy goal, and 45Q can be broadened and refined to achieve more than it was ever envisioned to do less than two decades ago.

The effect of revising 45Q will extend beyond decarbonization and will set a new precedent for performance-based policymaking that encourages and unlocks innovation. Until now, 45Q has incentivized many strategies with ranging energy-intensity and costs. This same incentive can instead be calibrated to make America more competitive, stimulate energy innovation, and provide industrial resource to restore American infrastructure. This will ensure greater resilience across multiple sectors, promote more efficient development and utilization of domestic resources, and stimulate innovation.

## Appendix A: 45Q Credit Table Summary

For any equipment placed into service after 12/31/2022. Inflation adjusted after 2026

	Base Credit	DAC Base Credit	Bonus Credit	DAC Bonus Credit
Geologically Sequestered	\$17	\$36	\$85	\$185
Enhanced Oil Recovery (EOR)	\$12	\$26	\$60	\$130
Other Qualified Use	\$12	\$26	\$60	\$130

\*Note Other Qualified Use requires verification

## Appendix B: Qualified Carbon Oxide Definitions

<p><b>(c) Qualified carbon oxide</b> For purposes of this section-</p> <p><b>(1) In general</b> The term "qualified carbon oxide" means-</p> <p>(A) any carbon dioxide which-</p> <p>(i) is captured from an industrial source by carbon capture equipment which is originally placed in service before the date of the enactment of the Bipartisan Budget Act of 2018,</p> <p>(ii) would otherwise be released into the atmosphere as industrial emission of greenhouse gas or lead to such release, and</p> <p>(iii) is measured at the source of capture and verified at the point of disposal, injection, or utilization,</p> <p>(B) any carbon dioxide or other carbon oxide which-</p> <p>(i) is captured from an industrial source by carbon capture equipment which is originally placed in service on or after the date of the enactment of the Bipartisan Budget Act of 2018,</p> <p>(ii) would otherwise be released into the atmosphere as industrial emission of greenhouse gas or lead to such release, and</p> <p>(iii) is measured at the source of capture and verified at the point of disposal, injection, or utilization, or</p> <p>(C) in the case of a direct air capture facility, any carbon dioxide which-</p> <p>(i) is captured directly from the ambient air, and</p> <p>(ii) is measured at the source of capture and verified at the point of disposal, injection, or utilization.</p>
--

## Citations and Notes

<sup>1</sup> Public Law 110-343.

<sup>2</sup> Public Law 116-91.

<sup>3</sup> Public Law No: 117-169.

<sup>4</sup> Internal Revenue Code, 26 U.S.C. § 45Q (2023).

<sup>5</sup> See Appendix A for 45Q Credit Table summary.

<sup>6</sup> See Appendix B for Qualified Carbon Oxide definitions.

<sup>7</sup> In recent years, numerous companies have proven the ability to crack natural gas into its valuable base components. Much like crude oil can be refined into various products and coproduct materials, natural gas (methane, or CH<sub>4</sub>) can be broken down into two key outputs: carbon and hydrogen. Advances in production methods have progressed well beyond the laboratory phase, with scalable production methods for carbon black, graphite, and a variety of other non-gaseous carbon forms and grades. These materials are stored more easily and efficiently than gas and hold significant value for industrial and construction applications. Solid carbon CCUS was not available when 45Q was first conceived, but by necessitating the carbon removal to be done in a gaseous form, the 45Q tax credit is now hampering opportunities for innovation.

<sup>8</sup> See e.g., Patlolla, S. R., Katsu, K., Sharafian, A., Wei, K., Herrera, O. E., & Mérida, W. (2023). *A review of methane pyrolysis technologies for hydrogen production*. *Renewable and Sustainable Energy Reviews*, 181, 113323. <https://doi.org/10.1016/j.rser.2023.113323>.

<sup>9</sup> Barrasso. *Colleagues Introduce Enhancing Energy Recovery Act*. John Barrasso United States Senator - Wyoming. (2025, February 5). <https://www.barrasso.senate.gov/public/index.cfm/news-releases?ID=DEC33C1C-0820-456D-8C68-3866DA6E192D>.



## Author

Benjamin Dierker, JD, MPA

*Executive Director, Alliance for Innovation and Infrastructure*

Owen Rogers

*Public Policy Associate, Alliance for Innovation and Infrastructure*

*For more information or inquiries on this report, please contact the Aii Media Coordinator at [info@aii.org](mailto:info@aii.org)*

## Recommended Citation for this report

Dierker, B. & Rogers, O. (February, 2025). *Maximizing the Potential of 45Q: Untapped opportunities in existing carbon capture incentives*. Alliance for Innovation and Infrastructure. [Aii.org](https://aii.org).

## About Aii

The Alliance for Innovation and Infrastructure (Aii) is an independent, national research and educational organization working to advance innovation across industry and public policy. The only nationwide public policy think tank dedicated to infrastructure, Aii explores the intersection of economics, law, and public policy in the areas of climate, damage prevention, eminent domain, energy, infrastructure, innovation, technology, and transportation.

Aii is a think tank consisting of two non-profits: the National Infrastructure Safety Foundation (NISF), a 501(c)(4) social welfare organization, and the Public Institute for Facility Safety (PIFS), a 501(c)(3) educational organization. Both non-profits are legally governed by volunteer boards of directors. These work in conjunction with Aii's own volunteer Advisory Council.

### Board of Directors

**Timothy Butters**, Director

**Surya Gunasekara**, Director

**Chris Kilgore**, Director

**Brigham McCown**, Founder, Chairman

**Jack Reape**, Director

**Robert Sumwalt**, Director

**David Venable**, Director, Senior Cybersecurity Fellow