Carbon Capture Could Get $100B in Credits from US Climate Bill

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- New credits increase payments to capture projects by 70%
- Could make net-zero plastics and steel capacity competitive

The revision of the 45Q tax credit for carbon capture, utilization and storage (CCUS) in the US climate bill could deliver more than $100 billion to scale up the technology, cut costs, decarbonize industry and deliver 24/7 clean power.

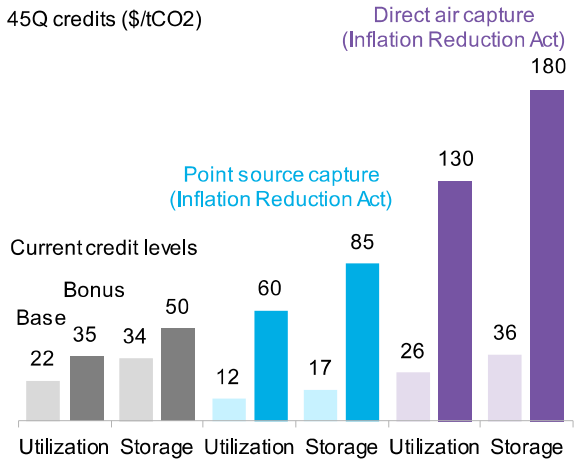
The long-anticipated changes are part of the Inflation Reduction Act now awaiting President Biden's signature after passing the House last week. The climate bill, the most ambitious in US history, also includes tax credits and subsidies for renewable power, electrified transport and hydrogen. It's also likely to cost far more than Congress estimated. It's also likely to cost far more than Congress estimated.

How will 45Q change?

An increase to 45Q, the CCUS tax credit that made the US the global leader in the industry, has been expected for some time. It is a broadly bipartisan mechanism, since it can reduce emissions, but is still mostly used by the oil and gas industry. A more generous 45Q was sketched out in the original Build Back Better Bill, and those provisions have carried over to the scaled-down measure that passed the House last week. The changes are as follows:

- The new legislation raises the credits for captured CO2 that is used and stored to $60/tCO2 and $85/tCO2 respectively. However, project owners must meet prevailing wage and apprenticeship requirements in order to qualify. If they do not, they will be paid a lower credit than the existing 45Q payment. Projects must be under construction by the end of 2032 to receive the credit.
- A new, much higher credit is available to direct air capture (DAC) projects. DAC currently costs around $600/tCO2. The credit pays $130/tCO2 for gas that is used, say, for enhanced oil recovery or to make synthetic fuels, and $180/tCO2 for CO2 that is stored permanently.

Comparison of current and new 45Q credits



Source: BloombergNEF.

Note: Bonus credits require project owners to pay prevailing wages to all workers and to have an apprenticeship scheme.

- 45Q is currently a tax credit. The act will make the credits direct pay for the first five years of each project, and then convert to a sellable tax credit for the remaining seven years. Projects can claim credits for a total of 12 years.
- The capture capacity requirements to qualify for the credit have been lowered. DAC facilities must

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capture at least 1,000 tCO2 per year. Most announced projects are aiming to capture 1 million tons. Power generation projects using CCUS must capture at least 18,750 tCO2/year but must also have a capture rate of 75% of the system's total emissions. Industrial projects, such as steel, cement, or petchems plants, must capture at least 12,500 tCO2/year, and have no capture rate requirement.

This revised version of 45Q introduces some new hurdles for project developers, around wages and capture rates, but overall, it is a generous increase in an already-generous subsidy. Power projects with CCUS, especially on natural gas plants, are one of the fastest growing sectors for the technology, due to represent roughly one-third of all US capture capacity by 2030 from 0.3% currently.

The 75% capture rate for power generation projects will be the most difficult to meet. Most of today's projects only install capture equipment on a portion of the plant, which would make hitting 75% capture for existing projects very difficult. However, many new announcements for power generation with CCUS aim to provide round-the-clock low-carbon energy. With this motivation, we would expect developers to be aiming for a high capture rate.

How does it compare to the Bipartisan Infrastructure Bill?

While Congressional estimates have the Bipartisan Infrastructure Bill providing more funding for CCUS ($11 billion in grants versus $3.2 billion in tax credits), the ongoing support for projects in the climate measure will be much more important to the industry.

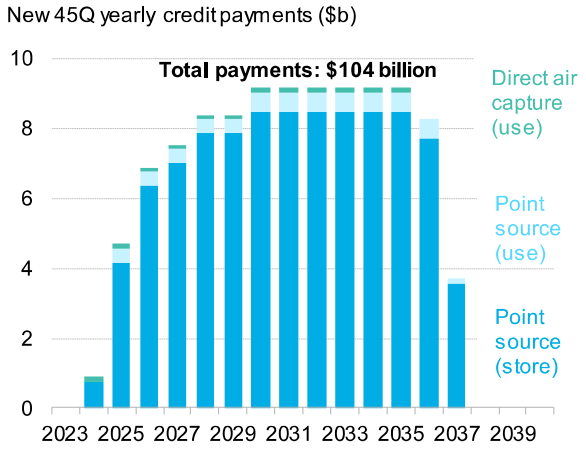
The infrastructure law set aside grant money for CCUS in industries where it would still be considered early-stage, such as industrial processes. While this will be helpful to kick-start CCUS in these sectors, the yearly tax credits and payments from the 45Q uplift in the climate bill will be what makes these projects viable. For more on the Bipartisan Infrastructure Bill, see *US House Bakes Clean Energy Half a Loaf* (web | terminal).

How much will it cost?

Congress's Joint Committee on Taxation believes that CCUS tax credits will cost $3.2 billion, according to its July 28 estimates of the budget effects of the bill. BNEF believes that figure could actually be more than $100 billion.

Congressional estimates typically use historical growth rates to forecast future expansion, and CCUS capacity in the US has seen little-to-no growth in the past 20 years. This, however, is due to change dramatically as a focus on CCUS as a decarbonization route has caused a flood of new announcements. BNEF has tracked projects amounting to more than 100 million tons of CO2 capture capacity that could come online by 2030. Today's figure is roughly 20 million tons. Taking this expected growth into account gives us a much higher figure for CCUS payments from the bill than the Committee's. We used the announced pipeline of projects to estimate yearly total payments from 45Q, assuming that projects are first paid in the year they have announced they will be commissioned.

45Q credit payments for US capture projects



Source: BloombergNEF.

Note: Assumes full credit value is realized for 12 years from commissioning year.

And BNEF's prediction could still be an underestimate of the final cost of the credit. We currently do not have visibility on projects beyond 2030 but expect more to

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be announced based on this enhanced credit. Projects typically take five to seven years from their announcement date to be commissioned. However, projects only need to start construction before the 2033 deadline to qualify, so there's plenty of time for announced CCUS capacity in the US to grow significantly beyond currently predicted levels. To view our tracked CCS capacity see *CCUS Projects Database (1.3)* (web | terminal).

There are a few caveats here. We assume that the full credit value is realized for all 12 years (in other words, that projects operate at full capacity) and that any projects that have not announced an end-use for their CO2 will choose to store it, due to the much higher credit value for storage than utilization. We have removed any projects that would be too small to qualify but have assumed that new power generation projects will meet the 75% capture rate requirements, a much higher standard than most current power projects.

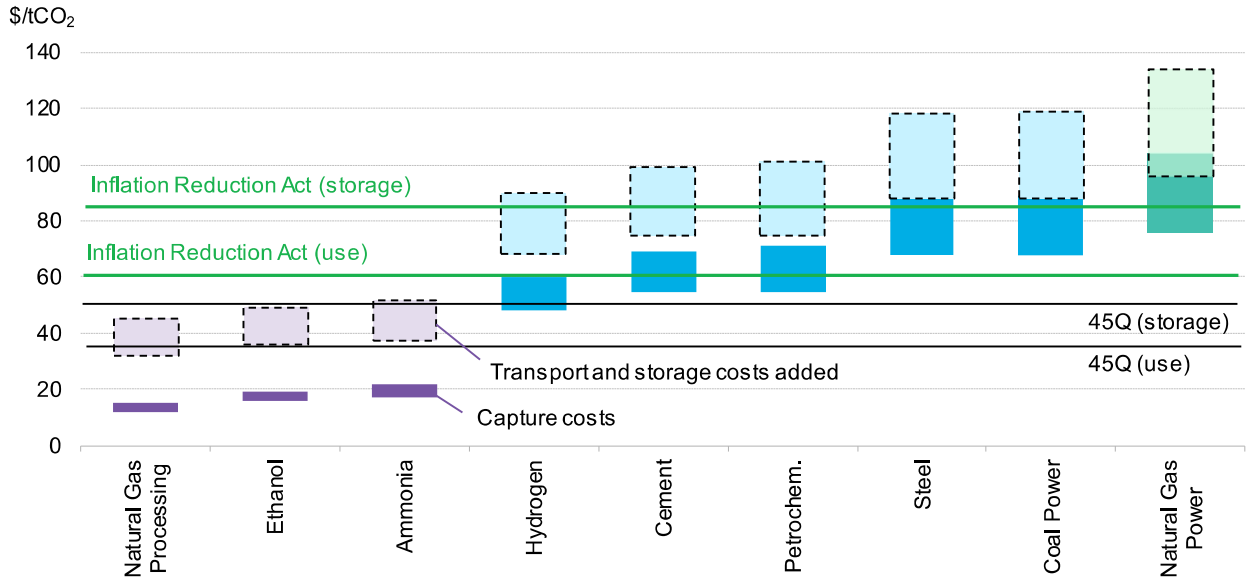
Will this incentivize new CCUS projects?

The most high-profile CCUS projects in the past have been on coal generation plants. Early technical difficulties and an association with coal gave CCUS a poor reputation. However, there are several industries where CCUS is almost unavoidable if operators wish to decarbonize their processes. Petrochemical and plastics production and cement both fall into this category. Both have significant process emissions or feedstock restrictions that mean fuel switching would only abate a portion of their total emissions.

The new uplift to 45Q credits makes CCUS viable for a much larger number of industries, a key benefit of the new policy. While 45Q could previously only cover capture, transport and storage costs for high-concentration CO2 sources like natural gas processing, ethanol and ammonia, the higher credits for storage would allow blue hydrogen, cement, petrochemical and steel plants to offset much of their CCS costs, lowering one barrier to decarbonization.

While the credits would not make petrochemicals with CCUS competitive with existing production routes, they bring net-zero technologies closer to being competitive, especially with potentially steep green price premiums. The steel industry has more options, and both CCS and hydrogen will receive subsidies

Nth-of-a-kind capture costs with previous and new 45Q credit levels



Source: Great Plains Institute, BloombergNEF

Note: Petrochem is petrochemicals, which are used to make plastics.

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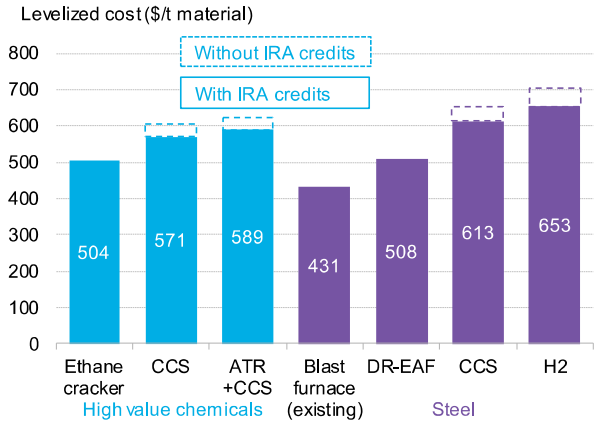
from the climate bill. CCUS remains the more competitive option between these two in the near-term until hydrogen costs fall, but it is still more expensive than building a new direct reduction furnace running on natural gas. However, many steel buyers with net-zero targets are willing to pay a premium of around 25% for low-carbon metals, which could allow plants with CCUS to compete with new gas-fired build. Thanks to this change, we expect to see more announcements for industrial CCUS in the US, especially in the petrochemical sector. For more on producing green materials see our steel (web | terminal) and petrochemicals (web | terminal) decarbonization research.

Reduction in green chemical and steel costs with 45Q and hydrogen subsidies



Source: BloombergNEF.

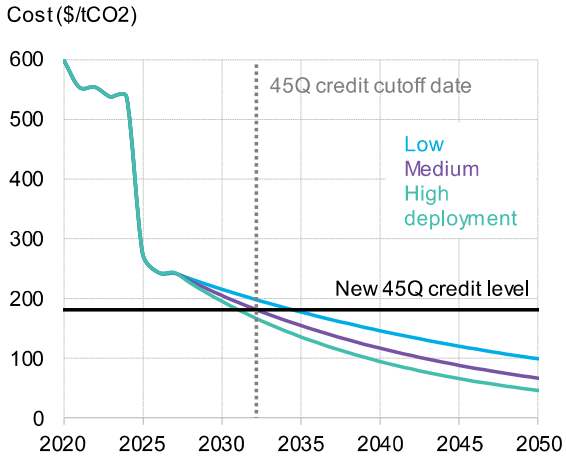
Note: ATR is autothermal reforming, DR-EAF is a direct reduction furnace paired with an electric arc furnace. H2 is hydrogen. Blast furnace cost is for an existing, coal-fired plant. Ethane cracker costs are for a new-build plant.

In addition to lowering the costs of industrial decarbonization, gas and coal with CCUS is currently one of the cheapest ways to provide load-following low carbon power. Many companies previously content to buy renewable power purchase agreements now have much higher standards for procuring clean power and want to be able to use low carbon electricity 24 hours a day, giving CCUS for power an opening. For more on the costs of 24/7 clean power, see *LCOE Highlights: Hydrogen, CCS and Small Nuclear Reactors* (web | terminal).

Will this help direct air capture to scale?

In contrast to point source carbon capture, which abates emissions from a plant, DAC removes CO2 directly from the air. It is a form of carbon removal often grouped together with natural carbon offsets like reforestation. However, it has the potential to reach a much greater scale than these nature-based solutions. Virtually all climate modelling calls for some amount of carbon removal in order to keep warming below 2°C, and DAC startups have raised hundreds of millions of dollars in the past two years. DAC capacity is currently around 10,000 tCO2/year globally, though plants with capacities of 1 MtCO2 are due to come online in the mid-2020s. For more on DAC, see *Material Tech Highlight: Direct Air Capture* (web | terminal).

Direct air capture costs compared with new 45Q credit levels and cutoff date



Source: BloombergNEF

Note: Low deployment uses a CAGR or 24%, medium is 37%, high is 50%.

The climate bill gives DAC a much higher credit than point source carbon capture, partly in recognition of its climate benefits and need to scale rapidly, but also due to its very high cost. DAC currently costs around $600/tCO2. We expect this to fall to around $250/tCO2

when the announced million ton plants come online. The rate of cost reductions after that depends on how quickly DAC capacity scales. If DAC continues to grow at current rates, deployment would still be slow (low scenario) and even the $180/tCO2 credit would not be enough to offset its cost completely. If the industry accelerates (medium- and high-deployment scenarios) there may be time for costs to fall below $180/tCO2 before the credit runs out in 2033.

Even absent a higher 45Q credit, we expected DAC capacity to grow. Tech companies like Stripe and Shopify have already been paying very high prices for offsets from DAC companies. This new credit will lower the price these companies need to charge to break even, and may open up DAC offsets to more customers, driving demand and greater scale.

BNEF Take

This significant increase in the 45Q tax credit value will incentivize CCS in sectors with a difficult path to net zero, accelerating industrial decarbonization. However, it will not bring CCS on coal plants back into vogue or change the competitive dynamics between CCS and hydrogen. Each has their place.

While the new credit is not as generous, relatively speaking, to DAC, making the credit direct pay should make it easier to develop new projects, bringing the industry crucial scale. It will also make DAC credits more accessible, allowing more companies to begin offsetting their emissions sooner.

Analyst Reaction

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