

*CARBON
CAPTURE &
SEQUESTRATION
IN LOUISIANA*

*Part 2:
Project Financing*

June 15, 2023



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INTRODUCTION

This report is the second in a series of three about carbon capture and sequestration (CCS) in Louisiana. [Part 1](#) presented findings on the current state of development plans in Louisiana, with detailed infrastructure maps and information on federal and state permitting. As of June 2023, there are at least 20 planned underground CO₂ storage sites in the state, in addition to thousands of miles of CO₂ pipeline networks and plans for carbon capture equipment at dozens of carbon-emitting facilities.

This second installment (Part 2) presents information on the financing of planned CCS projects in the state, which will be heavily dependent on money from the federal government.

It was only with passage of the Inflation Reduction Act (IRA) in August 2022 that CCS became financially viable at scale for carbon-emitting industries, such as refineries, steel, petrochemicals, hydrogen, and coal- and gas-fired power plants.¹ Expanded federal tax credits provide strong incentives for industrial emitters to capture and sequester their CO₂ emissions underground, whether with in-house CCS projects or through third parties looking to provide CO₂ transportation and storage as a service.

Passage of the IRA, which was heavily lobbied for by the most important CCS developers in Louisiana, provoked a near-immediate surge in CCS activity in the state, laying the groundwork for an industry that is dependent on government grants and tax credits. In one illustrative case, Venture Global LNG — which had characterized its Louisiana CCS proposal as technically and economically infeasible in July 2022² — incorporated two CCS subsidiaries in Delaware on August 8, 2022, the day after the U.S. Senate passed the IRA.³

The revised tax credits complement a series of multi-billion dollar federal grant and low-interest loan programs for CCS and hydrogen production outlined in the November 2021 Infrastructure Investment and Jobs Act (IIJA), currently being rolled out under the supervision of White House Senior Advisor Mitch Landrieu.

Federal government financing will complement private-sector equity investment to get CCS projects off the ground in Louisiana. Most companies planning to operate as third-party CO₂ underground storage providers in Louisiana are oil companies. As outlined in Part 1 of this series, key companies include ExxonMobil (NYSE:XOM), ConocoPhillips (NYSE:COP), Occidental Petroleum (NYSE:OXY), Shell (LSE:SHEL), and Talos Energy (NYSE:TALO). However, other actors have emerged as important investors in CCS project development. For example, in an unannounced series of 2022 deals, funds managed by Blackstone, the world's largest private equity firm, signed options to develop an underground storage project west of Donaldsonville, LA.⁴

The largest existing deal for CO₂ offtake in Louisiana, by far, is for a planned hydrogen plant that appears to be majority-owned by the Chinese government. Denbury (NYSE:DEN), which has the most ambitious plans for integrated CCS expansion in the state, is a minority equity investor in the plant, for which it has signed a major transportation and storage deal. The plant is being developed by Clean Hydrogen Works, a company whose CEO and president is the top executive at Shanghai Bi Ke Clean Energy Technology Co., the private equity arm of the government-owned Chinese Academy of Sciences.⁵

1 Clean Air Task Force, "The Inflation Reduction Act creates a whole new market for carbon capture," 22 August 2022, www.catf.us/2022/08/the-inflation-reduction-act-creates-a-whole-new-market-for-carbon-capture.

2 Title V air permit application documents submitted to Louisiana Department of Environmental Quality.

3 Delaware Secretary of State, Division of Corporations.

4 Land records purchased from Assumption, Iberville, and Ascension Parish Clerks.

5 Shanghai Bi Ke Clean Energy Technology Co., "Simon Zhang," www.cecc-tech.com/228.aspx.htm.

Financial research conducted for this report suggests that bank debt will not play a significant role in initial capital spending for Louisiana CCS projects, though it may be introduced once the industry has matured. Until projects become operational and prove to be financially viable, the industry presents too much of a financial risk for banks to lend money.

In the coming years, however, CCS companies will begin seeking private-sector credit to complement federal grants and tax credits. Amidst growing concern about the role of major banks in expanding fossil fuel and petrochemical infrastructure, banks should be made aware that this is a similarly intensive industry and that investments in CCS will likely attract the same levels of regulatory and media scrutiny and public opposition as do other forms of fossil fuel and petrochemical infrastructure.

INFLATION REDUCTION ACT OF 2022: THE CCS CATALYST

While a number of Louisiana CCS projects were in development before 2022, the business model was not viable for most initiatives given the federal subsidies at the time. Many companies appear to have been holding out for more federal incentives as they lobbied for changes to the remaining climate components of the defunct Build Back Better Act that were still up for negotiation. The resulting Inflation Reduction Act (IRA), which included changes to Section 45Q of the IRS tax code concerning credits for CCS, included a number of key lobbyists' aims and opened the floodgates of CCS activity in Louisiana, effectively marking the beginning of real potential growth in the industry in the view of investors and analysts.

On August 3, 2021, more than 170 companies and organizations signed a letter to Congressional leaders demanding several key CCS financial support measures that were subsequently passed as part of the IIJA and IRA. Signers included many key project developers in Louisiana, such as Denbury, Air Products, CF Industries, Capio Sequestration, Fidelis Infrastructure, Lake Charles Methanol, Oxy Low Carbon Ventures, and Shell.

These companies' demands, and the resulting legislative reforms, included the following:⁶

- **Provide a direct pay option for the federal Section 45Q tax credit**

The direct pay option established in the IRA effectively converts the 45Q tax credit into a subsidy. Companies can now claim the full credit as a refund even if they do not owe that full amount in federal taxes. This means that companies do not have to turn to the tax equity market, which allows project developers to form partnerships with investors that have enough income to make use of the credit.

- **Extend the commence construction window for the 45Q tax credit**

This IRA provision extends the date by which projects must begin construction in order to qualify for 45Q tax credits, from 2026 to 2033 (companies had lobbied for an extension to 2035).

- **Enhance the 45Q credit values for industrial and power plant carbon capture and direct air capture**

This was the most important component of CCS reform in the IRA, potentially making CCS a viable industry at scale. Credits were raised by the following amounts:

- From 50 USD to 85 USD per metric ton for carbon capture and storage;
- From 35 USD to 60 USD per metric ton for utilization of carbon captured, such as in enhanced oil recovery;
- From 50 USD to 180 USD per metric ton for carbon stored from Direct Air Capture; and
- From 50 USD to 130 USD per metric ton for carbon utilized from Direct Air Capture.

- **Eliminate annual carbon capture thresholds in the 45Q program**

⁶ Carbon Capture Coalition, Congressional letter, www.scalingcarbonmanagement.com.

Much projects aiming to capture substantial less CO₂ now qualify for the 45Q tax credit, with thresholds lowered as follows:

- Power generation facilities' threshold decreases from 500,000 metric tons of CO₂ emitted per year to 18,750 metric tons;
 - For industrial facilities, it will decrease from 100,000 metric tons of CO₂ emitted per year to 12,500 metric tons; and
 - Direct Air Capture threshold decreases from 100,000 metric tons of CO₂ captured per year to 1,000 metric tons per year.
- **Finance the build-out of regional CO₂ transport and saline geologic storage networks**

The IIJA provides for federal grants and low-interest loans currently being rolled out by the Department of Energy (DOE). The bill contains nearly 5 billion USD to support the development and financing of CO₂ transport and storage infrastructure,⁷ as well as increased funding for the U.S. Environmental Protection Agency (EPA) to support federal and state permitting.

- **Robust funding for commercial scale demonstration of carbon capture, direct air capture, and carbon utilization technologies**

The IIJA also includes 2.5 billion USD appropriated for CCS demonstration projects, 1 billion USD for large-scale CCS pilot projects, and 3.5 billion USD for regional direct air capture hubs.⁸

In particular, raising the amount of the 45Q tax credit to 85 USD per metric ton for carbon capture and storage opens up possibilities for expansion of CCS to more emitting industries. The Clean Air Task Force, an industry group that has estimated the break-even cost for various emitting industries to capture, transport, and store carbon, notes that only three of these — ammonia, ethanol, and gas processing — could realistically do so at the existing 50 USD level. Now, the Task Force estimates, cement, refineries, steel, petrochemicals, hydrogen, gas plants, and coal plants can economically capture and store CO₂.⁹ This not only incentivizes more carbon capture in additional sectors, but also means that companies like Denbury have a much broader potential customer base for their networked transport and storage businesses.

⁷ Global CCS Institute, "US Congress Passes Bill with the Single Largest CCS Infrastructure Investment Ever," 10 November 2021, www.globalccsinstitute.com/news-media/latest-news/us-congress-passes-bill-with-the-single-largest-ccs-infrastructure-investment-ever.

⁸ *Ibid.*

⁹ Clean Air Task Force, "The Inflation Reduction Act creates a whole new market for carbon capture," 22 August 2022, www.catf.us/2022/08/the-inflation-reduction-act-creates-a-whole-new-market-for-carbon-capture.

PROJECT FINANCING

Federal subsidies and low-interest loans from the U.S. Department of Energy (DOE) will complement private sector equity investment to get CCS projects off the ground in Louisiana. Financial research conducted for this report suggests that bank debt will play a relatively unimportant role in initial capital spending, though it may grow in importance if the CCS industry is able to build a reliable business model on the back of 45Q tax credit revenues.

Because few Louisiana CCS projects have yet made a final investment decision (FID), only incomplete information is available on the exact source and amount of capital to be used for most projects. Denbury projects that a generic 200 million metric ton sequestration site with a 20-year injection life will cost between 1.4-2.6 billion USD, accounting for both capital expenses (acquisition cost, seismic, well injection and monitoring, lateral pipeline, distribution network, and abandonment) and operating expenses (surveillance, utilities, repair and maintenance, labor, insurance, and pore space payment). For reference, Denbury's planned Louisiana storage sites range between 250-500 mtpa and 29,000-84,000 acres.¹⁰

The Livingston Parish Sequestration Hub, being developed by Occidental Petroleum's 1PointFive, provides an overview of its financing plans consistent with partial information available on other projects. Initial financing will come from existing Occidental capital, government grants and loans, and "strategic equity" investment, while the company aims to attract project debt based on long-term CO₂ offtake agreements from 2025-30, during the first years of operation.¹¹ Similarly, the three River Bend CCS storage reservoirs will be financed by equity investors in the joint venture,¹² and the company has already received DOE grant funding on another CCS project.¹³

Denbury, meanwhile, will finance its new CCS business with cash flow from its existing enhanced oil recovery (EOR) business, as the company has paid down nearly all of its outstanding bank debt.¹⁴ Denbury projects that its CCS segment could be self-funded by 2026-27, though it may choose to look for debt or equity financing in the future.¹⁵ Like a number of other CCS companies, Denbury has a large revolving credit facility available to it from a syndicate of international banks. While companies could potentially borrow hundreds of millions under these agreements, there is no indication that they plan to do so in the near future — several paid down outstanding debt in 2022 — or that banks would yet be willing to provide the credit for unproven CCS initiatives.

Oil companies have enjoyed abundant cash flows recently,¹⁶ meaning that companies like Exxon, ConocoPhillips, Shell, and Occidental should have little problem financing CCS projects in Louisiana with their own capital and federal support. The real question for these large companies was always whether CCS investments were financially viable in the absence of massive government subsidies; passage of the IRA thus changed the financial calculus, shifted more of the project cost and risk to the public, and gave companies the green light they had been waiting for.

¹⁰ Denbury, "Carbon Solutions for a Sustainable Future," Investor presentation, May 2023, s201.q4cdn.com/317576541/files/doc_presentations/2023/May/07/den-may-presentation-final.pdf.

¹¹ Oxy Low Carbon Ventures, "Stepping Up To Bring Emission Down," March 2022, www.oxy.com/siteassets/documents/investors/lcv-investor-update/oxy-low-carbon-ventures-investor-update---selected-presentation-transcript.pdf.

¹² Talos Energy, Investor Discussion Materials, 28 February 2022.

¹³ PR Newswire, www.prnewswire.com/news-releases/talos-energy-announces-fourth-quarter-and-full-year-2022-results-provides-2023-guidance-and-announces-major-ccs-acreage-expansion-in-southeast-texas-301758796.html.

¹⁴ Denbury, Q3 2022 earnings call.


¹⁵ Denbury, "Carbon Solutions for a Sustainable Future," Investor presentation, May 2023, s201.q4cdn.com/317576541/files/doc_presentations/2023/May/07/den-may-presentation-final.pdf.

¹⁶ Sabrina Valle, "U.S. oil companies' cash flow to rise by 68% per barrel in 2022 - Deloitte," *Reuters*, 25 October 2022, www.reuters.com/business/energy/us-oil-companies-cash-flow-rise-by-68-per-barrel-2022-deloitte-2022-10-25.

It should be noted that only companies which capture CO₂ emissions (generally, the emitting facilities) will receive 45Q tax credits. Companies that only provide transportation or storage services, while they may receive DOE funds, will not receive 45Q credits; rather, they will benefit indirectly, essentially receiving a cut of the 45Q payments from an expanding customer base of emitters that are newly incentivized to capture their emissions in the wake of the IRA, necessitating transportation and storage services.

As seen in Figure 1, Denbury sees revenues of between 15 and 25 USD per metric ton of CO₂ for transportation and storage agreements, compared to the 85 USD direct payment for permanent sequestration received by the party that captures CO₂.

Figure 1 — Denbury CCS commercial structures

CCUS Commercial Structures 			
Types of Emissions Agreements	Transportation	Transportation & Storage	Capture, Transportation, Storage
	Leverage DEN pipeline system to move CO ₂ to 3 rd party storage	Connect lateral to industrial customer; move CO ₂ to DEN owned and operated secure storage	Turnkey operation for customers who prefer full-service solution
% of anticipated DEN volumes	5 – 10%	80 – 90%	5 – 10%
Agreements announced (million metric tons per year)	4	18.5	–
Anticipated avg. revenue (\$/tonne)	\$5 – 15	\$15 – 25 (sequestration) \$0 – 10 (EOR)	\$85 \$45Q (less market-priced fee paid to industrial customer)
Term length (years)	Up to 20	12 – 20	12+ (\$45Q term)
Capital intensity	Low	Medium	High

Source: Denbury, May 2023.

At least 10 CCS projects in Louisiana have applied for the Industrial Tax Exemption and/or Quality Jobs payroll tax rebate,¹⁷ and this number will likely grow. These state tax incentives amount to tens or, in some cases, hundreds of millions of dollars. However, DOE grants and loans will be more important for getting projects off the ground, as their function is to provide initial project capital. The following programs are currently being rolled out federally, though recipients have not yet been chosen for most programs.

¹⁷ Louisiana Economic Development, FastLane NextGen database, fastlaneng.louisianaeconomicdevelopment.com.

Table 1 — Department of Energy CCS programs

Program and mechanism	Description	Total appropriation and # of awards	Key dates
<p>Carbon Capture Large-Scale Pilot Programs¹⁸</p> <p>Cooperative Agreement¹⁹</p>	<p>Pilot projects that represent the scale of technology development beyond laboratory development and bench scale testing, but have not yet advanced to the point of being tested under real operational conditions at commercial scale.</p>	<p>937 million USD for large-scale CCUS pilots</p>	<p>Estimated application opening date CY 2023</p>
<p>Carbon Capture Demonstration Projects Program²⁰</p> <p>Cooperative Agreement</p>	<p>Will focus on integrated carbon capture, transport, and storage technologies and infrastructure that can be readily replicated and deployed at fossil energy power plants and major industrial sources of CO₂, such as cement, pulp and paper, iron and steel, and certain types of chemical production facilities.</p>	<p>2.54 billion USD</p> <p>12 awards for Phase 1;</p> <p>6 awards for Phases 2-4</p> <p>Additional 20 awards for FEED studies, total 189 million USD²¹</p>	<p>Applications due 5 December 2022; Initial FEED study awardees announced 5 May 2023²²</p>
<p>Carbon Storage Validation and Testing²³</p> <p>Grant, Cooperative Agreement, or Other</p>	<p>Development of new or expanded commercial large-scale carbon sequestration projects and associated carbon dioxide transport infrastructure, including funding for the feasibility, site characterization, permitting, and construction stages of project development.</p>	<p>2.25 billion USD</p> <p>20-70 awards</p>	<p>Applications due 28 November 2022</p>
<p>Carbon Dioxide Transportation Infrastructure Finance and Innovation Program²⁴</p> <p>Loan / Grant</p>	<p>Designed to establish and carry out a carbon dioxide transportation infrastructure finance and innovation program for large-capacity, common carrier infrastructure.</p>	<p>2.1 billion USD</p>	<p>Estimated application opening date Q4 2022</p>
<p>Carbon Capture Technology Program, Front-End Engineering and Design for Carbon Dioxide (CO₂)</p>	<p>Expands the DOE’s Carbon Capture Technology program to include a program for carbon dioxide transport infrastructure necessary to deploy Carbon Capture Utilization and Storage technologies.</p>	<p>100 million USD</p>	<p>Selection announced 17 May 2023</p>

¹⁸ U.S. Department of Energy, "Carbon Capture Large-Scale Pilot Programs," www.energy.gov/oced/carbon-capture-large-scale-pilot-programs.

¹⁹ Cooperative agreements are similar to grants, but under cooperative agreements the government and prime recipients share responsibility for the direction of projects.

²⁰ U.S. Department of Energy, "Carbon Capture Demonstration Projects Program," www.energy.gov/oced/carbon-capture-demonstration-projects-program.

²¹ U.S. Department of Energy, "Funding Notice: Bipartisan Infrastructure Law: Carbon Capture Demonstration Projects Program," www.energy.gov/fecm/funding-notice-bipartisan-infrastructure-law-carbon-capture-demonstration-projects-program.

²² U.S. Department of Energy, "Carbon Capture Demonstration Projects Program Front-End Engineering Design (FEED) Studies Selections for Award Negotiations," 5 May 2023, www.energy.gov/oced/carbon-capture-demonstration-projects-program-front-end-engineering-design-feed-studies.

²³ U.S. Department of Energy, "Carbon Storage Validation and Testing," www.energy.gov/bil/carbon-storage-validation-and-testing.

²⁴ U.S. Department of Energy, "Carbon Dioxide Transportation Infrastructure Finance and Innovation Program," www.energy.gov/bil/carbon-dioxide-transportation-infrastructure-finance-and-innovation-program.

Transport ^{25,26}		30+ awards	
Cooperative Agreement			
Four Regional Clean Direct Air Capture Hubs ²⁷	Funding for eligible projects that contribute to the development of 4 regional direct air capture hubs that can store at least 1 million metric tons of carbon per year,	3.5 billion USD	Estimated application opening date Q4 2022
Grant, Cooperative Agreement, or Other		4 full awards, more for preliminary costs	
Regional Clean Hydrogen Hubs ²⁸	Projects that demonstrate the production, processing, delivery, storage, and end-use of clean hydrogen through regional clean hydrogen hubs, which are networks of clean hydrogen producers, potential clean hydrogen consumers, and connective infrastructure located in close proximity.	8 billion USD	Full applications due 7 April 2023
Grant, Cooperative Agreement, or Other		6 to 10 hubs	

Source: U.S. Department of Energy

At least three federal grants have already been awarded to CCS projects in Louisiana. Awardees of the Carbon Capture Demonstration Projects Program Front-End Engineering Design (FEED) program include a CO₂ capture facility for Entergy Louisiana's gas-fired Lake Charles Power Station and a carbon capture facility at the existing Taft power plant in Hahnville.²⁹ The Southern States Energy Board, of which Louisiana Governor John Bel Edwards is a member, was awarded 8.4 million USD in DOE funds for an offshore CO₂ storage complex³⁰ being developed by Carbon-Zero US near Grand Isle.³¹

Other Louisiana projects will likely receive federal funding from the DOE, but this cannot be confirmed until more grants and loans are awarded. While each CCS project will be competing against others for federal grants and loans, the DOE has the clear intention to broadly complement Section 45Q tax credits by providing initial project capital where the private sector has not, especially in geographically strategic regions like Louisiana.

²⁵ U.S. Department of Energy, "Front-End Engineering and Design Program Out Activities Under Carbon Capture Tech Program 962 Of Environmental Protection Agency (Sec 40303)," www.energy.gov/bil/front-end-engineering-and-design-program-out-activities-under-carbon-capture-tech-program-962.

²⁶ U.S. Department of Energy, "Funding Notice: Bipartisan Infrastructure Law: Carbon Capture Technology Program, Front-End Engineering Design for Carbon Dioxide (CO₂) Transport," www.energy.gov/fecm/funding-notice-bipartisan-infrastructure-law-carbon-capture-technology-program-front-end.

²⁷ U.S. Department of Energy, "Four Regional Clean Direct Air Capture Hubs," www.energy.gov/oced/four-regional-clean-direct-air-capture-hubs.

²⁸ U.S. Department of Energy, "Regional Clean Hydrogen Hubs," www.energy.gov/oced/regional-clean-hydrogen-hubs.

²⁹ U.S. Department of Energy, "Carbon Capture Demonstration Projects Program Front-End Engineering Design (FEED) Studies Selections for Award Negotiations," 5 May 2023, www.energy.gov/oced/carbon-capture-demonstration-projects-program-front-end-engineering-design-feed-studies.

³⁰ U.S. Department of Energy, "Project Selections for FOA 2610: CarbonSAFE Phase II - Storage Complex Feasibility," 30 January 2023, www.energy.gov/fecm/project-selections-foa-2610-carbonsafe-phase-ii-storage-complex-feasibility.

³¹ Robert Stewart, "Carbon capture hub could be coming to Gulf of Mexico near Grand Isle; see who's involved," *The Advocate*, 22 December 2022, www.theadvocate.com/baton_rouge/news/business/carbon-capture-hub-could-be-coming-near-grand-isle/article_7c895d18-8213-11ed-85cc-43db573ad831.html.

The Global CCS Institute, an industry-funded think tank, considers that grants are necessary for the time being in the CCS industry, since, under current conditions, "banks cannot qualify CCS projects for debt financing." However, eventually:

Risks will be well understood, reduce or disappear, and grant funding will no longer be needed to incentivize and support investments. The CCS market will attract significant debt funding at pricing comparable to other infrastructure projects, allowing deployment to reach the numbers required. Projects will eventually come to rely exclusively on equity and debt for funding, and acceptable returns will be achieved through diminished costs and the increased value of CO₂.³²

Furthermore, the 45Q tax credits will only last for 12 years after carbon capture equipment is placed in service, meaning that private sector revenues will eventually have to keep CCS businesses afloat without federal subsidies.

³² Global CCS Institute, "Investing in CCS: What do financiers need?," 12 June 2019, www.globalccsinstitute.com/news-media/insights/14285.

CONCLUSION

Passage of the IRA in August 2022 marked the beginning of financial viability at scale for the CCS industry in Louisiana and elsewhere, as the tax credits created will account for the bulk of initial revenue. Simply put, the industry is heavily dependent on taxpayer subsidies and will remain so for the foreseeable future.

This transfer of taxpayer money was heavily lobbied for by private sector project developers, which received nearly everything they asked for in the IRA. To the extent that CCS will help oil companies and others claim carbon offsets, these will largely be paid for by the public.

The reason so much public money is needed has to do, in large part, with the litany of risks associated with CCS development, which discourages banks from lending money. Those risks, and the insurance policies they require, are the subject of the third and final installment in this research series. The Global CCS Institute notes that, just as there is an inherent "revenue risk" to CCS, which has now been covered by U.S. taxpayers, the long-term environmental risk of CO₂ leakage will have to be shouldered by the public:

While a private company might put into place mitigation measures to manage the possibility of leakage throughout the operation of a storage site, post-closure, private investors will be very unlikely to bear that risk, so there needs to be a system of laws and policies whereby the liability is transferred from the private sector investor to government post-closure.³³

The transfer of this post-closure environmental risk to Louisianans has already been anticipated in state legislation, as explained in the forthcoming Part 3 of this series.

DATA SOURCES

Sources used for research on CCS project financing included but were not limited to:

- Company websites, investor presentations, earnings calls, and U.S. Security and Exchange Commission (SEC) filings;
- Subscription financial data platforms;
- Incorporation, financial, and tax-related filings with relevant state governments; and
- U.S. DOE program documents outlining the nature, number, and amount of grants and loans to the CCS industry, as well as information on Section 45Q tax credits from the U.S. Internal Revenue Service (IRS).

³³ Global CCS Institute, "Unlocking private finance to support CCS investments," 2021 Thought Leadership report, www.globalccsinstitute.com/wp-content/uploads/2021/06/Unlocking-Private-Finance-for-CCS-Thought-Leadership-Report-1.pdf.