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DOE Implementation of Carbon Capture and Storage (CCS) Programs

The Department of Energy (DOE) supports carbon capture and storage (CCS) technologies primarily through three programs: research and development support, demonstration project funding, and loan guarantees.

Research, Development and Demonstration

The DOE funds CCS Research, Development and Demonstration (RD&D) through the Office of Fossil Energy and Carbon Management (FECM). After the passage of the Infrastructure, Investment and Jobs Act (IIJA, P.L. 117-58), CCS demonstration programs are managed through the Office of Clean Energy Demonstrations (OCED), while the FECM continue to oversee other CCS research and development (R&D) activities. The DOE has funded CCS projects like FutureGen, Petra Nova, Archer Daniel Midlands, and others, though with limited success.

According to the Congressional Research Service (CRS), Congress has provided roughly \$9 billion (in nominal dollars) in annual appropriations for DOE’s FECM from FY2010 to FY2023, with over \$2.8 billion specifically directed towards CCS line items. The IIJA, enacted in November 2021, allocated advance appropriations for various new and existing CCS programs for FY2022-FY2026.

CCS Programs	FY2022-2026 Appropriations	Managing DOE Office
CCS demonstration projects	\$2.537 billion	OCED
Front-End Engineering and Design (FEED) program for CCUS transport infrastructure	\$100 million	FECM
Carbon Storage Validation and Testing	\$2.5 billion	FECM
Carbon Dioxide Transportation Infrastructure Financing and Innovation (CIFIA)	\$2.1 billion	FECM & Loan Program Office (LPO)
Large-Scale CCS Pilot Projects	\$937 million	OCED
Carbon Utilization	\$310 million	FECM
Regional Direct Air Capture (DAC) Hubs	\$3.5 billion	OCED
Carbon Removal Prize Competition	\$115 million	FECM
Total	\$12.1 billion	

In 2021, the Government Accountability Office (GAO) reviewed 11 demonstration projects financed by the DOE, finding that only three were completed. This was partly due to their lack of economic viability and partly because of poor DOE management. Normally, the DOE will select funding recipients through a detailed down-selection process after announcing a Funding Opportunity Announcement (FOA), providing sufficient time for negotiations, and defining the scopes, schedules, and budgets for each project phase to minimize financial risk. However, the GAO reported that the DOE did not use a down-selection process for picking which projects to fully fund and shortened the negotiation timeline when negotiating cooperative agreements with funding recipients. Additionally, the DOE breached its own cost control measures by reducing agreed-upon cost-sharing requirements, reallocating funds meant for later project phases to earlier ones or accelerating the disbursement of funds from the American Recovery and Reinvestment Act. Ultimately, the DOE spent \$472 million on four uncompleted projects, which was \$300 million more than initially budgeted for these phases. Consequently, this mismanagement placed taxpayers at higher financial risk.

The GAO has recommended that the DOE implement a down-selection process, allow sufficient time for negotiations, and oversee future demonstration programs according to established scopes, schedules, and budgets. In January 2024, the DOE announced it is developing procedures and plans to address these recommendations.

However, the pattern of mismanagement is an ongoing issue. A more recent [GAO investigation](#) in 2024 found out that from FY2018 to FY2023, FECM, which administered 70% of DOE funding (\$950 million) for CCS R&D projects, once again failed to follow DOE's own guidance on risk reduction on the selection and management of these projects. The GAO found that FECM did not consistently document how risks were addressed, which could jeopardize a project's continuity and success while also risking significant taxpayer funds. Another concern was the selection of a \$14.6 million project that did not meet FECM's own technical score. This project subsequently experienced cost overruns and delays, requiring an additional \$5.1 million and 18 more months to complete. Similar to the last report, the GAO recommended DOE improve risk documentation and adhere to selection criteria.

According to OCED, after the selection of funding recipients from the application round, the projects are divided into four phases:

- Phase 1: Initial planning and analysis to confirm the technological, social, and financial feasibility of the project.
- Phase 2: Project development, including finalizing engineering designs, business development, site selection, workforce and community agreements, and obtaining permits.
- Phase 3: Installation, integration, and construction, where most expenses are incurred.
- Phase 4: Ramp-up to full operation, during which data is collected for project activity analysis.

These phases mirror the DOE's historical approach to project management, which also delineates four stages: 1) project definition and front-end engineering design, 2) design, 3) construction, and 4) demonstration and operation.

OCED has indicated that it will assess the status and quality of each project at each phase, also known as the "go/no-go" decision points, which determine whether a project advances to the next phase. If projects fail to reach critical milestones at any phase and do not pass the "go/no go" decision point,

subsequent funding phases will not be available. OCED reserves the right to “adjust or discontinue funding for the project” at “go/no-go” decision points, based on the outcome of the evaluation.

The GAO also recommended Congress establish an oversight mechanism, such as mandatory regular DOE reports on CCS project funding and status. However, Congress has not enacted this recommendation, even though it has appropriated over \$12 billion to CCS through the IJIA.

So far, OCED has announced various FOAs and selected various projects under the three CCS programs established by the IJIA.

Projects Awarded by OCED				
Selected Projects	Project Owner	State	Award Amount	CCS Programs
Baytown Carbon Capture and Storage Project	Calpine/Exxon Mobil	TX	\$270 million	CCS demonstration projects
Project Tundra	TC Energy, Minnkota Power Cooperative, Mitsubishi Heavy Industries	ND	\$350 million	
Sutter Decarbonization Project	Calpine	CA	\$270 million	
Carbon Capture Pilot at Cane Run Generating Station	PPL Corporation	KY	\$72 million	Large-Scale CCS Pilot Projects
Carbon Capture Pilot at Vicksburg Containerboard Mill	RTI International	MS	\$88 million	
Carbon Capture Pilot at Big Spring Refinery	Delek US Holdings, Inc.	TX	\$95 million	
Carbon Capture Pilot at Dry Fork Power Station	TDA Research	WY	\$49 million	
Project Cypress	Battelle Energy, Heirloom Carbon Technologies	LA	-	
South Texas DAC Hub	Occidental	TX	-	Regional Direct Air Capture (DAC) Hubs

Debt Capital Financing

In addition to funding RD&D programs, the DOE Loan Program Office (LPO) supports the early commercialization of advanced technologies, including renewables, nuclear, and advanced fossil fuels through the Title XVII Innovative Loan Guarantee Program created by the Energy Policy Act of 2005. Loan guarantees entail that if the borrowers default, federal taxpayers will repay the lenders.

Before the Inflation Reduction Act (IRA), the LPO at the DOE had \$8.5 billion in loan guarantee authority designated specifically for advanced fossil energy projects such as CCS.

The IRA expanded the loan authority for Title XVII projects by an additional \$40 billion, available through the end of FY2026, and allocated \$3.6 billion in credit subsidy to cover the costs of those loans and

administrative expenses. Upon issuing a loan guarantee, the recipient is required to pay a credit subsidy cost—an estimate of the federal government's long-term expense to guarantee a loan throughout its duration. This cost covers interest subsidies, defaults, and delinquencies and varies based on the loan's size and risk level.¹

Additionally, the IRA established a new, time-limited \$250 billion Title XVII loan authority—Section 1706, Energy Infrastructure Reinvestment Financing—for projects that:

- (1) retool, repower, repurpose, or replace energy infrastructure that has ceased operations; or
- (2) enable operating energy infrastructure to avoid, reduce, utilize, or sequester air pollutants or anthropogenic emissions of greenhouse gases.

Potential projects could include converting shuttered fossil energy facilities to clean energy production or updating operational energy infrastructure with emissions control technologies, including CCS. The IRA appropriated \$5 billion in credit subsidy to support Section 1706 and administrative expenses.

The IIJA also launched a new carbon dioxide (CO₂) transportation infrastructure financing and innovation program (CIFIA) to provide federal credit instruments, such as loan guarantees, secured loans, or grants, to CCS infrastructure projects. CIFIA received \$2.1 billion from FY2022 through FY2026 to support the construction of infrastructure (e.g., pipelines, shipping, rail) for transporting CO₂ from capture sites to storage or utilization locations. This program is jointly managed by DOE's LPO and FECM.

The LPO advises applicants to submit comprehensive documents, including third-party supply agreements and engineering, procurement, and construction (EPC) contracts, access to capital and raw materials, etc. Despite these detailed procedures, the LPO has faced criticism for its lack of transparency in the loan guarantee application and selection process, particularly in terms of project bidding, term sheet negotiation, and credit subsidy cost calculation, citing the protection of confidential business information.

To date, the DOE has not finalized a loan guarantee for any CCS facility. However, it has historically issued substantial loan guarantees to projects that were high-risk, over-budget, and behind schedule. For example, the Title XVII program guaranteed up to \$12 billion for Vogtle Reactors 3 & 4, a nuclear plant that is more than 6 years behind schedule and \$14 billion over budget. Despite the financial instability encountered during its construction, including the bankruptcy of the partner company Westinghouse in 2017 due to the project, the DOE's credit subsidy cost estimate for the loan guarantee was \$0, suggesting it saw no risk in these loans. If this project fails, taxpayers will be liable for these loans.

Conclusion

While DOE has historically supported CCS technology through its RD&D and loan guarantee programs, these efforts have shown limited success, posing financial risks to taxpayers. With increased funding from the IIJA and IRA, both Congressional and public oversight of DOE's management of its CCS

¹ GAO, DOE Loan Guarantees: Further Actions Are Needed to Improve Tracking and Review of Applications. GAO-12-157. <https://www.gao.gov/assets/gao-12-157.pdf>

programs will be essential to ensure that taxpayers are not exposed to additional financial risks and that the funding effectively aids in reducing emissions.