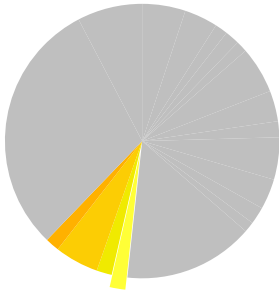




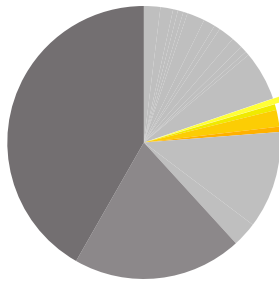
Federal Energy R&D: Carbon Capture

BY DAVID M. HART AND COLIN CUNLIFF | APRIL 2018

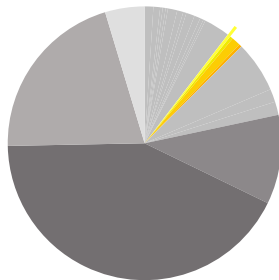
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Carbon Capture (yellow)
Other Fossil (yellow)
Energy R&D (light gray)



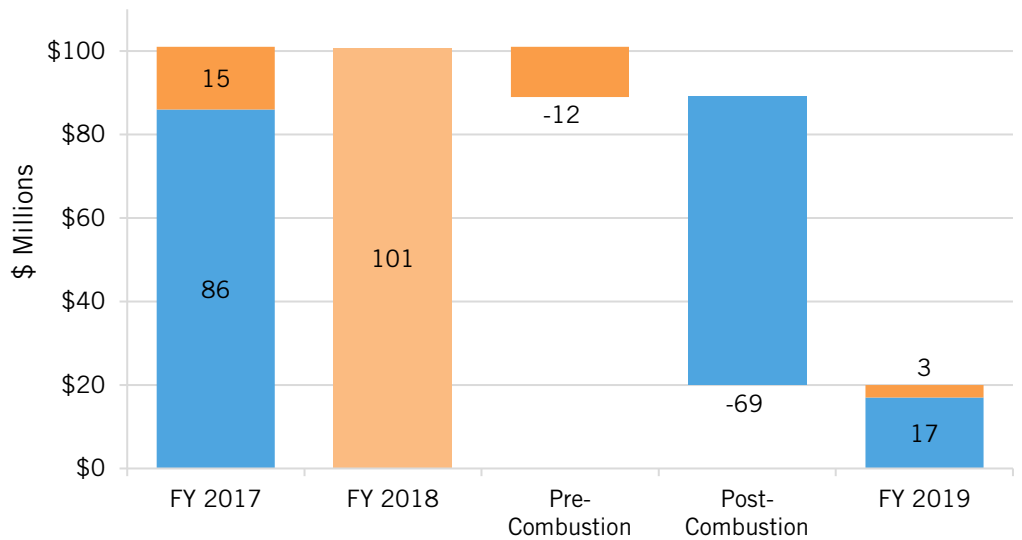
Carbon Capture & Energy R&D
Basic Science R&D
Defense R&D



Carbon Capture & Energy
Basic Science
Defense
Environ Mngmt
Other DOE

Carbon capture, utilization, and storage (CCUS) technologies for fossil-fuel power plants and carbon-emitting industrial sources have the potential to preserve important options—including coal-fired electricity generation—in a carbon-constrained future. Many studies suggest the future costs of achieving massive reductions in carbon pollution would be much higher if CCUS technologies were not available.¹ DOE’s carbon-capture RD&D program embraces two complementary technologies: pre-combustion systems, in which coal is gasified to allow for the removal of carbon dioxide (CO₂) prior to combustion or use in fuel cells; and post-combustion capture, which removes CO₂ from flue gas after combustion.

Figure 1: The FY 2019 Budget Request Would Cut Carbon Capture R&D by 80 Percent



What’s At Risk

The Department of Energy’s (DOE) efforts to advance carbon-capture technologies build on recent progress. For example, in January 2017, the world’s largest post-combustion carbon-capture facility came online on a large unit at the Petra Nova power plant near Houston, Texas, successfully removing 90 percent of the CO₂ from its emissions.² That success was quickly followed in April 2017, when the first-ever bioenergy with carbon capture and sequestration (BECCS) facility came online at the Archer Daniels Midland ethanol plant in Decatur, Illinois, demonstrating the viability of “negative-emissions” technology.³ Nevertheless, continued improvement and substantial cost reductions must occur before CCUS will be viable for full-scale deployment.

DOE has set the ambitious target of reducing the cost of carbon capture to less than \$40 per metric ton of CO₂ by 2025—and under \$30 per metric ton by 2035. Achieving these goals will improve the competitiveness of fossil-fuel resources in a carbon-constrained world. However, reductions in R&D funding threaten to delay or even derail current DOE progress toward these targets.

Carbon Capture R&D Activities

R&D in carbon capture is spread across two activities:

- **Post-Combustion Capture Systems** focuses on separating and capturing CO₂ from flue gas after the fuel has been combusted, and can be used to retrofit existing fossil-fuel power plants. Because CO₂ makes up only 5 to 15 percent of flue gas, separation is challenging—and once separated, the pure CO₂ must then be compressed for sequestration. Recent funding has gone to the development of second-generation technologies for these functions, including pilot tests at the National Carbon Capture Center, as well as their integration with advanced power cycles and environmental control technologies for other pollutants.
- **Pre-Combustion Capture Systems** focuses on removing CO₂ from fossil fuels before combustion is complete. For example, coal can be gasified under high pressure to produce a mixture of hydrogen (H₂) and highly concentrated CO₂, with the former used for energy storage and fuel, and CO₂ captured and sequestered. Recent R&D has focused on advanced solvents, sorbents, and membranes to lower the cost of CO₂ separation for pre-combustion systems.

Key Elements of the FY 2019 Budget Proposal

- **An 80-percent reduction in Post-Combustion Capture Systems**, including a discontinuation of all large-scale demonstrations, pilot projects, and similar ventures that address technology scale-up. The budget proposes refocusing on early-stage research and bench-scale development of advanced membranes and metal organic frameworks, in addition to advanced gas-separation technologies with the potential to reduce the cost of CO₂ capture.
- **An 80-percent reduction in Pre-Combustion Capture Systems**, including a discontinuation of all large-scale demonstrations and pilot projects. No funding is requested for activities to scale up pre-combustion technologies beyond bench-scale demonstrations.
- **Discontinuation of all funding for the National Carbon Capture Center (NCCC)**, a research facility in Alabama that is used to conduct small- and large-scale pilot tests of both pre-combustion and post-combustion capture technologies. Managed and operated by Southern Company, the NCCC leverages public funding through partnerships with leaders in the energy industry, and evaluates technologies at various levels of maturity with the aim of accelerating their commercialization.

ENDNOTES

1. IPCC, “Climate Change 2014: Synthesis Report,” *Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, ed. Core Writing Team, R.K. Pachauri and L.A. Meyer, (Geneva, Switzerland: IPCC, 2014), 25, https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf. See also IEA, *Energy Technology Perspectives 2016 – Towards Sustainable Urban Energy Systems* (IEA, 2015), http://www.iea.org/publications/freepublications/publication/EnergyTechnologyPerspectives2016_ExecutiveSummary_EnglishVersion.pdf.
2. “DOE-Supported Petra Nova Captures More Than 1 Million Tons of CO₂,” DOE website, accessed April 15, 2018, <https://www.energy.gov/fe/articles/doe-supported-petra-nova-captures-more-1-million-tons-co2>.
3. “DOE Announces Major Milestone Reached for Illinois Industrial CCS Project,” DOE website, accessed April 15, 2018, <https://www.energy.gov/fe/articles/doe-announces-major-milestone-reached-illinois-industrial-ccs-project>.

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