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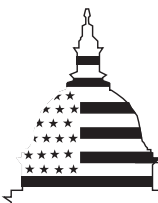
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Lessons Learned in the Clean Coal Technology Program

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Mr. Chairman and Members of the Subcommittee:

We are pleased to be here today to discuss our past work on the Department of Energy's (DOE) Clean Coal Technology program. As you know, the program was established in 1984 to provide cost-sharing assistance or partnerships with industry in demonstrating the commercial applications of emerging technologies, referred to as "clean coal." The success of the demonstration program was tied to creating technological innovations to help clean the environment, fuel an expanding economy with more coal energy and new jobs, make the U.S. more competitive, achieve commercial sales, and create new government-industry partnerships.

DOE funded a variety of projects under the program. DOE was authorized to fund up to 50 percent of an individual project's cost, with nonfederal participants funding the balance. DOE reported to us that the actual cost-sharing was about 34 percent from DOE and 66 percent from industrial participants. Overall, DOE has contributed about \$1.8 billion, while the private sector and other nonfederal participants have contributed about \$3.4 billion, for a combined commitment of about \$5.2 billion.

In reporting on the status of the program last year, we noted that 24 projects had been completed, 16 were currently active, and 10 had terminated or withdrawn.¹ No new projects have been started in the last 5 years. As of October 1999, about \$784 million of the available appropriations had not been spent. Of that amount, DOE expected to use \$589 million to complete the projects and \$66 million for program administration through fiscal year 2004. The Congress rescinded \$441 million (from April 1995 through October 1998) in unobligated funds associated with terminated or restructured projects. About \$129 million remained unobligated.

The just-completed report of the White House National Energy Policy Development Group is recommending that the Administration invest \$2 billion in a new restructured clean coal program over the next 10 years. In this context, our testimony today focuses on the findings of our reviews of the Clean Coal Technology program conducted over the last decade and

¹*Budget Issues: Budgetary Implications of Selected GAO Work for Fiscal Year 2001* (GAO/OCG-00-8, Mar. 31, 2000).

the lessons that can be learned from past efforts on this front. In particular, we want to discuss (1) the successes DOE has reported, (2) some weaknesses we identified, and (3) lessons learned in cost-sharing.

In summary, the Clean Coal Technology program has had its ups and downs. DOE has numerous examples of successes in the program, including commercialization of some technologies—the primary way DOE measures success. From a management perspective, we found that many projects had experienced delays, cost overruns, bankruptcies, and performance problems. We also expressed concerns about some of the projects DOE had selected. Nevertheless, this program serves as an example to other cost-share programs in demonstrating how the government and the private sector can work effectively together to develop and demonstrate new technologies.

Background

Although the Nation is heavily reliant on coal as a fuel source for electricity generation, burning coal has well recognized environmental consequences. Coal accounts for over 90 percent of the proven U.S. energy reserves and supplies about half of the nation's electricity. According to the Environmental Protection Agency, coal-fired power plants produced about 63 percent of U.S. emissions of sulfur dioxide and about 19 percent of the nitrogen oxides. When emitted into the air, these two gasses may be transformed into tiny sulfate and nitrate particles, both of which may be transported hundreds of miles away. These gases and substances can harm human health and the environment in various ways. For example, "acid rain"—formed when sulfate and nitrate particles are deposited by precipitation—harms human health and damages forests, lakes, and streams. In addition, global climate change has been linked, in part, to carbon dioxide emissions from burning coal. To help address this problem, DOE began exploring technologies to get the benefits of the nation's huge coal resources without the adverse environmental consequences. In fact, the Clean Coal Technology program has been one of the largest environmental technology development efforts the federal government has ever conducted.

The program has been implemented in a series of five solicitations for project proposals (rounds of nationwide competitions) spread over 9 years. Industry sponsors proposed demonstration projects in response to each competitive solicitation, and DOE evaluated and selected projects on the basis of evaluation criteria. The criteria include (1) the project's adequacy and technology's readiness for the proposed demonstration,

(2) the sponsor's commercialization plan and the technology's potential contribution to emission reductions, and (3) the sponsor's plan for financing the project. Each project was carried out and funded under a cooperative agreement between DOE and the project's sponsor. The sponsors directed the design, construction, and operation of their projects, and DOE oversaw project activities and assessed progress.

DOE-Reported Successes in the Clean Coal Technology Program

DOE has reported numerous successes in the program.² DOE noted that the program has been highly successful in bringing a broad suite of clean, efficient power technologies and control systems into the marketplace, which is the program's primary goal and which will provide the primary benefits to the nation. DOE has completed 24 projects at a cost of about \$400 million. Of these, 15 had sales of a demonstrated clean coal technology—3 in the domestic market, 3 in the international market, and 9 in both. These 15 projects cost DOE \$282 million and DOE reported that they are returning billions in commercial sales in addition to numerous U.S. and international patents for technology. A specific example of the program's success is a total of 162 commercial units of two clean-coal technologies (the atmospheric circulating fluidized-bed and the pressurized fluidized bed combustion) either in operation or soon to be commissioned. These units are distributed in Europe, Asia, and North America. Valued at \$9 billion, they represent a commercial return of over \$9 for every \$1 of DOE's investment, according to DOE. In addition, the technologies present an opportunity to use low-quality coal. DOE also counts as a success the over 700 U.S. and international patents awarded to domestic technology suppliers of advanced electric power generation, environmental control, coal processing, and industrial application technologies. These patents position U.S. industry to compete for an estimated \$480 billion export market over the next 30 years that will support more than 600,000 jobs in the U.S. power equipment industry.

²*Clean Coal Technology: Status of Projects and Sales of Demonstrated Technology* (GAO/RCED-00-86R, Mar. 9, 2000).

GAO-Reported Weaknesses in the Clean Coal Technology Program

Over the years we identified numerous management weaknesses in the program. In particular, we reported that multiple clean coal technology demonstration projects experienced problems and difficulties in meeting cost, schedule, and performance goals. As we reported last year, of 13 projects we examined, 8 had serious delays or financial problems—6 were behind their original schedules by 2 to 7 years, and 2 projects were bankrupt and will not be completed.³ The delays and cost overruns occurred, in part, because of changes in a project's site as well as a project's participants. DOE extended deadlines several times on some projects to allow their sponsors to restructure the projects, find suitable alternative project sites, and obtain financing commitments to make the projects economically viable.

On another front, in 1991, we questioned whether DOE had adequately protected federal investments in the projects it funded.⁴ For example, DOE did not always comprehensively consider whether projects were likely to be successfully completed when it provided additional funding to cover cost increases. Some projects were withdrawn from the program after receiving additional funds. Furthermore, DOE requires that project sponsors eventually repay the federal investment from revenues resulting from the subsequent use of the technologies. However, DOE reduced the likelihood of recouping its investment by reducing the percent of sales revenues subject to repayment.

In addition, we reported on problems with DOE's project selection process. For example, we identified some projects demonstrating technologies that might have been commercialized without federal assistance. We also identified projects that might have limited potential for widespread use as well as projects that have proven not to be economically viable. DOE selected such projects to achieve a diversity of technologies. Although these projects met DOE's selection criteria, they may not be the most effective use of federal funds.

³*Clean Coal Technology: Status of Projects and Sales of Demonstrated Technology* (GAO/RCED-00-86R, Mar. 9, 2000).

⁴*Fossil Fuels: Improvements Needed in DOE's Clean Coal Technology Program* (GAO/RCED-92-17, Oct. 30, 1991).

In 1990, we also questioned the pace and focus of the program.⁵ We noted that many of the technologies selected for demonstration may have limited potential for achieving nationwide emission reductions when used at existing coal-burning facilities. Also, some of the selected projects may have difficulty in successfully demonstrating, and ultimately commercializing, their technologies. Given the selections that DOE made in its second round, we were concerned that it may have problems in identifying and funding additional promising projects in future rounds. Delaying subsequent rounds until DOE obtained additional demonstration results from projects already in the program would allow DOE to make more informed decisions regarding the identification, selection, and funding of the more promising technologies. It would also help ensure that the funds allocated to this program were effectively and efficiently spent.

Cost-Sharing Lessons Learned

In a 1994 report, we noted that the Clean Coal Technology program offered an example of the government and the private sector working together effectively to develop and demonstrate new technologies.⁶ We identified lessons learned from the program that could be applied to other cost-share programs. They included:

- Full funding (through advanced appropriations) to cover the total federal share of project costs increases participant confidence that federal funds will be available for multiyear projects.
- Cooperative agreements between the federal government and participants allow participants more flexibility in managing their projects, providing clear instructions on the roles and responsibilities of the government and the nonfederal participants.
- Federal cost-sharing limits help to ensure the industry's commitment.
- Early industry participation in developing solicitation documents helps the industry to structure responsive proposals.
- A comprehensive process for evaluating and selecting projects and keeping it free of political influence helps ensure the program's integrity.
- Multiple, sequential solicitations for project proposals enable an agency to modify the program's objectives to meet changing needs and to benefit from lessons learned.

⁵*Fossil Fuels: Pace and Focus of the Clean Coal Technology Program Need to Be Assessed* (GAO/RCED-90-67, Mar. 19, 1990).

⁶*Fossil Fuels: Lessons Learned in DOE's Clean Coal Technology Program* (GAO/RCED-94-174, May 26, 1994).

In conclusion, to address today's energy challenges, the lessons learned from the Clean Coal Technology program should be considered as the Congress decides how to use future research dollars.

Mr. Chairman, this completes my prepared statement. I would be happy to answer any questions you or Members of the Subcommittee may have.