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Report to the Chairman, Subcommittee on Energy and Power, Committee on Energy and Commerce, House of Representatives

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FOSSIL FUELS

Lessons Learned in DOE's Clean Coal Technology Program

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Resources, Community, and
Economic Development Division

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The Honorable Philip R. Sharp
Chairman, Subcommittee on Energy and Power
Committee on Energy and Commerce
House of Representatives

Dear Mr. Chairman:

The Department of Energy's (DOE) Clean Coal Technology program, which has been under way since 1986, is a unique partnership between government and industry for sharing the costs of commercial-scale projects that demonstrate innovative technologies for using coal in a more environmentally sound, efficient, and economical manner. DOE funds up to 50 percent of a project's cost, and the project's sponsor and other nonfederal participants fund the balance.

The clean coal program is one of the largest environmental technology development efforts in the federal government. At your request, we reviewed the lessons DOE has learned in implementing the clean coal program and the changes DOE has made as a result of such lessons in order to identify concepts or experiences that might be useful to other federal programs that share in the costs of developing and demonstrating technologies. We also obtained information on DOE's plans for the future direction of the clean coal program.

In conducting our review, we obtained the views of DOE program management officials, almost half of the project sponsors, other industry participants, and several national and state organizations involved with the program. We also reviewed pertinent reports and other documents and drew from a series of our past reports on the clean coal program. (See app. I for a more detailed description of our scope and methodology.)

Results in Brief

According to DOE, the success of the clean coal program ultimately will be measured by the degree to which the technologies demonstrated under the program are commercialized in the energy marketplace. Although it is too early to judge the program's success in commercializing technologies, the program has shown that the government and the private sector can work together effectively to develop and demonstrate new technologies. The lessons learned from DOE's experience with the program should be useful for similar programs in which costs are shared. For example:

- Obtaining advanced funding increased the participants' confidence that federal funds would be available for multiyear projects.
- Using cooperative agreements allowed the participants to manage their projects with more flexibility and less-intensive federal oversight than under contracts.
- Establishing federal cost-sharing limits helped to ensure the industry's commitment to the projects, while recognizing the need for federal assistance to reduce the risks associated with demonstration projects.
- Obtaining early industry participation in developing solicitation documents that included clear guidance, requirements, and specific criteria for evaluating and selecting projects helped the industry to structure responsive proposals.
- Establishing a comprehensive process for evaluating and selecting projects and keeping it free of political and other influence helped to ensure the integrity of the program.

Also, by having multiple, sequential solicitations for project proposals, DOE was able to modify the clean coal program's objectives to meet changing national needs and make improvements and adjustments on the basis of the lessons learned. Many of the program's improvements and modifications addressed the problems and difficulties that DOE had in the early years of the program with the private-sector financing arrangements, the repayment of the federal share of costs, the treatment of proprietary data, the sharing of preaward costs, and the time involved in developing and approving cooperative agreements. But DOE is continuing to experience some problems under the clean coal program, particularly project delays and cost increases resulting from compliance with environmental review requirements and project site changes. DOE is reviewing options, such as making design improvements on existing projects, for using unspent federal funds that had been designated for projects withdrawn from the program, but DOE's plans for the program's future direction are uncertain.

Background

The clean coal program has been implemented in a series of five solicitations for project proposals (rounds of nationwide competitions) spread over 9 years. The industry sponsors proposed demonstration projects in response to each competitive solicitation, and DOE evaluated and selected projects on the basis of the best-qualified proposals. The projects' sponsors are responsible for directing the design, construction, and operation of their projects. DOE oversees project activities and assesses progress. As of December 1993, 36 projects were active in the

program, and 9 projects had been completed. A total of 15 other projects had been withdrawn from the program. Ten of the withdrawn projects had not been funded, and five had been partially funded.

The Congress has appropriated $2.75 billion for the program, most of which has been committed to the 45 active and completed demonstration projects. The private sector and other nonfederal participants have committed more than $4.5 billion for these projects. Each project is carried out and funded under a cooperative agreement between DOE and the project's sponsor. According to DOE, the number of complex, high-dollar-value projects put in place under the clean coal program and the degree of cost-sharing achieved are unprecedented. DOE believes that the clean coal program and concepts could serve as a model for other federal cost-sharing programs aimed at introducing new technologies into the commercial marketplace. A DOE report on the lessons learned in the clean coal program was scheduled to be issued in May 1994.

Advanced Appropriations Can Increase Industry's Confidence in the Stability of Federal Funding

In implementing a multiyear, cost-shared program for developing or demonstrating technologies, one of the first questions that needs to be addressed is whether the administering federal agency should be required to request project funds each year for the program. In DOE's clean coal program, the Congress provided advanced appropriations for each of the five solicitations, or rounds, of clean coal projects. Having the full funding in place for each solicitation to cover the total federal share of the costs of all projects selected in the round increased potential participants' confidence that federal funds would be available to complete their multiyear projects.

According to DOE, this advanced commitment of federal funds has been an important reason for the industry's significant response to the program, in terms of both the quantity and quality of the proposals received and the nonfederal cost-sharing achieved. The nonfederal participants are contributing about two-thirds of the funding for the projects in the program, and DOE is providing about one-third. Virtually all of the DOE officials, project sponsors, and other program participants whom we asked perceived the government's advanced financial commitment as a very big advantage for multiyear projects, because it indicated that the government would be involved in cost-sharing throughout the life of the projects. The industry participants told us that they would not want to commit significant funds in the early years of projects if they perceived

that the government might stop sharing costs before the projects were completed.

One drawback to advanced funding is that tying up federal funds for several years could limit the Congress's ability to fund other programs within or outside of the receiving agency. According to congressional staff members we spoke with, advanced appropriations should probably be considered only for large programs with large projects to which industry is less likely to commit its resources without the assurance of advanced federal funding.

Certain Program Design Features Offer Advantages

Cooperative agreements, multiple solicitations, and appropriate cost-sharing limits can be successful design features of a federal/industry program to develop or demonstrate technologies. Cooperative agreements allow the participants to manage their projects with less-intensive federal oversight and more flexibility than under contracts. Multiple solicitations provide the flexibility to modify the program's objectives on the basis of changing needs or to adjust procedures. Establishing federal cost-sharing limits helps to ensure the industry's commitment to projects, while recognizing the need for federal assistance to reduce the risks and uncertainties associated with development and demonstration projects.

Cooperative Agreements More Effective Than Contracts or Grants

In establishing roles and responsibilities for federal and nonfederal participants, contracts are normally used when the principal purpose is to acquire goods and services for the benefit of the federal government. Either cooperative agreements or grants are normally used when the principal purpose is to accomplish a public purpose by providing financial assistance. Cooperative agreements are more appropriate if substantial involvement is anticipated between the federal agency and the recipient during the performance of the contemplated activity, while grants are more appropriate if substantial federal involvement is not anticipated.

Congressional guidance for the clean coal program pointed out that the demonstration projects should be industry projects assisted by the government, not government-directed demonstrations. To emphasize this point, the Congress directed that federal funding not exceed 50 percent of a project's cost. After considering the congressional guidance, DOE chose cooperative agreements as the legal instrument for implementing the program.

The project sponsors, utilities, and other organizations we talked to generally favored the use of cooperative agreements. We were told that such agreements have worked well in carrying out projects; provided clear instructions on the roles and responsibilities of the government and the nonfederal participants; allowed the sponsors to manage their projects with less-intensive federal oversight; and provided more flexibility than contracts.

Multiple Solicitations Allow More Program Flexibility

The solicitations for project proposals can be structured in two basic ways. Under one method, the proposals are submitted and the selections are made by specified dates.[1] Under the second method, the solicitation is open ended. Proposals are submitted over a period of time, even over a period of years, and are reviewed, and selected if qualified, in the order received.

According to DOE, when multiyear programs are involved, multiple sequential solicitations for project proposals have a distinct advantage over a single long-running solicitation because they provide the flexibility for the Congress and federal program managers to modify the program objectives to meet changing national needs. Such flexibility is particularly important for long-term programs. Multiple solicitations also provide program managers with the flexibility to adjust procedures and processes from one solicitation to the next on the basis of the lessons learned. According to DOE, fairness considerations would not allow such adjustments if a single long-running solicitation were used.

The focus of the clean coal program did change as the program matured. The Congress directed that the round-one solicitation be directed at demonstrating a broad slate of emerging clean coal technologies to enhance the use of coal for all market applications. Then, as a result of the administration's decision to expand and use the program to address acid rain, the Congress directed that the round-two and -three solicitations be focused on demonstrating innovative clean coal technologies that are capable of achieving significant near-term reductions of acid rain-causing pollutants at existing coal-burning facilities. The Congress then broadened rounds four and five of the program to include a wider range of high-efficiency technologies that can meet longer-term energy and environmental needs. By implementing the clean coal program in a series

[1]This approach generally does not allow for discussions between the proposer and the government before selection. Under a variation of this method, proposals are reduced to a competitive range and discussions are conducted with these proposers to gain more insight into the reasonableness of their proposals. Selections are made from proposals in the competitive range.

of solicitations for project proposals spread over several years, DOE was able to use the time between solicitations to modify the program objectives to meet changing national needs and to make programmatic and procedural improvements and adjustments on the basis of the lessons learned.

Establishing Federal Cost-Sharing Limits Helps to Ensure Industry's Commitment

According to DOE officials, in establishing federal cost-sharing limits for a technology development program, consideration should be given to where the technology is on the pathway of development. The federal government's share of the costs should normally decrease as a technology moves closer to commercialization. When the objective is to share the costs of research and development projects, DOE has generally funded at least 80 percent of the projects' costs. Once the technologies are ready to be demonstrated on a commercial scale, as in the case of the clean coal program, DOE officials as well as many program participants believe that the federal government's relative share of the costs should substantially decrease. If the government is to continue to share the costs of the technologies' initial deployment, or of the first commercial sales of the technologies, as some argue should be done in the clean coal program, the federal share should be further reduced.

The statutory provisions governing the clean coal program provide that DOE cannot finance more than 50 percent of the total allowable costs of a project, as estimated by DOE at the time that financial assistance is awarded. The statutes also provide that DOE cannot finance more than 50 percent of the cost during each of a project's budget periods. DOE can provide additional funds of up to 25 percent of its original investment for a project's cost overruns. DOE believes that requiring nonfederal participants to finance at least 50 percent of the costs throughout the project helps to ensure the industry's commitment to fulfill the project's objectives. According to DOE, allowing for limited federal cost-sharing of a project's cost overruns recognizes the risk involved in first-of-a-kind demonstrations, while committing the nonfederal participants to share in all cost increases. DOE, the project sponsors, and the other organizations we talked to expressed a consensus view that the overall federal cost-sharing limits established in the clean coal program are appropriate, given the state of technology development and the objectives of this program.

In determining how much financial assistance to award to individual project sponsors, we reported in March 1993 that consideration should be

given to how third-party contributions are treated and whether sponsors should be responsible for funding a minimum level of project costs with their own resources.[2] Under the clean coal program, DOE allows a project's sponsor to include third-party contributions in the sponsor's share of the project's financing. We pointed out that sharing third-party contributions with DOE could reduce the amount of the required federal investment in projects. We also pointed out that in a few projects, the practice of including third-party contributions in the sponsor's funding has significantly reduced the sponsor's direct investment. We argued that sponsors may have more incentive to manage their projects to meet cost, schedule, and performance goals if they risk more of their own funds. DOE argued against such a requirement for several reasons. Its chief argument was that the requirement could make it more difficult for small companies to sponsor projects if they had to rely less on third-party funding to make up the nonfederal share of the costs.

Opening Up the Solicitation Process Fosters Better Results

The public's involvement in developing solicitations can help to obtain more widespread interest and participation by the industry. Also, including guidance in the solicitation document that spells out the applicable program objectives, policies, and requirements and the specific criteria that will be used to evaluate and select projects, encourages the submission of better proposals.

At the beginning of round two and each subsequent round of the clean coal program, DOE held regional public meetings to discuss the program and the issues of concern and to solicit public comments on how the program could be improved. DOE also solicited public comments on a draft of each solicitation document. In addition, DOE held a preproposal conference a few weeks after issuing the final solicitation document to respond to public questions and concerns. DOE and virtually all of the project sponsors and other organizations we talked to believed that these efforts helped significantly in structuring the solicitations and in obtaining the industry's widespread interest and participation in the program.

To assist the private sector in structuring responsive proposals for clean coal projects, each solicitation document contained instructions for preparing proposals; the applicable objectives, requirements, and guidelines for that particular round of projects; and a model cooperative agreement that incorporated the applicable government regulations and

[2]Fossil Fuels: Ways to Strengthen Controls Over Clean Coal Technology Project Costs (GAO/RCED-93-104, Mar. 31, 1993). Third parties are nonfederal project participants other than sponsors.

provisions. The solicitations also discussed the specific criteria that would be used to evaluate the proposals, the relative importance of the criteria, and the program policy and other factors that would be considered in selecting projects. In addition, the solicitations discussed DOE's responsibilities for and role in overseeing projects and contained the policies and guidelines for preparing project cost estimates, determining allowable and unallowable costs, determining financial assistance, and repaying federal funds if the technology is commercialized. Round-four and -five solicitations also included a model repayment agreement.

The project sponsors and other organizations we talked to generally indicated that the solicitation documents were clear and adequately explained how to prepare project proposals. However, some believed that the requirements called for too much detailed and repetitious information, resulting in voluminous and expensive proposals that could be particularly burdensome to small businesses or discourage their participation. According to DOE, some extensive and repetitious material was necessary to facilitate the evaluation of project proposals by different evaluation teams. DOE officials also indicated that the round-one solicitation document was not as clear as the documents for subsequent rounds because it was developed fairly quickly to implement the program.

Project Selection Practices Can Enhance the Return on Federal Investment

A comprehensive and thorough process for evaluating and selecting project proposals, using appropriate technical expertise, helps to ensure a program's integrity. Insulating project evaluation and selection officials from political or other influence helps to keep the process free of inappropriate intervention. To realize the greatest possible return on the federal investment, certain practices may be needed to weed out those projects that are likely to advance without the need for federal funding and those that are poor financial risks. Including multiple program objectives in the selection process can limit the extent to which any one objective is achieved.

DOE Used a Comprehensive Evaluation Process

In implementing the clean coal program, DOE established a comprehensive and thorough process for evaluating, ranking, and selecting project proposals. The evaluations were done by various teams of DOE experts in a secured area where information was kept. The teams consisted of about 80 to 100 staff members with technical, environmental, procurement, and other areas of expertise. DOE also used a Source Evaluation Board to help

evaluate and rank the projects and a Source Selection Official to make the final selections.

In the initial phase of the evaluation process, all proposals were reviewed to determine whether they met the minimum criteria for qualification. The qualified proposals were then reviewed to determine whether they addressed the program's objectives and contained sufficient information to undergo a comprehensive evaluation. The most intensive phase of the process addressed the technical and environmental merits of each project, the management plan for conducting the demonstration, the marketing plan for commercializing the technology, the project's financing plan, and the reasonableness of the project's estimated costs. The proposals were rated against the comprehensive evaluation criteria, weights were applied for the relative importance of certain criteria, and the proposals were scored and ranked. The selection official considered the evaluation results and the relevant program policy factors, such as the diversity of technical approaches and applications, in determining the mix of projects that would best serve the program's objectives.

Our previous review of the round-two evaluation and selection process showed that the evaluation criteria conformed to the legislative and regulatory requirements and other program guidance and were consistently applied during the evaluation process.[3] Our previous work also showed that DOE picked the highest-ranked proposals submitted for the various mix of technologies that it wanted to see demonstrated. Current and former DOE headquarters and field officials told us that a strength of the selection process was that the evaluation and selection of projects were free of political and other influence. The project sponsors, utilities, and other organizations we talked to also perceived that the process was fair and free of inappropriate intervention.

DOE also established a process for debriefing the sponsors of projects that were not selected. We talked to several such sponsors, who indicated that they were generally satisfied with the debriefing process.

Strategies for Enhancing the Return on the Federal Investment

When project proposals are evaluated, we believe that an important issue to consider is whether certain projects are likely to be done, even without federal assistance. In an October 1991 report on the clean coal program, we said that selecting such projects may not be the best use of limited

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

federal resources, even though the projects may have been highly ranked.[4] DOE argued, however, that (1) accelerating the commercialization of clean coal technologies is also a program objective and (2) selecting technologies that may be commercialized without federal funding could speed up the process. While we agreed, we pointed out that the availability of federal funds could be a substantial incentive for sponsors who intend to demonstrate their technology on their own to submit their projects for consideration. We also pointed out that an assessment to determine whether a technology is likely to advance in the marketplace without federal funding could be particularly useful in choosing between closely competing projects.

Another issue is the extent to which projects that appear to be poor financial risks should be excluded from further evaluation and not ranked for selection consideration. We pointed out in our October 1991 report that DOE questioned the economic viability and financing of two round-one projects and one round-two project but selected them nevertheless to obtain the mix of technologies that it wanted to see demonstrated. All three projects experienced financial difficulties and were withdrawn from the program because the sponsors could not find buyers for their products. Recognizing this problem, DOE began placing significantly more emphasis and weight on project financing in evaluating and ranking subsequent projects. We reported, however, that projects that have problems with financing and economic viability can still be selected as long as they are ranked for selection consideration and score well on other evaluation factors.

A third issue to consider is the potential impact of competing program objectives. Our October 1991 report pointed out that some of the clean coal projects that were selected to provide a diversity of technologies are demonstrating technologies that have much less potential for widespread use, or for achieving significant reductions in emissions, than others. In selecting clean coal projects, however, DOE has attempted to strike a balance between satisfying its objective to obtain a diversity of technologies (methods, technical approaches, and applications for various types of potential users) and meeting its objectives to demonstrate technologies that have significant potential for energy savings, environmental protection, or both.

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

Problems in Negotiating Agreements Can Delay Getting Projects Under Way

Several issues may need to be resolved early in the negotiations to avoid delays in completing the cooperative agreements between federal and nonfederal partners. DOE experienced numerous delays and difficulties in formalizing the cooperative agreements in the early rounds of the clean coal program. In a March 1989 report,[5] we pointed out that the delays resulted from the sponsors' (1) difficulties in completing financial and other business arrangements to fund the nonfederal share of project costs, (2) reluctance to agree to repay the federal share of project costs should the technology be commercialized, and (3) reluctance to provide proprietary data to DOE for fear that it might be publicly released. Delays were also caused by issues related to sharing certain preaward costs and by a cumbersome process for DOE headquarters review and approval. On the basis of the lessons learned from these issues, DOE took several actions to speed up the process.

Requirements for Completing Financing Arrangements Were Relaxed

As a condition to signing round-one agreements, DOE required the sponsor to obtain firm financing commitments in advance for covering the project's entire estimated cost. According to DOE, this requirement turned out to be unreasonable because many proposed projects were not defined well enough to attract funding from financial institutions for construction and operation costs. Beginning in round two, DOE required the sponsor to provide firm financing only for the project's first budget period and a specific plan for financing the balance of the project's estimated total cost before the cooperative agreement was signed. The sponsor could use the project's first budget period to better define the project, develop more realistic cost estimates, and obtain firm financing for the balance of the project's cost. All financing had to be in place before the project could proceed to the second budget period. According to DOE, this change helped speed up the process of formalizing agreements.

Repayment Provisions Were Revised

The Energy Policy Act of 1992 requires DOE to establish repayment procedures under several of the act's authorized technology demonstration programs, whereby the government would recover over time its portion of the costs shared with nonfederal partners. DOE's experiences with repayment in the clean coal program may offer important insights into how the repayment provisions in these and other programs should be structured. The sponsors' dissatisfaction with DOE's initial clean coal repayment provisions contributed significantly to the

[5]Fossil Fuels: Commercializing Clean Coal Technologies (GAO/RCED-89-80, Mar. 29, 1989).

delays in negotiating round-one and -two cooperative agreements and led to a number of changes in the repayment provisions.

DOE requires the clean coal projects' sponsors to repay the federal investment in demonstration projects within 20 years after a project ends, if the technology is commercialized. Round-one provisions required that repayment was to come from (1) any net revenues generated from project operations and (2) revenues accruing from the commercial sale, lease, manufacture, licensing, or use of the technology. According to DOE, the negotiations for round-one cooperative agreements were delayed considerably because the sponsors argued, among other things, that their ability to compete in the marketplace would be adversely affected by the repayment provisions.

DOE now agrees that if the repayment obligations are too demanding, especially in the early years of technology sales, cash flows and profitability may not be sufficient for the organization responsible for repayment to remain in business, or licensing fees and costs may be too high for the technology to remain competitive with alternative technologies. During rounds two and three of the clean coal program, DOE made a number of changes to the repayment provisions to lessen the likelihood that the repayment requirements could hamper the project participants' competitiveness. Among other things, DOE (1) excluded net operating revenues as a source of repayment, (2) reduced the percentage of revenues from technology sales that are subject to repayment, (3) eliminated an inflation adjustment requirement, (4) allowed a grace period before repayment begins to facilitate the technology's initial market penetration, and (5) provided for a waiver from repayment altogether if repayment would place the participants at a competitive disadvantage in the marketplace. Following congressional direction, DOE kept the repayment provisions the same for the remaining rounds of the program.

DOE officials, sponsors, and others we spoke with told us that these changes greatly facilitated the negotiation of cooperative agreements. The impact of these changes on the likelihood of the federal government's recovering its investment, however, is unknown. As of March 1994, only two commercial sales had been made of a technology demonstrated under the clean coal program, and no sponsors had yet incurred any obligation to begin repayments. Several project sponsors and other organizations we talked to thought that the provisions are now so lenient that DOE will not recoup much of its investment. We recommended in our October 1991 report that DOE evaluate the likelihood of recovery on the basis of the

changes made to the program. According to DOE, it is currently conducting such an evaluation as part of a larger review of its clean coal program repayment policy.

Proprietary Information Was Protected

During the cooperative agreement negotiations, some project participants were reluctant to provide proprietary technical data to DOE because they were concerned that the data might be released publicly. The participants were also concerned that sensitive technical data acquired during the demonstration projects might be subject to public disclosure. DOE required access to technical data to enable it to evaluate and monitor project performance. To alleviate such concerns, DOE advised the project participants to identify the proprietary parts of their submissions and allowed them to negotiate the boundaries of the demonstration data that should be treated as proprietary. DOE assured the sponsors that proprietary information would be appropriately safeguarded.

In negotiating cooperative agreements, DOE also obtains a commitment from the sponsors to actively commercialize and/or license the technology, if it is successfully demonstrated. DOE allows the project participants to retain real and intellectual property rights. But to protect the government's interest, DOE reserves the right to allow others to commercialize successfully demonstrated technologies, if the participants do not. DOE also retains limited rights to use the technology for the government's purposes.

According to DOE, an important aspect of negotiation is striking a balance between the need to protect the sponsors' intellectual property and maintain their competitive position and the need to protect the public interest. To help protect sponsors' intellectual property and maintain their competitive position, DOE requested legislative authority to allow certain sensitive data to be protected for up to 5 years after a demonstration project ends. The authority was included in appropriations legislation enacted before round four of the program.

DOE Began Sharing Preaward Costs

Because DOE did not share the costs, some of the round-one project sponsors were reluctant and slow to provide environmental and other data that DOE required during preaward activities. To provide more incentive for subsequent sponsors, in round two DOE began to share preaward costs incurred by the sponsors in obtaining and providing (1) the project-specific environmental data needed to satisfy the requirements of

the National Environmental Policy Act and (2) other data needed to clarify proposal issues. After the cooperative agreement is signed, allowable preaward costs are reimbursed on the basis of the federal government's relative share of the project's total costs. The preaward costs are not shared by the government if a project is withdrawn during the process of formalizing an agreement.

Headquarters Review and Approval Process Was Streamlined

In implementing the clean coal program, DOE headquarters retained the authority to coordinate, review, and approve each step of the negotiation process for formalizing cooperative agreements. This arrangement was adopted because of the program's size—some projects cost hundreds of millions of dollars—and to ensure that DOE's field organizations negotiated the agreements in a consistent manner. The headquarters review process became a problem because it involved several offices that conducted time-consuming sequential reviews of the various negotiation documents.

In December 1989, the Secretary of Energy issued a directive that streamlined the process of administrative review and approval at headquarters. An Executive Board was formed to oversee and manage the process, and a concurrent review process was implemented, in contrast to the earlier sequential review process. DOE also established mutually agreeable schedules and milestones with project sponsors for determining progress in formalizing the agreements. The sponsors were required to document the problems causing delays and the actions taken to address the problems and to stay on schedule. The directive set a goal to have the agreements for round three and subsequent rounds completed within 1 year after the projects were selected. The agreements for 18 of the 20 round-three and -four projects were completed within, or shortly after, the 1-year target period.[6]

Aggressive Project Oversight Is Important, but Delays and Increased Costs Are Likely to Occur

A key to successful oversight of technology development projects is aggressive monitoring, including required key decision points for assessing progress and periodic status reports. Nevertheless, cost increases and delays are to be expected in some first-of-a-kind demonstration projects. External factors that can also cause delays include environmental reviews and difficulties in siting projects.

[6]Round-five projects were selected in May 1993. DOE expects to complete the agreements for these projects by July 1994.

Oversight Protects the Public Interest

In the clean coal program, the project's sponsor is responsible for managing the project, while DOE oversees the project to protect the public interest. DOE tries to strike a balance in the degree of oversight it provides. DOE and the sponsor negotiate mutually agreeable key decision points in the cooperative agreement for determining whether to proceed with the project. Budget periods are established that tie into the decision points, and project funding is provided by budget period. Before proceeding from one budget period to the next, the sponsor must submit a continuation application to DOE, including a project evaluation report that compares the actual progress and performance during the budget period with mutually agreed-on goals and a detailed plan and budget for the balance of the project. DOE analyzes the application and either approves it, approves it on the basis that certain conditions be met, or disapproves it.

DOE also requires the sponsors to provide monthly, quarterly, and annual reports on the progress and financial status of their projects. These reports summarize the projects' status, accomplishments, planned and actual costs on a cumulative basis, problems and issues, and future plans. To help ensure that project sponsors submit only allowable costs for federal cost-sharing reimbursement, DOE uses the Defense Contract Audit Agency to perform incurred cost audits on clean coal projects. In our March 1993 report, we pointed out that although such audits are needed to protect the government's interest, they had not been performed in a timely manner because the Defense Contract Audit Agency had an extensive backlog of audits for federal agencies.

The project sponsors and other project participants that we talked to were generally satisfied with the extent of DOE's oversight involvement in their projects. Many said that they had a close working relationship with DOE staff members connected with their projects and generally found them accessible and helpful when needed for providing technical and other assistance on project matters. Many of the participants we spoke with were also satisfied with the use of the budget period mechanism as an oversight control. However, some said that the process of obtaining DOE's approval to proceed from one budget period to the next, or to modify the scope of work, sometimes slowed down a project's progress. To help projects stay on schedule, DOE sometimes allowed sponsors to proceed with their projects at their own risk without federal cost-sharing until the next budget period was approved. DOE often extended budget periods to provide additional time for the project participants to resolve issues and problems.

A lesson learned in connection with oversight is that cost increases and delays should be expected and planned for in some first-of-a-kind demonstration projects. In our October 1991 report, we pointed out that after projects were begun, many experienced cost increases and/or delays in completing design, construction, or operation activities. The delays resulted from equipment failures, site availability problems, difficulties in scheduling tests around plant outages, and other factors. The cost increases occurred because of inflation; additional equipment requirements; and unexpected design, construction, or testing costs. In some cases, the scope of the work planned for the projects was scaled back because of cost increases.

As previously noted, DOE also experienced a problem with projects' dropping out of the program. As of December 1993, 15 projects had been withdrawn by their sponsors. Ten withdrew before the cooperative agreements were signed and therefore were not funded by DOE. The other five were partially funded by DOE for a total of about $21 million, which amounts to about 3 percent of the total federal expenditures for all projects through February 1994. The sponsors' inability to arrange or provide adequate financing led to many of the withdrawals.

Environmental Compliance Can Cause Delays

Another lesson learned is that demonstration projects are often delayed by the need to comply with the requirements for environmental reviews. Dealing with such requirements has been a learning experience for both DOE and the project sponsors. As previously mentioned, during the process of formalizing the cooperative agreements, the sponsors are required to prepare and submit site-specific environmental information to DOE. DOE uses this information in preparing site-specific environmental impact documents for each project. In order to satisfy the National Environmental Policy Act and DOE's implementing regulations and procedures, DOE requires that the project-specific environmental compliance activities be satisfactorily completed before DOE will share project costs beyond the preliminary design phase.

In the early years of the clean coal program, for a number of projects DOE prepared memorandums to the files to satisfy the project-specific requirements for environmental review. The memorandum, which could be developed relatively quickly, was intended for circumstances in which the expected impacts of the proposed action were clearly insignificant. But this mechanism was discontinued in September 1990 by a directive issued by the Secretary of Energy. Since then, and in some earlier cases,

projects have been subjected to an environmental assessment. Some projects have also been, or will be, subjected to an environmental impact statement. (An assessment is prepared first to determine whether a proposed action requires the preparation of a full environmental impact statement.)

According to DOE, it takes well over 2 years to complete a full environmental impact statement for a project. DOE believes the environmental review process could significantly delay the start of detailed design and construction work for many of the more environmentally complex projects selected in the later rounds of the clean coal program—those that will require a full environmental impact statement. Several projects have already been delayed as a result of the process. Although DOE has made attempts to help simplify and expedite the process, DOE contends that the effects of environmental review activities on projects' schedules remain a serious area of concern. According to DOE, the consequences of project delays can range from cost escalation to project termination.

Project Site Changes Can Cause Delays

The clean coal program has also experienced a problem with project site changes. Several projects have changed sites since they were selected—in some cases, more than once. The site changes were made for several reasons, including public opposition, permitting problems, changes in the economic viability of the original sites, and the changing needs of participants. When a site change is proposed by the project's sponsor, DOE assesses the situation and decides whether the project would have been selected on the basis of the proposed new site. DOE makes every effort to approve site changes.

Project delays have often resulted from site changes, and in some cases funds from the federal share of costs have been spent on environmental permitting activities, engineering and preliminary design work, and other actions associated with sites that were not used for the projects. When a project faces the problem of site availability, a factor to consider is how long the project should be federally supported without a firmly established site.

Project Results Should Be Sufficiently Assessed and Communicated to Potential Commercial Users

In any technology development or demonstration program, mechanisms are needed for disseminating the projects' results to the potential users of the technologies. Independent government assessments can help ensure that the projects' sponsors provide accurate and sufficient information in their final project reports to better enable the potential users to make informed judgments on using the technologies.

DOE and the projects' sponsors have established an extensive outreach effort for disseminating technical, economic, and environmental information on the results of both ongoing and completed clean coal demonstration projects to potential commercial users and vendors of the technologies. The efforts have also been aimed at regulators, public educators, and export markets. A variety of mechanisms has been used for this purpose, including meetings and conferences, technical papers, periodic newsletters and reports, and various technical and environmental reports.

DOE has also implemented a process for preparing a post-project assessment report (after a project has been completed and the sponsor's final project report has been issued) to provide DOE's independent assessment of the demonstrated technology. DOE's assessment addresses (1) the relative success of the demonstration project in collecting operational and other data needed for decisions to commercialize the technology and (2) the costs and environmental benefits (or impacts) that can be expected from the commercial use of the technology. The report is intended to help potential users to adequately judge the capabilities and commercial readiness of the demonstrated technologies so that they can make informed decisions on whether to use them under their site-specific conditions.

The project sponsors and other organizations we talked to were generally satisfied with DOE's efforts to disseminate information on the projects' results. Many singled out DOE's annual program update report and annual clean coal technology conference as very useful sources of information, both on the program and on specific demonstration projects.

Future Direction of Clean Coal Program Is Uncertain

The Energy Policy Act of 1992 authorizes additional rounds of projects for the clean coal program, but DOE has not requested funding for such rounds, and its future plans for the program are uncertain. DOE's current emphasis is to get the technologies that are already being developed into the commercial marketplace. However, commercialization may prove

more difficult than anticipated. As noted previously, to date only two sales have been made of the technologies demonstrated in the clean coal program, although it is relatively early in the program for many projects. The National Coal Council, in a recent report to DOE,[7] noted that before the clean coal program began, it was believed that the rising price of fuels competing with coal, the expectations of more-stringent air pollution controls, and forecasts of the increasing need for new electric generation capacity would help push demonstrated clean coal technologies into the commercial marketplace. However, the Council pointed out that these conditions have not yet occurred. As a result, the Council said that the market for clean coal technologies has been weaker than anticipated and may not materialize until after the year 2000. Rather than having the federal government fund additional rounds of clean coal demonstration projects, the Council recommended that the federal government share the capital and operating costs of deploying clean coal technologies to stimulate a sustainable long-term market.

DOE currently has a clean coal reserve fund, totaling about $202 million as of March 31, 1994, which is made up of funds that were earmarked for projects that were withdrawn before the funds were spent. DOE is required to report to the House and Senate Committees on Appropriations by May 1994 on how the reserve fund should be spent. According to DOE, this fund has been used to pay for some cost overruns on active projects, a need that is likely to continue.

DOE has also already sought congressional approval for using some of the reserve fund to share part of the costs of overseas projects that use promising technologies demonstrated in the clean coal program, or to help pay for feasibility studies and other front-end costs of other overseas projects where U.S. commercial technologies might be used. According to DOE, for many of the technologies being demonstrated under the clean coal program that add generating capacity, the near-term market is overseas, because U.S. utilities are not planning to build new coal-fired powerplants in the near future. DOE maintains that this use of federal funds would encourage the export of U.S. technology, equipment, and services; help make U.S. industry more competitive in the international energy marketplace; help reduce the U.S. trade deficit; and create jobs for highly skilled American workers.

Another option suggested by DOE officials and others as a possible use for the reserve fund is to help pay for enhancements to or design

[7]Clean Coal Technology for Sustainable Development, The National Coal Council (Feb. 1994).

improvements for the projects currently in the clean coal program. DOE officials believe that if federal cost-sharing is approved for technology enhancements or other technology deployment activities, the federal share should be relatively small in view of the late stage of technology development. But designating which projects would get funding, and how much, is an issue that would need to be resolved.

Conclusions

The Clean Coal Technology program has shown that the government and the private sector can work together effectively in demonstrating new technologies. The following experiences should be particularly useful for other federal cost-shared programs involved in technology development and demonstration.

- When programs have multiple or competing objectives, it may be more difficult to maximize the achievement of any one objective. Project selection strategies should consider the trade-offs associated with achieving multiple or competing program objectives and enhancing the return on the federal investment.
- A balance needs to be struck in allowing private-sector project participants enough flexibility to manage their projects to meet cost, schedule, and performance goals, while the federal government provides sufficient oversight (checks and balances) to protect its investment and interest.
- Requirements for repayment of federal cost-sharing funds should be structured so as not to impede the objectives of technology commercialization. One approach would be to allow a repayment grace period to give the technology an opportunity to enter the commercial marketplace.
- Potential private-sector participants should be given ample opportunities to be involved in developing solicitations for project proposals.
- Appropriate federal cost-sharing requirements should be established for projects to ensure the industry's continued commitment to them.
- Federal program managers should have enough flexibility to be able to modify program objectives and goals, if necessary, to meet changing congressional or national needs and to make improvements and adjustments on the basis of the lessons learned.

We discussed the information presented in this report with DOE's Associate Deputy Assistant Secretary for Clean Coal Technology. The official agreed with the factual information presented, and his views have been

incorporated in the report, where appropriate. As requested, we did not obtain written agency comments on a draft of this report.

Our work was performed between July 1993 and March 1994, in accordance with generally accepted government auditing standards. As noted above, appendix I describes the scope and methodology of our review.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 7 days from the date of this letter. At that time, we will send copies of this report to the Secretary of Energy; appropriate congressional committees and subcommittees; the Director, Office of Management and Budget; and other interested parties. We will also make copies available to others on request.

Please call me at (202) 512-3841 if you need additional information. Major contributors to this report are listed in appendix II.

Sincerely yours,

Victor S. Rezendes
Director, Energy and Science Issues

Contents

Abbreviations

DOE	Department of Energy
GAO	General Accounting Office

Scope and Methodology

In conducting this review, we interviewed representatives from 19 companies that have participated in more than half of the active and completed demonstration projects in the Clean Coal Technology program. These companies included nine electric utilities that are sponsoring projects and/or providing facilities and project sites, eight technology owners that are sponsoring and/or cofunding projects, and two other nonutility project sponsors. Altogether, we contacted almost half of the project sponsors. We also interviewed representatives from the Electric Power Research Institute, which is cofunding a number of the projects; three Illinois, Ohio, and Pennsylvania state government agencies involved in project funding; two state utility commissions; and several national organizations, including the National Coal Council, National Coal Association, and Clean Coal Technology Coalition.

Some of the participating project sponsors that we contacted had also submitted nonselected proposals in other rounds of the program. To obtain additional industry views on the project selection process, we interviewed representatives of three nonparticipating companies that had submitted nonselected project proposals.

To obtain the Department of Energy's (DOE) perspectives on the lessons learned in the program, we met with a number of program and project management officials at DOE headquarters and DOE's Morgantown and Pittsburgh Energy Technology Centers, including several officials involved in the project evaluation and selection process. We also met with an attorney at DOE's Chicago Operations Office to discuss the treatment of intellectual property under the program. In addition, we reviewed the various DOE and private sector reports and publications on the program; all five rounds of project proposal solicitation documents; the applicable program legislation, regulations, and requirements; and other relevant documents on lessons learned and actions taken by DOE to address problems in implementing the program. We also interviewed congressional staff involved in oversight of program direction and funding and drew from our past reviews and reports on the program.

Major Contributors to This Report

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Related GAO Products

Fossil Fuels: The Department of Energy's Magnetohydrodynamics Development Program (GAO/RCED-93-174, July 29, 1993).

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Fossil Fuels: Commercializing Clean Coal Technologies (GAO/RCED-89-80, Mar. 29, 1989).

Views on DOE's Clean Coal Technology Program (GAO/T-RCED-88-47, June 22, 1988).

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