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Testimony

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CLEAN COAL

DOE Should Prepare a Comprehensive Analysis of the Relative Costs, Benefits, and Risks of a Range of Options for FutureGen

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Mr. Chairman and Members of the Subcommittee:

Thank you for the opportunity to discuss our recent report on the Department of Energy's (DOE) decision to restructure the FutureGen program.¹ As requested, my remarks will focus on that report, which examined (1) the goals of the original and restructured FutureGen programs, (2) the similarities and differences between the restructured FutureGen program and other DOE carbon capture and storage programs, and (3) the extent to which DOE used sufficient information to support its decision to restructure the FutureGen program.

As you know, Mr. Chairman, coal is currently the world's leading source of electricity. Coal-fired power plants generate about one-half of the electricity used in the United States, as well as about one-third of the nation's carbon dioxide (CO₂) emissions, which contribute to climate change. In 2003, DOE initiated FutureGen—a program to design, build, and operate a commercial-scale, coal-fired power plant that incorporated carbon capture and storage (CCS) with integrated gasification combined cycle (IGCC), an advanced technology for generating electricity that has been deployed on a commercial scale at only two coal-fired power plants in the United States.² In IGCC power plants, coal is gasified to produce a synthesis gas, consisting primarily of hydrogen, carbon monoxide, and CO₂. Then, in a process called precombustion CCS, the CO₂ is removed and separated from the synthesis gas before the synthesis gas is burned in a combustion turbine to generate electricity. Through IGCC, electricity is generated more efficiently than through conventional pulverized coal-fired technology, the process most widely in use, because IGCC uses less coal to generate the same amount of electricity.

The original FutureGen plant was to capture and store underground about 90 percent of its CO₂ emissions. DOE's cost share was to be 74 percent, and industry partners agreed to fund the rest. Concerned about escalating

¹GAO, *Clean Coal: DOE's Decision to Restructure FutureGen Should Be Based on a Comprehensive Analysis of Costs, Benefits, and Risks*, [GAO-09-248](#) (Washington, D.C.: Feb. 13, 2009).

²Currently, only two IGCC plants operate at commercial scale in the United States. In service since 1997, the Polk Station, near Mulberry, Florida, can provide 250 megawatts to the electric grid. The Wabash River Coal Gasification Repowering Project is the first full-size commercial gasification-combined cycle plant built in the United States, having begun operations in November 1995. The plant, located outside West Terre Haute, Indiana, can provide 262 megawatts to the electric grid.

costs, DOE announced in January 2008 that it had decided to restructure FutureGen. In October 2008, DOE received a small number of applications for the restructured FutureGen; however, some of these applications were for proposals outside the restructured FutureGen's scope. As we reported, DOE is currently assessing proposals received and stated it expected to announce a selection of projects by December 2008; however, as of the beginning of March 2009, it had made no decision. DOE requested supplemental information from restructured FutureGen applicants, which will be reviewed before any selection decision.³ As you know, the recently enacted American Recovery and Reinvestment Act of 2009, known as the stimulus law, provides DOE an additional \$3.4 billion for "Fossil Energy Research and Development."⁴ Such a substantial amount of funding could significantly impact DOE's decisions about how to move forward with programs such as FutureGen.

Our report provides detailed information about our findings. In summary, we found the following:

- The overall goals of the original and restructured FutureGen programs are largely similar in that both programs seek to produce electricity from coal with near-zero emissions by using CCS, and to make that process economically viable for the electric power industry. However, the programs have different approaches for achieving their goals, which could have different impacts on the commercial advancement of CCS and, therefore, result in two largely distinct programs. First, the original program focused on researching and developing the integration of IGCC and CCS at a new, commercial-scale, coal-fired power plant, while the restructured FutureGen aims at demonstrating the use of CCS technology at one or more new or existing commercial coal-fired power plants. As a result, the restructured program could provide opportunities to learn about CCS at different plants, including those that use IGCC and conventional ones that use pulverized coal generating technology. However, under the restructured program, learning about the integration of IGCC and CCS would be possible only if DOE received applications

³DOE has identified certain details regarding the negotiations for both the original and the restructured FutureGen as sensitive or proprietary information. Due to the ongoing nature of these negotiations for the restructured FutureGen and the fact that disclosure of sensitive/proprietary information could adversely affect negotiations of these projects and related future projects, our discussion of some aspects of these negotiations is necessarily general.

⁴Pub. L. No. 111-5, tit. IV, 123 Stat. 115, 139 (2009).

proposing IGCC and selected one for funding. Second, it is unclear which of the two programs would advance the broader roll out of CCS across industry more quickly. In particular, the original program was to be operated by a nonprofit consortium of some of the largest coal producers and electric power companies in the world at one plant, while the restructured program called for CCS projects at multiple commercial plants. DOE officials told us that the original program would likely have improved the global advancement of CCS more quickly than the restructured program because of its various international partnerships and that DOE is developing an approach to recoup the loss of international involvement that resulted from restructuring FutureGen. Finally, the original FutureGen would have served as an operating laboratory host facility for (1) emerging technologies aimed at the goal of near-zero emissions (such as hydrogen fuel cells and advanced gasification) and (2) gaining broad industry acceptance for these technologies. In contrast, the restructured FutureGen would not include a facility for testing these technologies, and its ability to advance them would, therefore, be limited.

- DOE manages a portfolio of clean coal programs that research and develop CCS technology or demonstrate its application. The restructured FutureGen differs in important ways from most of DOE's other CCS programs, with the exception of one program—Round III of the Clean Coal Power Initiative (CCPI). Both the restructured FutureGen and CCPI (1) fund the commercial demonstration of CCS at new or existing coal-fired power plants and (2) require industry participants to bear at least 50 percent of costs. We reported that the restructured FutureGen targets a higher amount of CO₂ to be captured and stored (at least 1 million metric tons stored annually, per plant) than CCPI does (300,000 metric tons of CO₂ stored or put to use annually, such as to enhance oil recovery, per plant). However, CCPI's goals may be more achievable for industry partners than those of the restructured FutureGen and, therefore, lead to more industry participation. Regarding the restructured program's differences from most of the other CCS programs, the restructured FutureGen would integrate key components of CCS at commercial coal-fired power plants, such as CO₂ capture, compression, transport, storage, and monitoring of stored CO₂. In contrast, most of DOE's other CCS programs concentrate on developing individual components of CCS, such as CO₂ storage, and/or an individual component and a related one, such as capture and compression.
- Contrary to best practices, DOE did not base its decision to restructure FutureGen on a comprehensive analysis of factors such as the associated costs, benefits, and risks. DOE based its decision largely on its conclusion that costs for the original FutureGen had doubled and would escalate

substantially. However, this conclusion was problematic because it was derived from a comparison of two cost estimates for the original FutureGen that were not comparable; DOE's \$950 million estimate was in constant 2004 dollars, while the \$1.8 billion estimate of DOE's industry partners was inflated through 2017. As a result, DOE has no assurance that the restructured FutureGen is the best option to advance CCS. In contrast, DOE's Office of Fossil Energy had identified and analyzed 13 other options for incremental, cost-saving changes to the original program, such as reducing the CO₂ capture requirement. While the Office of Fossil Energy did not consider all of these options to be viable, it either recommended or noted several of them for consideration, with potential savings ranging from \$30 million to \$55 million each.

Conclusions

According to various energy experts, for the foreseeable future, because coal is abundant and relatively inexpensive, it will remain a significant fuel for the generation of electric power in the United States and the world. However, coal-fired power plants are a significant source of CO₂ and other emissions responsible for climate change. Hence, for at least the near-term, any government policies that address climate change will need to have a goal of significantly reducing CO₂ and other emissions from coal-fired power plants. While CCS is still in its infancy, it may be a promising technology to achieve these purposes. By integrating IGCC and CCS technology at an operating laboratory host facility, DOE's original FutureGen program was intended to address significant technological, cost, and regulatory issues associated with the implementation of CCS at a new plant. Alternatively, the restructured FutureGen left open the possibility of successfully applying CCS technology to existing conventional, pulverized coal-fired power plants—an important goal in its own right, since those plants account for almost all of the coal-fired generating capacity in the United States and abroad. However, DOE's decision to restructure FutureGen and remove the program's emphasis on integrating IGCC and CCS technology was not well documented or explained, in light of the fact that DOE already had existing programs to address CCS at existing coal-fired power plants.

Given the magnitude of the current fiscal and economic challenges facing our nation, along with the urgent need to secure an adequate and sustainable energy supply that does not contribute to climate change, much rides on the success of clean coal programs, such as FutureGen. To ensure the best uses of billions of federal dollars, informed and thoughtful approaches should be taken when making decisions about these programs, including the restructuring of FutureGen. Such informed

decision making has become even more critical with the important opportunity that over \$3 billion in additional funding for fossil energy research and development in the recently enacted stimulus law provides DOE for promoting cleaner forms of power generation.

Along these lines, to help DOE make more fully informed decisions on how best to move forward with FutureGen, our February 2009 report recommended that DOE conduct a comprehensive analysis of different options. Specifically, to help ensure the widespread commercial advancement of CCS while protecting taxpayer interests, we recommended that, before implementing significant changes to FutureGen or obligating additional funds for such purposes, the Secretary of Energy direct DOE staff to prepare a comprehensive analysis comparing the relative costs, benefits, and risks of a range of options, including the original and restructured FutureGen programs and incremental options for modifying the original program. We also recommended that the Secretary consider the results of the comprehensive analysis and base any decisions that would alter the original FutureGen on the most advantageous mix of costs, benefits, and risks resulting from the options evaluated. In reviewing a draft of our report, DOE did not comment on the report's recommendations.

In performing our work, we reviewed best practices for making programmatic decisions, FutureGen plans and budgets, and documents on the restructuring of FutureGen. We also contacted DOE, industry partners, and experts. We conducted this performance audit from June 2008 to February 2009, in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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

Contacts and Acknowledgments

For further information about this testimony, please contact me at (202) 512-3841 or by e-mail at gaffiganm@gao.gov. Ernie Hazera (Assistant Director), Nancy Crothers, and Chad M. Gorman made key contributions to this testimony. Harold Brumm, Jr., Cindy Gilbert, Angela Miles, Timothy Persons, Karen Richey, Michael Sagalow, and Jeanette M. Soares also made important contributions.

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