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NUCLEAR ENERGY

DOE's Next Generation Nuclear Plant Project Is at an Early Stage of Development

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Natural Resources and Environment

GAO-06-1110T

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Highlights

Highlights of GAO-06-1110T, a testimony before the Subcommittee on Energy and Resources, Committee on Government Reform, House of Representatives

Why GAO Did This Study

Under the administration's National Energy Policy, the Department of Energy (DOE) is promoting nuclear energy to meet increased U.S. energy demand. In 2003, DOE began developing the Next Generation Nuclear Plant, an advanced nuclear reactor that seeks to improve upon the current generation of operating commercial nuclear power plants. DOE intends to demonstrate the plant's commercial application both for generating electricity and for using process heat from the reactor for the production of hydrogen, which then would be used in fuel cells for the transportation sector. The Energy Policy Act of 2005 required plant design and construction to be completed by 2021.

This testimony, which summarizes a GAO report being issued today (GAO-06-1056), provides information on DOE's (1) progress in meeting its schedule for the Next Generation Nuclear Plant project and (2) approach to ensuring the project's commercial viability. For the report, GAO reviewed DOE's research and development (R&D) plans for the project and the reports of two independent project reviews, observed R&D activities, and interviewed DOE, Nuclear Regulatory Commission (NRC), and industry representatives.

www.gao.gov/cgi-bin/getrpt?GAO-06-1110T.

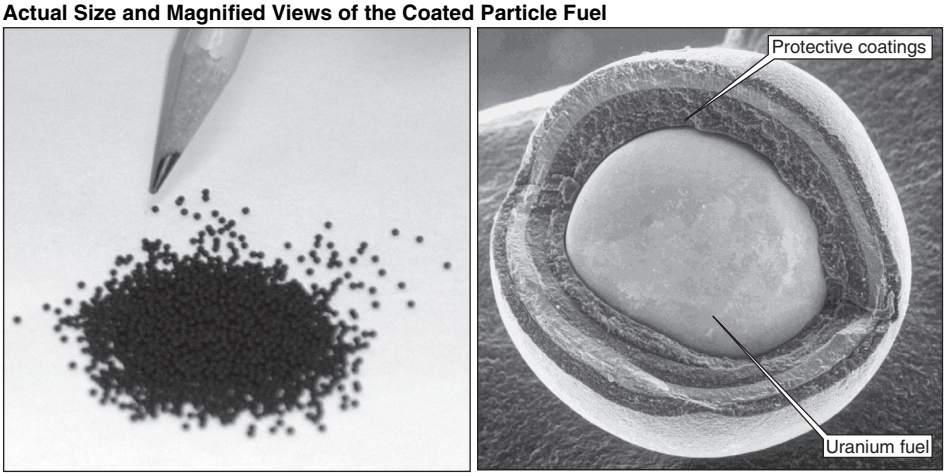
To view the full product, including the scope and methodology, click on the link above. For more information, contact Jim Wells at (202) 512-3841 or wellsj@gao.gov.

What GAO Found

DOE has prepared and begun to implement plans to meet its schedule to design and construct the Next Generation Nuclear Plant by 2021, as required by the Energy Policy Act of 2005. Initial R&D results are favorable, but DOE officials consider the schedule to be challenging, given the amount of R&D work that remains to be conducted. For example, while researchers have successfully demonstrated the manufacturing of coated particle fuel for the reactor, the last of eight planned fuel tests is not scheduled to conclude until 2019. DOE plans to initiate the design and construction phase in fiscal year 2011, if the R&D results support proceeding with the project. The act also requires that DOE and NRC develop a licensing strategy for the plant by August 2008. The two agencies are in the process of finalizing a memorandum of understanding to begin work on this requirement.

DOE is just beginning to obtain input from potential industry participants that would help determine the approach to ensuring the commercial viability of the Next Generation Nuclear Plant. In the interim, DOE is pursuing a more technologically advanced approach, compared with other options, and DOE has implemented some (but not all) of the recommendations made by two advisory groups. For example, as recommended by one advisory group, DOE lessened the need for R&D by lowering the reactor's planned operating temperature. In contrast, DOE has not accelerated its schedule for completing the plant, as recommended by the Nuclear Energy Research Advisory Committee. The committee was concerned that the time frame for completing the plant is too long to be attractive to industry, given that other advanced reactors may be available sooner. However, DOE believes the approach proposed by the committee would increase the risk of designing a plant that ultimately would not be commercially viable. GAO believes DOE's problems with managing other major projects call into question its ability to accelerate design and completion of the Next Generation Nuclear Plant.

Actual Size and Magnified Views of the Coated Particle Fuel



Sources: General Atomics (left); DOE (right).

Mr. Chairman and Members of the Subcommittee:

I am pleased to be here to discuss the Department of Energy's (DOE) progress on its Next Generation Nuclear Plant demonstration project. My testimony is based on our report being issued today, entitled *Nuclear Energy: Status of DOE's Effort to Develop the Next Generation Nuclear Plant* (GAO-06-1056). As you know, the administration's National Energy Policy calls for the greater use of nuclear power and hydrogen to meet the nation's growing energy needs. The purpose of the Next Generation Nuclear Plant project is to establish the technical and commercial feasibility of producing both electricity and hydrogen from an advanced nuclear reactor. DOE has been engaged since fiscal year 2003 in research and development (R&D) on such a plant. The Energy Policy Act of 2005 formally established the Next Generation Nuclear Plant as a DOE project and set further requirements for the project's implementation, including obtaining a license from the Nuclear Regulatory Commission (NRC) to operate the plant and completing the project by fiscal year 2021.[1] DOE estimates the total cost of the plant to be approximately $2.4 billion. The act also designated DOE's Idaho National Laboratory as the lead laboratory and construction site for the plant and gave it responsibility for carrying out cost-shared R&D, design, and construction with industry partners. The Idaho National Laboratory has considerable experience with nuclear energy technologies. Since 1949, 52 nuclear reactors have been designed and tested at the site.

DOE has chosen the "very-high-temperature reactor," which is cooled by helium gas, as the advanced reactor design for the Next Generation Nuclear Plant. As its name implies, this reactor would operate at a much higher temperature than existing nuclear power plants—up to about 950 degrees Celsius (1,742 degrees Fahrenheit). This temperature would be roughly three times the temperature of a light water reactor, which is cooled by water and is the technology generally in use in the United States and around the world. Despite the high temperature, there is general agreement that a gas-cooled reactor offers the potential for improved safety. In addition, DOE considers the very-high-temperature reactor to be the nearest-term advanced nuclear reactor design that operates at temperatures high enough to generate the heat (called "process heat") needed to produce hydrogen. Under the administration's National

[1]Pub. L. No. 109-58 (2005).

Hydrogen Fuel Initiative, hydrogen is envisioned to be used in fuel cells for the transportation sector as an alternative to imported oil.

Over the course of the last several years, two independent groups have reviewed DOE's plans for the Next Generation Nuclear Plant. The Independent Technology Review Group—coordinated by the Idaho National Laboratory and composed of an international group experienced in the design, construction, and operation of nuclear systems—issued a report in 2004 on the design features and technological uncertainties of the very-high-temperature reactor. The report concluded that the uncertainties associated with the project appeared manageable and that the project's objectives could be achieved.[2] In 2006, as required by the Energy Policy Act of 2005, DOE's Nuclear Energy Research Advisory Committee also completed an initial review of the project.[3] The advisory committee reviewed DOE's R&D plans in light of the Independent Technology Review Group's report and recommended that DOE accelerate the project. Both reviews also made recommendations to modify DOE's R&D plans to ensure the project's success.

DOE is managing the Next Generation Nuclear Plant under its project management process for the acquisition of capital assets, which sets forth planning requirements that have to be met before DOE may begin design or construction activities. The goal of these requirements is to complete projects on schedule, within budget, and capable of meeting performance objectives. Our reviews of DOE's management of other major projects have found that project management has long been a significant challenge for DOE and is at high risk of waste and mismanagement.[4] In an effort to improve cost and schedule performance, DOE issued new policy and guidance on managing and controlling projects in 2000, but performance problems continue on major projects. For example, we testified in April 2006 that DOE's fast-track approach to designing and building the Waste Treatment Plant Project at DOE's Hanford site in Washington state

[2]Idaho National Engineering and Environmental Laboratory, *Design Features and Technology Uncertainties for the Next Generation Nuclear Plant*, INEEL/EXT-04-01816 (Idaho Falls, Idaho; June 30, 2004).

[3]The Nuclear Energy Research Advisory Committee was established in 1998 to provide independent advice to DOE on complex science and technical issues associated with the planning, management, and implementation of DOE's nuclear energy program.

[4]GAO, *High-Risk Series: An Update*, GAO-05-207 (Washington, D.C.: January 2005); and *High-Risk Series: An Update*, GAO-03-119 (Washington, D.C.: January 2003).

increases the risk that the completed facilities may require major rework to operate safely and effectively and could increase the project's costs.[5]

My testimony discusses the results of our report being issued to you today and addresses DOE's (1) progress in meeting its schedule for the Next Generation Nuclear Plant and (2) approach to ensuring the commercial viability of the project, including how DOE has implemented the recommendations of the two advisory groups. For the report, we analyzed DOE's project plans, interviewed DOE and Idaho National Laboratory officials, and observed R&D efforts at Idaho National Laboratory. Furthermore, we reviewed the two independent assessments of the project and how DOE had responded to their recommendations. We also reviewed NRC documentation related to the development of a licensing strategy for the Next Generation Nuclear Plant, and we interviewed DOE and NRC officials regarding licensing issues. We performed our work from April to September 2006 in accordance with generally accepted government auditing standards.

Summary

DOE has prepared an R&D schedule designed to support the design and construction of the Next Generation Nuclear Plant by fiscal year 2021, as set forth in the Energy Policy Act of 2005. Initial R&D results have been favorable, but DOE officials consider this schedule to be challenging, given the amount of R&D that remains to be conducted. For example, DOE officials told us that researchers have successfully demonstrated in a laboratory setting the manufacturing of nuclear fuel for the reactor, which is critical to the plant's operation. The first of eight planned experiments to irradiate the fuel in order to test how well it performs will not begin until early in fiscal year 2007, and the final experiment is not scheduled to end until fiscal year 2019. DOE plans to initiate design work in fiscal year 2011, but only if the R&D results support proceeding with design and construction of the plant. With regard to licensing the Next Generation Nuclear Plant, DOE and NRC are in the process of finalizing a memorandum of understanding so that the two agencies can work together to develop a licensing strategy by August 2008, as required by the Energy Policy Act of 2005. In the long term, NRC will need to address "skill gaps" related to the agency's capability to license a gas-cooled

[5]GAO, *Hanford Waste Treatment Plant: Contractor and DOE Management Problems Have Led to Higher Costs, Construction Delays, and Safety Concerns*, GAO-06-602T (Washington, D.C.: Apr. 6, 2006).

reactor such as the Next Generation Nuclear Plant. A 2001 NRC assessment identified these skill gaps, but the commission has taken limited action to address them because until recently it had not anticipated receiving a license application for a gas-cooled reactor.

DOE's approach to ensuring the commercial viability of the Next Generation Nuclear Plant is to significantly advance existing gas-cooled reactor technology in order to support the development of a plant design that utilities and other end users will be interested in deploying to help meet the nation's energy needs. For example, if successful, DOE's R&D would enable the reactor to operate at a higher temperature compared with other high-temperature gas-cooled reactors. The higher temperature would result in more efficient fuel use and hydrogen production and thus would be a more economically attractive plant. In addition, DOE is seeking industry involvement on the design of the plant and the business considerations for deploying it. In some cases, DOE officials' views on how best to achieve technological advances and ensure the commercial viability of the plant differ from the two independent advisory groups that have reviewed DOE's plans, and DOE has implemented some but not all of the advisory groups' recommendations. For example, in accordance with a recommendation of the Independent Technology Review Group, DOE lessened the need for R&D on advanced materials by lowering the planned operating temperature of the reactor from 1,000 degrees Celsius to no more than 950 degrees Celsius. In contrast, DOE has not implemented recommendations to scale back other planned technological advances or accelerate its schedule for completing the plant. For example, the Nuclear Energy Research Advisory Committee had recommended accelerating the schedule to make the plant more attractive to industry compared with other advanced gas-cooled reactors that may be available sooner and thus attract greater industry participation.

DOE believes accelerating the project would increase project risk—for example, the risk of cost overruns or a failure to meet project specifications—and would require significant additional resources that are not in keeping with the department's current priorities. According to DOE officials, additional R&D conducted early in the project would reduce overall project risk but would require additional resources. However, DOE has limited funding for nuclear energy R&D and has given other projects, such as developing the capability to recycle fuel from existing nuclear power plants, priority over the Next Generation Nuclear Plant.

Background

One of DOE's strategic goals is to promote a diverse supply of reliable, affordable, and environmentally sound energy. To that end, DOE is promoting further reliance on nuclear energy under the administration's National Energy Policy.[6] According to DOE officials, the department has three priorities for promoting nuclear energy. The first priority is deploying new advanced light water reactors under the Nuclear Power 2010 program. The second priority is the Global Nuclear Energy Partnership, launched in February 2006. The partnership's objectives are to demonstrate and deploy new technologies to recycle nuclear fuel and minimize nuclear waste, and to enable developing nations to acquire and use nuclear energy while minimizing the risk of nuclear proliferation. The third priority is R&D on the Next Generation Nuclear Plant. According to DOE officials, the department remains committed to this project even though the Global Nuclear Energy Partnership has assumed a higher priority.

DOE is engaged in R&D on the Next Generation Nuclear Plant as part of a larger international effort to develop advanced nuclear reactors (Generation IV reactors) that are intended to offer safety and other improvements over the current generation of nuclear power plants (Generation III reactors). DOE coordinates its R&D on advanced nuclear reactors through the Generation IV International Forum, chartered in 2001 to establish a framework for international cooperation in R&D on the next generation of nuclear energy systems.[7] In 2002, the Generation IV International Forum (together with DOE's Nuclear Energy Research Advisory Committee) identified what it considered the six most promising nuclear energy systems for further research and potential deployment by about 2030. DOE has selected one of the six advanced nuclear systems—the very-high-temperature reactor—as the design for its Next Generation Nuclear Plant, in part because it is considered to be the nearest-term reactor design that also has the capability to produce hydrogen. According to DOE officials, the very-high-temperature reactor is also the design with the greatest level of participation among the Generation IV International Forum members.

[6]While DOE is the federal agency tasked with promoting nuclear energy, NRC is responsible for ensuring public health and safety with regard to nuclear power.

[7]Members of the Generation IV International Forum include Argentina, Brazil, Canada, the European Atomic Energy Community (Euratom), France, Japan, South Africa, South Korea, Switzerland, the United Kingdom, and the United States. In July 2006, DOE announced that China and Russia are also expected to join the forum.

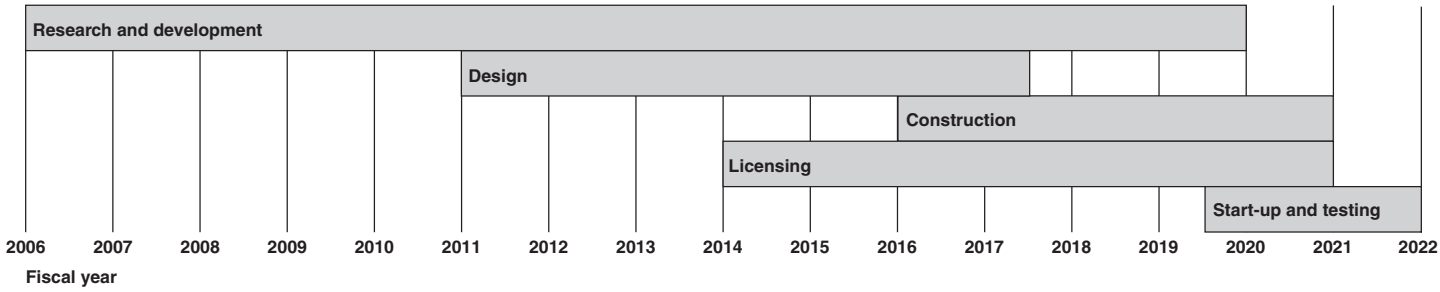
Furthermore, the very-high-temperature reactor builds on previous experience with gas-cooled reactors. For example, DOE conducted R&D on gas-cooled reactors throughout the 1980s and early 1990s, and two gas-cooled reactors have previously been built and operated in the United States. The basic technology for the very-high-temperature reactor also builds on previous efforts overseas, in particular high-temperature gas-cooled reactor technology developed in England and Germany in the 1960s, and on technologies being advanced in projects at General Atomics in the United States, the AREVA company in France, and at the Pebble Bed Modular Reactor company in South Africa. In addition, Japan and China have built small gas-cooled reactors.

DOE Has Made Initial Progress Toward Meeting Near-Term Milestones for the Next Generation Nuclear Plant

DOE has developed a schedule for the R&D, design, and construction of the Next Generation Nuclear Plant that is intended to meet the requirements of the Energy Policy Act of 2005, which divides the project into two phases. For the first phase, DOE has been conducting R&D on fuels, materials, and hydrogen production. DOE also recently announced its intent to fund several studies on preconceptual, or early, designs for the plant. DOE plans to use the studies, which are expected to be completed by May 2007, to establish initial design parameters for the plant and to further guide R&D efforts.

DOE is planning to begin the second phase in fiscal year 2011 by issuing a request for proposal that will set forth the design parameters for the plant. If R&D results at that time do not support the decision to proceed, DOE may cancel the project. Assuming a request for proposal is issued, DOE is planning to choose a design by 2013 from among those submitted by reactor vendors. Construction is scheduled to begin in fiscal year 2016, and the plant is expected to be operational by 2021. In addition, DOE is planning for the appropriate licensing applications for the plant to be submitted for NRC review and approval during the second phase of the project. See figure 1 for the overall Next Generation Nuclear Plant project schedule.

Figure 1: Next Generation Nuclear Plant Project Schedule



Source: DOE.

As scheduled by DOE, the Next Generation Nuclear Plant project is expected to cost approximately $2.4 billion, part of which is to be funded by industry. According to DOE officials, the department budgeted about $120 million for the project from fiscal years 2003 through 2006. This amount includes about $80 million for R&D on the nuclear system of the plant and about $40 million for R&D on the hydrogen production system.

Initial research results since DOE initiated R&D on the Next Generation Nuclear Plant project in 2003 have been favorable, but the most important R&D has yet to be done. For example, DOE is planning a series of eight fuel tests in the Advanced Test Reactor at Idaho National Laboratory. Each test is a time-consuming process that requires first fabricating the fuel specimens, then irradiating the fuel for several years, and finally conducting the postirradiation examination and safety tests. DOE is at the beginning of the process. In particular, DOE officials said they have successfully fabricated the fuel for the first test and addressed previous manufacturing problems with U.S. fuel development efforts in which contaminants weakened the coated particle fuel. However, the irradiation testing of the fuel in the Advanced Test Reactor has not yet begun. The first test is scheduled to begin early in fiscal year 2007 and to be completed in fiscal year 2009. The eighth and final test is scheduled to begin in fiscal year 2015, and the fuel testing program is scheduled to conclude in fiscal year 2019. As a result, DOE will not have the final results from all of its fuel tests before both design and construction begin.[8] While DOE has carefully planned the fuel tests and expects favorable results, a DOE

[8]Under DOE's fuel R&D plan, the results from the first six tests would be available before construction begins, and the results from the final two tests would be available before completion of the plant.

official acknowledged that they do not know if the fuel tests will ultimately be successful.

DOE is also at the beginning stages of R&D on other key project areas such as the hydrogen production system for the plant and materials development and testing. For example, Idaho National Laboratory successfully completed a 1,000-hour laboratory-scale test of one of two potential hydrogen production systems in early 2006. DOE ultimately plans to complete a commercial-scale hydrogen production system for demonstration by fiscal year 2019, which will allow time to test the system before linking it to the very-high-temperature reactor. DOE also has selected and procured samples of graphite—the major structural component of the reactor core that will house the nuclear fuel and channel the flow of helium gas—and designed experiments for testing the safety and performance of the samples. Nevertheless, much of the required R&D for the graphite has not yet begun and is not scheduled to be completed until fiscal year 2015.

Regarding licensing of the plant, DOE and NRC are in the process of finalizing a memorandum of understanding that will establish a framework for developing a licensing strategy. As required by the Energy Policy Act of 2005, DOE and NRC are to jointly submit a licensing strategy by August 2008.[9] NRC has drafted a memorandum of understanding and submitted it to DOE, but its approval has been delayed by additional negotiations on details of the agreement. Nevertheless, NRC has already taken certain other actions to support licensing the Next Generation Nuclear Plant. In particular, NRC has been developing a licensing process that could be used for advanced nuclear reactor designs and that would provide an alternative to its current licensing framework, which is structured toward light water reactors.

In addition to developing a licensing strategy, NRC will need to enhance its technical capability to review a license application for a gas-cooled reactor, such as the Next Generation Nuclear Plant. In 2001, NRC completed an assessment of its readiness to review license applications for advanced reactors. The assessment identified skill gaps in areas such as accident analysis, fuel, and graphite, which apply to gas-cooled

[9]The act also directs DOE to seek NRC's active participation throughout the duration of the project—for example, to avoid design decisions that would compromise safety or impair the accessibility of safety-related components for inspection and maintenance.

reactors.[10] Furthermore, NRC identified a "critical" skill gap in inspecting the construction of a gas-cooled reactor. As a result of its 2001 assessment, NRC issued a detailed plan in 2003 to address the gaps in expertise and analytical tools needed to license advanced reactors, including gas-cooled reactors. However, NRC has since taken limited steps to enhance its technical capabilities related to gas-cooled reactors because, until recently, it had not anticipated receiving a license application for a gas-cooled reactor.

DOE Is Pursuing a More Technologically Advanced Approach Than Other Options in an Effort to Ensure the Plant's Commercial Viability

DOE is beginning to obtain input from potential industry participants that would help DOE determine its approach to ensuring the commercial viability of the Next Generation Nuclear Plant. In the interim, DOE is pursuing a more technologically advanced approach—with regard to size, fuel type, and the coupling of electricity generation and hydrogen production in one plant—compared with the recommendations of the Independent Technology Review Group and the Nuclear Energy Research Advisory Committee. These technological advances require substantial R&D on virtually every major component of the plant. For example, the advanced uranium fuel composition that DOE is researching is not proven and requires fundamental R&D.

The Independent Technology Review Group cautioned that attempting to achieve too many significant technological advances in the plant could result in it becoming an exercise in R&D that fails to achieve its overall objectives, including commercial viability. Another key factor likely to affect the plant's commercial viability is the time frame for its completion. For example, the plant's commercial attractiveness could be affected by competition with other high-temperature gas-cooled reactors under development and potentially available sooner, such as one in South Africa, although these other reactor designs would also need to be licensed by NRC before being deployed in the United States.

DOE acknowledges the risk of designing and building a plant that is not commercially viable and has taken initial steps to address this challenge. For example, DOE has established what it considers to be "aggressive but achievable" goals for the plant, such as producing hydrogen at a cost low

[10]As defined in the *Future Licensing and Inspection Readiness Assessment*, published by NRC in September 2001, skill gaps occur when individuals with technical expertise are working in other areas within the agency, are near retirement or are expected to leave the agency, or do not exist in the agency.

enough to be competitive with gasoline. Furthermore, DOE is beginning to obtain industry input to help the department develop an approach for ensuring the commercial viability of the plant. DOE initiated two efforts in July 2006 to obtain input from industry on the design of the plant and the business considerations of deploying the plant. Specifically, DOE announced its intent to fund multiple industry teams to develop designs (and associated cost estimates) for every aspect of the plant, including the reactor and hydrogen production technology, by May 2007. In addition, DOE began participating in meetings with representatives from reactor vendors, utilities, and potential end users in order to obtain their insight into the market conditions under which the plant would be commercially viable. Until DOE develops a better understanding of the business requirements for the Next Generation Nuclear Plant, DOE is conducting R&D to support two distinct designs of the very-high-temperature reactor—pebble bed and prismatic block—rather than focusing on one design that may ultimately be found to be less commercially attractive.[11]

As recommended by the Independent Technology Review Group, DOE revised its R&D plans to lessen the technological challenges of designing and building the Next Generation Nuclear Plant. Most importantly, it reduced the planned operating temperature of the reactor from 1,000 degrees Celsius to no more than 950 degrees Celsius. According to Idaho National Laboratory officials, this small reduction is significant because it enables DOE to use existing metals rather than develop completely new classes of materials.

DOE, however, has not adopted other recommendations—in particular to revise its R&D plans to focus on a uranium dioxide fuel kernel, which has been more widely used and researched than the advanced uranium oxycarbide fuel kernel DOE is currently researching.[12] The Independent Technology Review Group considered DOE's fuel R&D plan on an advanced uranium fuel composition more ambitious than necessary and concluded that focusing on the more mature fuel technology would reduce

[11]The pebble bed design uses fuel particles formed into billiard-ball-size graphite spheres that slowly move through the reactor core in a continuous refueling process. In the prismatic block design, fuel particles are formed into cylindrical rods that are loaded into large graphite blocks making up the reactor core, which is periodically refueled in a batch process.

[12]The fuel is composed of a small uranium kernel that is coated with several protective layers. Whereas the more widely researched fuel kernel is composed of uranium dioxide, the advanced composition incorporates both uranium dioxide and uranium oxycarbide.

the risk of not meeting the schedule for the plant. Nevertheless, DOE has continued to focus on the advanced uranium oxycarbide fuel because it has the potential for better performance. DOE officials also told us that the most significant challenge with regard to the fuel is not its composition but rather the coatings, which is independent of the fuel kernel composition. To respond to the recommendation, DOE decided to test the performance of the two types of fuel kernels side-by-side as part of its fuel R&D plan.

The Nuclear Energy Research Advisory Committee also recommended that DOE re-evaluate the project's dual mission of demonstrating both electricity and hydrogen production. Although the advisory committee did not recommend what the project's focus should be—electricity generation or hydrogen production—it wrote that the dual mission would be much more challenging and require more funding than either mission alone. Instead, DOE's R&D is currently supporting both missions, and DOE officials said they consider the ability to produce hydrogen (or to use process heat for other applications) key to convincing industry to invest in the Next Generation Nuclear Plant rather than advanced light water reactors similar to the current generation of nuclear power plants operating in the United States.

Moreover, a key Nuclear Energy Research Advisory Committee recommendation was to accelerate the project and deploy the plant much earlier than planned by DOE in order to increase the likelihood of participation by industry and international partners. Representatives of the Nuclear Energy Institute, which represents utilities that operate nuclear power plants, also told us that accelerating the project would increase the probability of successfully commercializing the plant. As one possible approach to acceleration, the advisory committee further recommended that DOE design the Next Generation Nuclear Plant to be a smaller reactor that could be upgraded and modified as technology advances. However, DOE officials consider the advisory committee's schedule high risk and doubt that the degree of acceleration recommended could be achieved. Furthermore, according to DOE officials, a smaller reactor would require the same R&D as a larger reactor but would not support future NRC licensing of a full-scale plant, which is critical to the plant's commercial viability.

Idaho National Laboratory officials also consider the schedule proposed by the advisory committee to be high risk, potentially resulting in the need to redo design or construction work. Nevertheless, the laboratory has also proposed accelerating the schedule, though to a lesser extent than

recommended by the advisory committee. According to laboratory officials, if DOE does not begin design sooner than currently planned, too much R&D and design work will be compressed into a short time frame after DOE begins design in fiscal year 2011, and the department will not be able to complete the plant by fiscal year 2021. Consequently, the laboratory has proposed beginning design earlier than planned by DOE, which would also reduce the scope of the R&D by focusing on fewer design alternatives. The laboratory's proposed schedule would result in completing the plant up to 3 years earlier than under DOE's schedule. While the laboratory's proposed schedule would slightly reduce the project's total cost estimate, it would require that DOE provide more funding in the near term. For example, in fiscal year 2007, Idaho National Laboratory estimates that R&D on the very-high-temperature reactor design would need to be increased from $23 million (the amount requested by DOE in its fiscal year 2007 budget submission) to $100 million.

DOE officials believe that the laboratory's current proposed schedule is the best option for the plant and stated that they would consider accelerating it if there were adequate funding and sufficient demand among industry end users to complete the project sooner. In addition, DOE officials said that even if the schedule is not accelerated, increasing the funding for the project would enable additional R&D to be conducted to increase the likelihood that the plant is completed by fiscal year 2021. For example, DOE officials stated that its current R&D plans for the very-high-temperature reactor design could support doubling the department's fiscal year 2007 budget request of $23 million. However, DOE has limited funding for nuclear energy R&D and has given other projects, such as developing the capability to recycle fuel from existing nuclear power plants, priority over the Next Generation Nuclear Plant.

Concluding Observations

While DOE is making progress in implementing its plans for the Next Generation Nuclear Plant, these efforts are at the beginning stages of a long project and it is too soon to determine how successful DOE will be in designing a technically and commercially viable plant. As we note in our report, it is also too soon, in our view, to support a decision to accelerate the project. Accelerating the schedule would require that DOE narrow the scope of its R&D and begin designing the plant before having initial research results on which to base its design decisions. This could result in having to redo work if future research results do not support DOE's design decisions. In addition, DOE has only recently begun to systematically involve industry in the project. Such input is critical to key decisions, such as whether DOE should design a less technologically advanced plant that

is available sooner rather than a larger, more technologically advanced plant that requires more time to develop. Finally, DOE's history of problems managing large projects on budget and within schedule raises concerns about the department's ability to complete the Next Generation Nuclear Plant in the time frame set forth in the Energy Policy Act of 2005, and accelerating the schedule would only add to these concerns.

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

GAO Contact and Staff Acknowledgments

For further information about this testimony, please contact me at (202) 512-3841 or wellsj@gao.gov. Raymond H. Smith Jr. (Assistant Director), Joseph H. Cook, John Delicath, and Bart Fischer made key contributions to this testimony.

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