Draft Final Report

MOVING FORWARD WITH NUCLEAR POWER: ISSUES AND KEY FACTORS

Final Report of the Secretary of Energy Advisory Board Nuclear Energy Task Force

January 10, 2005

Secretary of Energy Advisory Board
U.S. Department of Energy

This draft report has been approved by the Members of the Nuclear Energy Task Force, a subcommittee of the Secretary of Energy Advisory Board. As with any consensus product, the views of any individual member may differ slightly from the specific detailed recommendations contained in the report. The draft report is not a Department of Energy or Administration document and will not be transmitted officially to the Secretary of Energy without the consideration of any public comments received and the approval of the Secretary of Energy Advisory Board.

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Nuclear Energy Task Force
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PREFACE

Nuclear power has had a substantial role in supplying electric power to the United States for over 30 years. Currently, there are 103 operating U.S. nuclear power reactors producing approximately 20 percent of the electricity consumed by the nation. The average capacity factor for U.S. nuclear power plants increased from 70 percent in the early 1990s to almost 90 percent in the early part of this decade, providing the equivalent additional nuclear capacity of 25 large reactors. Over this same period, nuclear safety has improved, and operating and maintenance costs have decreased. In addition, the volumes of radioactive waste resulting from operations have decreased, as have worker exposures to radiation.

Despite this record of achievement, and the fact that nuclear power generation does not result in greenhouse gas emissions, no new U.S. nuclear power plants have been ordered and subsequently built since 1973. But the need for new generating capacity over the coming decades, increased oil and natural gas prices, and societal concerns over greenhouse gas emissions have rekindled interest in nuclear power as a means of providing safe, clean, and economical electricity generation.

In July 2004, the Secretary of Energy requested the Secretary of Energy Advisory Board (SEAB) to form the Nuclear Energy Task Force (NETF), a subcommittee of the SEAB. The objective of this subcommittee was to provide both the Board and the Secretary of Energy with an assessment of the issues and key factors that must be addressed if the Federal government and industry are to commit to financing, constructing, and deploying new nuclear power generation plants to meet the nation's electric power demands in the 21st Century. The NETF was asked to provide the SEAB with an actionable plan to resolve these issues, and thereby facilitate the deployment of new nuclear generation facilities.

Because of the importance of considering the use of nuclear power to meet the nation's needs in the relatively near-term, the NETF was charged to evaluate only those issues associated with thermal reactor systems using the current once-through fuel cycle. The detailed Terms-of-Reference guiding the work of the task force are included in Appendix C.

The NETF met from August 2004 through December 2004 and received information and comments from a cross-section of public- and private-sector representatives, including vendors, new nuclear generation consortia, government officials, and trade and environmental organizations. This report summarizes the NETF's findings, conclusions, and recommendations.

The task force emphasizes that there is a difference between the "needs" that must be met to revitalize the nuclear option in the United States and the "wants" of the nuclear industry (i.e., what the industry might like to have to reduce the risks and costs associated with new construction). The NETF believes it has made that distinction and that its recommendations provide a fair representation of what is needed to achieve the construction and deployment of new nuclear plants.

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EXECUTIVE SUMMARY

FINAL REPORT OF THE SECRETARY OF ENERGY ADVISORY BOARD NUCLEAR ENERGY TASK FORCE

Nuclear power has had a substantial role in the supply of electric power in the United States for over 30 years. The United States currently has 103 operating nuclear power reactors producing approximately 20 percent of the electricity consumed by the nation. The average capacity factor for U.S. nuclear power plants increased from 70 percent in the early 1990s to almost 90 percent in the early part of this decade, providing the equivalent additional nuclear capacity of 25 large reactors. Over this same period, nuclear safety has improved; operating and maintenance costs have declined; and radioactive waste quantities and worker exposures to radiation have decreased. Despite this record of achievement, and the fact that nuclear power generation does not result in greenhouse gas emissions, no new U.S. nuclear power plants have been ordered and subsequently built since 1973.

In the summer of 2004, Secretary of Energy Spencer Abraham requested that the Secretary of Energy Advisory Board (SEAB) form a subcommittee to assess the issues and key factors that must be addressed if the Federal government and industry are to commit to the financing, construction, and deployment of new nuclear power generation to meet the nation's electric power demands in the 21st Century. The Nuclear Energy Task Force (NETF) was formed to provide the Secretary with an actionable plan to resolve the issues and barriers to the development and deployment of new nuclear generation. The membership of SEAB's bipartisan NETF was made up of SEAB members, as well as individuals from the nuclear industry, the financial world, public interest and environmental communities, former government officials and regulators, and the science community.

Task force members conducted five meetings to gather information and assess the barriers to new nuclear generation. They received information and comments from a cross-section of public- and private-sector representatives, including vendors, new nuclear generation consortia, government officials, and trade and environmental organizations. The NETF focused on the critical differences between the "needs" that must be met to actually revitalize the nuclear option in the United States and the "wants" of the nuclear industry (i.e., what the industry might like to have to reduce the risks and cost associated with new construction). This report summarizes the NETF's findings, conclusions, and recommendations. The task force believes that the report provides a fair representation of what is needed to achieve the construction and deployment of new nuclear plants. The Terms of Reference for the Secretary of Energy Advisory Board Nuclear Energy Task Force are presented in Appendix C.

TASK FORCE RECOMMENDATIONS AND CONCLUSIONS

The process for obtaining permits to construct and operate a nuclear plant has been considerably streamlined, but the new process has never been fully tested and confirmed as valid and effective. The task force believes that the government must act to clear up the residual uncertainty in plant licensing and to minimize or eliminate the threat of the abuse of litigation as a means for delay.

Because the licensing process needs to develop further and evolve with new designs, and because it is in the national interest to ensure our energy security and reap the environmental benefit arising from the absence of carbon emissions by nuclear power generation, the NETF believes there should be government-supported demonstration programs and financial incentives to overcome the uncertainties and economic hurdles that would otherwise prevent the first few new plants from being built. The NETF thus recommends legislative support and funding for the following programs:

- Early Site Permit and combined Construction and Operating License demonstration programs jointly funded by the Department and industry.

- A cost-sharing program for the First-of-a-Kind Engineering (FOAKE) costs inherent in building the first facility of a new design. FOAKE costs would be shared by the design vendor and the Federal government on a 50/50 basis, up to a maximum of $200 million (2004 dollars) of Federal contribution for each of three major competing design types, with the Secretary of Energy being given discretion to select the types to be supported. Each of the subsequent 50 units using these designs would repay the government $12 million (2004 dollars).

- A basket of support programs for the first few reactors (up to four) of each new supported design to provide efficient financial options for new construction in different circumstances (regulated utilities, unregulated merchant generating companies, and project-financed plants). This package of incentives would consist of secured loans or Federal loan guarantees; accelerated depreciation; investment tax credits, production tax credits, or both; and power purchase agreements. The generating company would elect a package of support not to exceed $250 million (2004 dollars) for each reactor in cost to the government. The total cost to the government would be spread over a period, probably at least 10 years, when these first units would be built.

These and other specific NETF recommendations are included in appropriate chapters of this report and summarized in Chapter 6.

CHAPTER 1
THE CONTEXT FOR NEW NUCLEAR POWER

The Secretary of Energy formed the Nuclear Energy Task Force (NETF) in July of 2004 and directed its members to "assess the issues and determine the key factors that must be addressed if the Federal government and industry are to commit to the financing, construction, and deployment of new nuclear power generation plants to meet the nation's electric power demands in the 21st Century." There are a variety of ways to provide for electricity needs, and the vast majority of electrical generation capacity in the United States is built without substantial government involvement. Why, then, should the NETF investigate obstacles to the construction of new nuclear plants and the means to overcome them?

Nuclear power, which currently accounts for about 20 percent of the electricity generated in the United States each year, has two important advantages over its two leading competitors — it is non-polluting, and it is not subject to significant price volatility and supply disruption. At the same time, the history of nuclear plant construction is replete with costly delays in project completion. These delays, coupled with volatility in energy demand in the 1970s and 1980s, made reactor construction a costly proposition for generating companies. This experience has made the generating companies and the financial community wary of investing in new plants.

The NETF is charged with identifying today's barriers to new construction and determining how they might be overcome. Unlike electricity generated from coal and natural gas — which account, respectively, for about 51 percent and 16 percent of electricity generation — nuclear generation results in no emissions whatsoever of so-called "conventional" air pollutants, such as sulfur dioxide and nitrogen oxides. Much more importantly, nuclear power plants emit no carbon dioxide in electrical generation. Carbon dioxide is the greenhouse gas of greatest concern because of its growing concentration in our atmosphere and its possible role in climate change, both now and in the future. This advantage will grow in importance if the United States eventually imposes taxes, caps, or otherwise regulates greenhouse gas emissions from electricity generators and other sources. This gives rise to one of the central questions in energy policy — if coal and (to a lesser extent) natural gas are constrained in their future growth by restrictions on carbon dioxide emissions, what sources will provide the estimated 300 gigawatts of new electricity generation capacity that it is estimated the United States will need by 2025?

To illustrate the difference that nuclear power (or any other carbon-free source of electricity generation) could make, assume for the moment that nuclear power's share of the present generation mix is 30 percent (rather than its present 20 percent) and that this gain came entirely by displacing coal generation. This change alone would result in a reduction in annual carbon dioxide emissions of about 90 million metric tons of carbon equivalent, or about 8 percent of total annual U.S. emissions of carbon dioxide. There also would be significant reductions in sulfur dioxide, oxides of nitrogen, and mercury and other heavy metals.

Nuclear power has another advantage. Unlike the market for natural gas, which seems likely to resemble that for petroleum in the future (with prices being set in a tight world market and supplies being widely transported around the globe), the market for the uranium that fuels nuclear power plants benefits from relatively abundant and secure supply in North America. Thus, nuclear power (like coal, which is also abundant here in the United States) presents none of the energy security problems that currently plague us with respect to the petroleum we use, principally for transportation, and that may attend natural gas-fired electricity generation in the years ahead.

In the absence of government policies that would force all generators to "internalize" all of the costs associated with environmental harm and energy security, there will be underinvestment in new nuclear capacity, as well as in energy conservation and other sources of clean and secure electricity generation, from a societal perspective. That is the reason the NETF has undertaken its work. (It is recognized, of course, that nuclear power must also continue to bear all of the costs associated with its use, including those associated with the disposition of spent fuel.)

What is the backdrop against which this report has been written? The most important fact to note is that although the 103 currently operating nuclear units account for a fifth of the nation's electricity supply, no new plant construction has begun since 1978. In contrast, during the last decade alone, more than 140,000 megawatts of new natural-gas-fired generation capacity were installed domestically.

Nuclear power has been able to maintain a significant share of the overall generation mix over the past decade because there have been dramatic improvements in the efficiency with which almost all existing plants have been operated. The average capacity factor for the nuclear industry as a whole (the fraction of the time that plants are available to generate full power) rose from 70 percent in the early 1990s to near 90 percent in the early 2000s. This was the equivalent of building 25 new 1,000 MW power plants. Because further improvements in efficiency will be much harder to come by, and because no new nuclear plants are under construction or even under very serious consideration, nuclear power's share of the generation mix is likely to fall over time.

There are other important reasons for a thorough review of the future prospects for nuclear power. For instance, nuclear plant construction is underway in other countries, raising issues associated with the loss of U.S. leadership and business opportunities if the U.S. does not similarly commit to new construction. Also, the (at least partial) deregulation of electricity generation in the United States has made for a much more difficult environment for investment in any highly capital-intensive form of electricity generation — namely nuclear power and, to a lesser extent, "clean" coal plants — because of the high "front-end" costs. For this reason alone, some believe that the government should share in the costs of, or in some other way assist, new nuclear plant construction. The NETF believes the arguments for nuclear power associated with the national security issues arising from dependence on foreign supplies of natural gas and with climate change carry more weight.

Several conditions must, however, be satisfied if new nuclear construction is to occur. First, any growth in reliance on nuclear power is dependent on sustained assurance of adequate protection of public health and safety. The industry's record in this regard provides considerable reassurance. Data maintained by the Nuclear Regulatory Commission (NRC) show that the safety performance of the nuclear industry has improved steadily over recent decades. Moreover, any new construction in the near term will no doubt use evolutionary designs that apply the knowledge that has been gained from experience with the current fleet and from advances arising from research, including advances in information technology and materials. The new designs should be even safer than existing plants. Indeed, some of the new designs use passive safety features that should enhance the reliability of safety systems.

Second, as a result of the experiences of 9/11, there is a need to provide the country with confidence that nuclear power plants are adequately protected against terrorist attacks. Significant security upgrades were introduced at all nuclear plants in the period following 9/11, with the consequence that nuclear power plants are more secure than most other elements of our civilian infrastructure. A continued focus on security will be an essential precondition for growth in nuclear generating capacity.

If these conditions are met, we conclude that some catalytic governmental financial incentive support is appropriate for new construction to gain the environmental and energy security benefits that nuclear power offers. Indeed, we believe there is a national interest in reliance on a more diverse set of fuels and technologies, thereby providing some capacity to mitigate price shocks and supply disruptions. We thus turn our attention to the obstacles that stand in the way of a larger role for nuclear power in U.S. electricity generation.

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CHAPTER 2
LEGAL, INSTITUTIONAL, AND REGULATORY BARRIERS

No nuclear power plant can operate without a license issued by the Nuclear Regulatory Commission (NRC). One of the barriers to new construction is a so-called "regulatory barrier" — the risk that the operation of a nuclear power plant will be prevented, made considerably more expensive, or delayed as a result of unanticipated action by the NRC or the courts. Although there is a new licensing process in place that should serve over time to alleviate these concerns, the new system has not yet been completely tested.

THE LICENSING PROCESS

The Original Two-Step Licensing Process

Historically, the NRC and its predecessor, the Atomic Energy Commission, issued licenses for all of the existing operating nuclear power plants using a two-step licensing process. (The regulations governing this process are found in the Code of Federal Regulations, Title 10, Part 50). The NRC first issued a "construction permit" that allowed the applicant to begin construction. The construction permit was issued only after the NRC staff was satisfied with the preliminary plant design and had determined the suitability of the site. The process also involved a mandatory public hearing in which affected parties could intervene, a review by a group of independent technical experts (i.e., the Advisory Committee on Reactor Safeguards or ACRS), and the preparation of an environmental impact statement that complied with the National Environmental Policy Act.[1]

The second stage of the licensing process involved issuance of an operating license. The application for an operating license was customarily submitted when construction was substantially complete. The process included a review of a final safety analysis report that described the plant design and demonstrated the capacity of the design to meet various safety requirements. The NRC staff also reviewed the applicant's emergency plans in consultation with the Federal Emergency Management Agency. The ACRS then conducted another review of the application, and all affected parties were again given an opportunity for a hearing.

Although the process provided appropriately for an exhaustive examination of safety and environmental issues, there were sometimes extensive delays and expensive retrofits before plants were allowed to go into operation. Often, critical details of plant design were first available at the operating license stage, requiring a time-consuming review. As a result of the Three Mile Island accident, significant new requirements were introduced. Because the regulatory delays and new requirements arose in many instances after substantial expenditures had already been incurred for construction, the total cost of the affected plants increased significantly. This experience has made the nuclear industry and the financial community wary that unanticipated regulatory actions could increase the financial risk associated with new construction.

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[1] The NRC authorized some limited construction work before the issuance of a construction permit in some circumstances.

The Revised Licensing Process

The NRC has established an alternative approach to licensing that should serve to improve the regulatory framework surrounding decisions relating to new construction. (The regulations governing the revised process are found in the Code of Federal Regulations, Title 10, Part 52). The new system ensures a careful and thorough review of safety, but serves to minimize the financial risk associated with NRC review. The new framework achieves this reduction in regulatory risk by moving decisions to as early as possible in the review process, thereby providing a large measure of regulatory certainty before a significant portion of the total cost of power-plant construction is incurred. Design certification, an Early Site Permit (ESP), and a combined Construction and Operating License (COL) are the elements of the revised licensing process.

Design Certification. The NRC can now certify a reactor design for 15 years, using a decision process that is independent of a specific site or even a specific decision to construct the design. The NRC first undertakes an analysis to determine that the design meets all regulatory requirements. If the design is acceptable, NRC begins a rulemaking process (during which public comments are received) that leads to the final rule, which may then be subject to judicial review on petition by an interested party. This has the effect of providing finality for issues that are resolved or could be resolved. And the entire decision process is undertaken before the actual expense of building a plant incorporating the design has been undertaken.

As part of this process, the applicant proposes — and the NRC determines — the inspections, tests, analyses, and acceptance criteria (ITAAC) that will be sufficient after construction to demonstrate that a plant will operate in accordance with the design certification. A plant applying the certified design can be allowed to operate only if the ITAAC are satisfied. The NRC has certified three designs — the ABWR, the System 80 plus, and the AP 600; design certification is pending on the AP 1000, which has received Final Design Approval. Various other designs are expected to receive design certification in the future.

Early Site Permit. The revised process also provides for the early approval of a site for construction of one or more nuclear power plants. Again, an applicant may seek an ESP before the decision to use the site for this purpose has been made. The permit is valid for up to 20 years and can be renewed for up to an additional 20 years.

As part of this process, the NRC examines the site safety characteristics and emergency planning issues included in a safety evaluation report and the various environmental issues identified in draft and final environmental impact statements. The ACRS reviews each application for an ESP, and the NRC conducts a mandatory public hearing in which interested parties may intervene. Any decision to issue an ESP is subject to judicial review. Again the issues associated with an ESP can be resolved before construction and before the costs associated with construction have been incurred. The NRC is now reviewing three applications for ESPs.

Combined License. A COL authorizes both the construction and the conditional operation of a nuclear power plant. The application for a COL can reference a certified design, thereby eliminating the need for evaluating issues associated with the design in connection with the issuance of the COL. Of course, the applicant must then satisfy all ITAAC associated with the certified design, as well as any ITAAC associated with site-specific design features, before operation.

Similarly, if the applicant references an ESP, the environmental issues that were resolved in connection with the ESP need not be reexamined in connection with issuance of the COL. Instead, the applicant must demonstrate that the design is compatible with the ESP. In addition, certain issues that were not previously resolved in connection with the ESP (such as the need for power from the proposed plant) must also be resolved.

An application for a COL is subject to review by the ACRS and to a public hearing in which interested parties may participate. In addition, any decision by the NRC to issue a COL is subject to judicial review. Again, the administrative process reduces the risk in comparison with the old two-step process because the regulatory process with judicial review can largely run its course before the expenditures for actual construction of a plant have been incurred. Also, the scope and complexity of any review is narrowed if the COL is founded on an ESP, a certified design, or both.

The NRC rules provide that not less than 180 days before the initial loading of fuel, the NRC must publish a notice of intended operation of the plant. At this time, affected parties are authorized to seek a hearing on whether all ITAAC have been adequately satisfied. The NRC can authorize a period of interim operation while the matter is resolved if it finds reasonable assurance of adequate protection of public health and safety. The rules provide that the NRC shall, to the maximum extent possible, reach a final decision expeditiously on any issues that are raised.

No applicant has sought a COL as yet. However, the Department of Energy (DOE) has solicited proposals from interested parties and is undertaking some cost-sharing with certain applicants that propose to make submissions to the NRC. Three groups have sought and been awarded DOE funding.

The revised NRC process serves to reduce regulatory risk. Because regulatory decisions are made early in the process — with most decisions being made before construction commences — the financial risk of an adverse regulatory decision is significantly reduced. Although the reform of the licensing process serves to minimize regulatory risk, it does not completely eliminate it. The ITAAC process and the possibility of a hearing on satisfaction of the ITAAC create the possibility of regulatory disruption after substantial funds have been expended. Achieving the purpose of the revised regulatory process will be thwarted if the NRC does not keep the ITAAC process focused narrowly on those issues that must be subject to post-construction verification. ITAAC should not be used as a vehicle for a second examination of matters that can be resolved early in the process. We urge that the NRC establish ITAAC that serve to ensure public health and safety, but that are no broader or more extensive than necessary.

The new regulatory process has not been completely tested, and generating companies have understandably been reluctant to be the first in line to exercise the new system. The reason, of course, is that the first applicants must incur substantial expenditures that might be avoided by those who can follow the model these first applicants have established. As mentioned, DOE has undertaken some cost-sharing with the early applicants, thereby serving to reduce the first-time regulatory costs and demonstrating that the new system is workable. We urge that adequate funding be provided for these demonstrations.

INTERNATIONAL CONSIDERATIONS

The nuclear industry is an increasingly international enterprise that is in the midst of significant expansion. Specifically, as a result of industry restructuring, the number of vendors is significantly reduced and all are international enterprises. Because of the knowledge that has developed since the current generation of reactors was introduced, the new designs hold the promise of enhanced safety, greater reliability, and reduced cost. However, all of the vendors must seek to sell the improved reactors in an international marketplace to achieve economies of scale and to maximize the gains from their investment.

The licensing of new reactors is, and will remain, a sovereign exercise. But, the introduction of new designs — and the costs of their introduction — will be significantly increased if the requirements that must be satisfied in one country are inconsistent with or significantly different from those that must be satisfied in another. The development of custom modifications for each country will increase costs.

There are many international groups that serve to facilitate international interaction within the nuclear industry. These include the International Atomic Energy Agency (IAEA); the Nuclear Energy Agency of the Organization for Economic Cooperation and Development (OECD); and various coordinating organizations, such as the International Nuclear Regulators Association (INRA). Other groups include the Western European Nuclear Regulators Association (WENRA), as well as several multinational groups that seek to collaborate on new generations of reactors, (e.g., the Generation IV International Forum and the International Project on Innovative Nuclear Reactors and Fuel Cycles).

Nonetheless, the NETF believes that there should be a concerted effort among the various affected regulatory bodies to coordinate their activities so a design that is suitable in one country does not have to be substantially modified to meet licensing requirements elsewhere. Indeed, coordinated activities could serve to enhance the technical scrutiny of new designs in ways that exceed the capability of any one country. It is in the interest of all countries that seek to deploy new reactors to work together. Such coordination should be a high priority.

CHAPTER 3
FINANCIAL BARRIERS

Construction of the first new nuclear power plants in the United States is regarded as a relatively high-risk undertaking by both the electric power industry and the financial community. This perception is largely a result of past experience. Construction of a number of currently operating nuclear plants caused severe financial impacts for the companies that built them. Several factors contributed to these adverse financial impacts, including a poorly designed regulatory and licensing process; changing regulatory standards and requirements; the absence of design standardization and modular construction practices; the fact that nuclear technology was still evolving and had not reached today's level of technological maturity; rising interest rates; fluctuating electricity demand; and inexperience and mismanagement of the construction process.

This history means that both debt investors and equity investors will be extremely cautious before undertaking the financing of new nuclear construction. The major risk for those who provide debt financing is a delay in operations, and hence of revenues, by factors that are beyond the private sector's control. That risk might arise, for example, as a result of regulatory or judicial actions. Unless this risk is mitigated, the financial community has indicated that it will be impossible to gain access to debt financing from the capital markets at a reasonable cost and in sufficient amounts to permit a balanced capital structure for the project.

Equity investors also focus on both a return of and a return on capital, where the pricing of the underlying equity is a function of the predictability of a company's projected earnings and cash flows and the dividends paid to the investor. The resulting share price, as evidenced by the forward price/earnings multiple, measures the relative risk (versus other similarly situated companies) that investors place on whether a particular company will meet its financial projections and directly indicates how well management has executed its strategic goals. This assessment ultimately dictates the tactical and strategic options available to a company. Because investment in a nuclear power plant would likely be viewed by equity investors as quite risky, the equity markets would probably demand very high returns.

These items, taken individually or together, will likely be a deterrent to management and investors who are contemplating undertaking a large nuclear construction project in the absence of some form of initial governmental backstop during at least the construction phase of the earliest new reactors. Although various structures are contemplated that could reduce the risk to debt investors and equity investors (see below), both types of investors are unlikely to be willing to assume risks associated with new technology, potential delays in the regulatory and licensing process, or delays in the construction process. It is these risks, combined with the decision to authorize an equity issuance and face its dilutive effects (as well as the resulting share price erosion), that may be one of the more important hurdles a corporate board faces when deciding whether to proceed with the development of a new nuclear facility. However, current experience demonstrates that managements are willing to assume the risk associated with nuclear plants once the plants are operational.[2] We believe that both debt investors and equity investors will similarly be prepared to assume the risks of new nuclear construction once the first several projects have been successfully

[2] Generating companies have been able to obtain financing to purchase operating nuclear plants.

completed. The challenge is to find appropriate means to enable the first several construction projects to take place.

FINANCING STRATEGIES

New construction might take place today in three different financing situations — a project undertaken by a regulated utility, by an unregulated merchant generating company, or through non-recourse project financing. The NETF has considered various alternative financial incentive proposals in the context of these three different financing situations.

Regulated Utility Project

A regulated utility in a state that has not elected to deregulate its power generation market could choose to develop a new nuclear plant under traditional cost-of-service rate regulation. Because the project would be financed as part of the utility's ongoing regulated operations, this financing strategy would probably offer the highest degree of certainty in obtaining the needed debt and equity financing with the least need for secured loans or loan guarantees. Debt investors, for example, are likely to be most comfortable with this approach because the lenders would have access (or recourse) to all of the utility's assets and revenues both during and after construction. Debt investors lending to an unregulated merchant generating company would also have recourse to the assets and revenues of the merchant company, but they are likely to be more comfortable with the lower business risk arising from the authorized rate of return of the regulated utility.

This alternative would expose the utility to potential credit rating pressure, but the pressure could be mitigated by a rate compact with state regulators or by a consortium approach that spreads the risk among several sponsors, as described in Appendix A. The financial incentives likely to offer the greatest value in this situation would be incentives to offset the higher costs of the initial plants — a cost-sharing mechanism for First of a Kind Engineering (FOAKE) costs; accelerated depreciation; and an investment tax credit, a production tax credit, or both. This alternative would probably receive only a limited benefit from a secured loan or Federal loan guarantee because credit-rating agencies may continue to view the cost of the project as an obligation of the utility for rating purposes, and debt investors would in most cases already be comfortable with the protection of revenues afforded by utility regulation.

Unregulated Merchant Generating Company Project

Especially in deregulated power markets, it is likely that a new nuclear plant will be built and operated by an unregulated merchant generating company rather than by a regulated utility. The unregulated merchant generator may be either an affiliate of one or more regulated utilities within a holding company corporate structure or a standalone company. Given its relatively greater exposure to commodity price risk (i.e., the uncertainty in electricity prices), the rating agencies will typically require a less leveraged balance sheet (more equity and less debt) for a merchant generation company (versus a regulated utility) to achieve an equivalent credit rating. With its higher business risk profile, a merchant generating company seeking to build a new nuclear plant may face greater rating pressure than a regulated utility. However, this risk could be mitigated to some degree by a long-term power purchase agreement for the new plant's output with a regulated utility affiliate or other load-serving entity or by support from the parent company. A merchant generating company would also likely require a higher return on equity for a new nuclear plant investment than a regulated utility.

A merchant generating company will be more likely to require secured loans or loan guarantees to undertake a new nuclear plant than a regulated utility. As is the case for the regulated utility project, appropriate financial incentives would include a cost-sharing mechanism for FOAKE costs; accelerated depreciation; and an investment tax credit, a production tax credit, or both. In addition, a merchant generating company may benefit to a greater extent from a secured loan or Federal loan guarantee than would a regulated utility.

As is the case with the regulated utility, the credit rating agencies may continue to view the nuclear project's cost as an obligation of the merchant generating company despite the secured loan or loan guarantee. However, the ability of the merchant company to attract debt financing for a new nuclear plant would depend upon the size and composition of its asset base, the strength of its revenues, and the extent of any parent company support. For example, a merchant generating company with a limited existing asset base and revenues or a merchant generator with only nuclear assets and without significant parent company support, would likely require a secured loan or Federal loan guarantee similar to the non-recourse project finance model described in the following section to attract debt financing.

Non-recourse Project

Under the non-recourse project finance structure, debt investors lend to a single-purpose entity, whose only asset is the new power plant and whose only revenues are from power sales once the plant enters commercial operation. These transactions are highly structured. Lenders have a lien on all project assets, and there are restrictions on dividends and distributions from the project to sponsors if the plant fails to perform as expected. In the event of a default, lenders have recourse only to the assets of the project (the plant and any contracts, such as a power purchase agreement) and not to the other assets or revenues of the project sponsor.

A project finance structure offers significant advantages to the project sponsor, including the following:

- Potential to reduce capital costs by using a more leveraged capital structure (some gas-fired cogeneration projects have used capital structures with a debt component of 80 percent or higher);

- The ability to reduce earnings-per-share dilution by making equity contributions at the latter stages of project construction after proceeds from the debt component of the capital structure have been expended; and

- The ability to insulate the sponsor's other assets from claims by the project lenders in the event of a default by the project. As a consequence, the credit-rating pressure for a sponsor using a non-recourse project finance structure is likely to be significantly lower than for the other available financing models.

A sponsor seeking to finance a new nuclear plant using a non-recourse project finance model will face great challenges in attracting debt financing for the project. The financial community has indicated that debt investors will be unwilling to lend under a non-recourse project finance structure to a new nuclear project, absent other protection against the risk of a default. Therefore, the use of a non-recourse project finance structure for a new nuclear plant would require a secured loan or Federal loan guarantee for the debt component of the project's capital structure, making the secured loan or Federal loan guarantee the most valuable financial incentive for this financing alternative.

At the same time, certain of the characteristics of non-recourse project financing (e.g., the lower capital cost due to the lower equity component in the capital structure and the ability to reduce earnings-per-share dilution by contributing equity capital to the project only after the proceeds of the debt financing have been used) may reduce the need for other financial incentives, such as an investment tax credit and accelerated depreciation. As is the case with the other financing methods, a cost-sharing mechanism for FOAKE costs and an investment tax credit, a production tax credit, or both, would be valuable for offsetting the higher costs of the initial plants.

FINANCIAL INCENTIVES

Cost-sharing for FOAKE Costs

One obstacle to expanding the nuclear power option in the United States is the extra costs associated with the first units of a design family for engineering work that will then be reused for building subsequent units. A vendor who can have confidence that many more units of a particular reactor design will be ordered and built could invest funds in FOAKE costs and spread those charges over multiple future units. In the current environment, however, there is reasonable uncertainty surrounding the actual number of future orders that would follow, leading some vendors to plan to load all of the FOAKE costs on the first few units ordered, driving the price for the first plants to an unacceptably noncompetitive level. Estimates of the FOAKE costs range from $300 million to $500 million for first units.

As it does routinely for new technologies, the Federal government can reduce the capital cost of the first few plants by sharing with industry some portion of the first-of-a-kind design and engineering expense as part of a national energy research and development portfolio. DOE has committed to this approach under its Nuclear Power 2010 program (although the minimal funding provided to date is substantially short of actual needs). The Department provides similar research and development (R&D) support to commercialize clean coal technologies.

Given the current projections of electricity demand, it is estimated that as many as 50 new nuclear plants would need to be constructed by 2030 if nuclear power is to continue to provide 20 percent of our electricity supply. If the Federal government were to assume the risk for half of the FOAKE costs, subject to recovery from the next 50 units to be built, and the reactor vendors would be responsible for an equal amount, the repayment to the government by power companies using the new designs could be kept reasonably low without making any units built, whether first or later, uneconomical.

A cost-sharing mechanism for FOAKE costs would have a high benefit for all three possible financing models for a new nuclear plant. From a Congressional Budget Office (CBO) scoring perspective, a subsidy of FOAKE costs could result in relatively high cost-scoring based upon the high probability of Federal funding within a relatively short budget horizon. But, the royalty payment mechanism that we propose for recovery of the initial Federal government costs from the subsequent 50 units using the designs could mitigate that impact. Therefore, the NETF concludes that a sharing mechanism for FOAKE costs for the initial designs is likely to offer high value for all of the financing models with possibly medium CBO scoring costs.

The NETF recommends that FOAKE costs be shared by the design vendor and the Federal government on a 50/50 basis, up to a maximum of $200 million (2004 dollars) of Federal contribution for each of three major competing design types, with the Secretary of Energy being given discretion to select the types to be supported. Each of the subsequent 50 units would repay the government $12 million.

Secured Loans and Federal Loan Guarantees

The relatively higher risks associated with nuclear power, manifested through higher interest rates or the unavailability of debt capital under certain financing approaches, as discussed previously, can be mitigated through Federal government secured loans and loan guarantees. A secured loan or Federal loan guarantee can help ensure the availability of debt financing at attractive costs by providing lenders protection against the risk of the project's default due to certain specified causes, such as regulatory and litigation risks. Of course, a secured loan or Federal loan guarantee provides default protection only for the debt component of the capital structure and not for the sponsor's equity investment.

A secured loan or Federal loan guarantee could be sized to cover a debt component of 50 percent, consistent with the capital structure for a regulated utility or unregulated merchant generating company, or of 80 percent, consistent with a non-recourse project finance capital structure. In addition, a secured loan or Federal loan guarantee should result in a lower cost of debt financing due to the effects of Federal credit support. A reasonable assumption is that a secured loan or Federal loan guarantee would result in about a 0.5 percent to 1.0 percent spread savings in debt costs under the regulated utility financing model and a somewhat larger spread savings under the other two financing approaches. Such secured loans or Federal loan guarantees are common and can be structured with reasonable underwriting criteria to minimize the probability and amount of Federal payout. (A discussion of possible underwriting criteria can be found in Appendix A.)

A secured loan or Federal loan guarantee appears to have relatively low value for regulated utility financing, medium to high value for the unregulated merchant generating company, and high value for non-recourse project financing. From a CBO-scoring perspective, previous legislative proposals for secured loans or Federal loan guarantees for new nuclear plants have received relatively high cost scores, based upon the assumption that there is a high likelihood of default on the loans. However, the NETF believes that underwriting criteria could reduce the perceived default risk and should thereby achieve a low CBO cost score.

Federal Purchase Power Agreement

The risk of regulatory or litigation delay could also be mitigated through a power purchase agreement (PPA) that could provide for prepaying for power deliveries if a regulatory or litigation delay prevented the scheduled start of commercial operations. This would provide cash flow to cover debt obligations until the plant entered commercial operation. This Federal PPA incentive appears to have relatively low value for regulated utility financing, but it may have somewhat more value for unregulated merchant generating company and non-recourse project financing in protecting against the effects of relatively short-term regulatory or litigation delays.

Accelerated Depreciation

Accelerated depreciation is a form of fiscal policy that allows for more rapid recognition of the tax benefits associated with targeted investment categories. Its benefit comes from reducing taxes in early periods; it is not a permanent tax savings. There is a strong precedent for the accelerated depreciation option, as it has been frequently used to encourage investment and economic development in other situations. Accelerated depreciation proposals for the initial new nuclear plants include changing the Modified Accelerated Cost Recovery System (MACRS)[3] assumption for the plants from 15 years to 7 years. An accelerated depreciation incentive would likely have a medium value for all three financing methods and would likely have a medium CBO scoring cost.

Investment Tax Credit

The Investment Tax Credit (ITC) is a specified percentage of the tax basis of an asset that is taken immediately as a reduction in the firm's tax liability. There is a strong precedent for the ITC option, as it has been used to encourage investment and economic development in prior fiscal policy.

The ITC option has relatively high value for the project sponsor because it is known, quantifiable, and generally received at the completion of construction of the asset. This option is not dependent on the ongoing operating performance of the asset. ITC proposals of 10, 15, and 20 percent have been suggested as financial incentives for the initial group of new nuclear plants. The ITC option is likely to have both high value to the project sponsor and high cost from a CBO-scoring perspective. Its value to a power company would be even greater if it could be taken during construction rather than only upon construction completion.

Production Tax Credit

Production tax credits are provided as direct reductions to a firm's tax liability during operation of the tax-favored facility so as to encourage activity in certain endeavors promoting fiscal

[3] Modified Accelerated Cost Recovery System. This method moves depreciation up into the earlier years of an asset's life, allowing for faster capital recovery than standard methods of depreciation, such as "straight line" or "units of production."

or social policy. Production tax credits are a function of the output of the facility qualifying for the credits, and the benefits occur over an extended period of time. The fact that the benefits occur over an extended time period and are tied to the actual operating performance of the plant may make them somewhat less certain and less valuable to a new nuclear plant sponsor than the ITC. At the same time, the CBO-scoring cost of this option is likely to be lower than for the ITC.

Proposals for production tax credits for new nuclear plants have been computed as a function of MWh generation levels, beginning in the year in which the plant enters commercial operation. Production tax credits of $10 per MWh for 10 years, and $18 per MWh for 10 years, have been suggested for the initial nuclear plants. There is precedent for a tax credit of $18 per MWh for 10 years, which is already available for certain renewable generating resources, such as wind power. The production tax credit incentive appears to provide a medium to high benefit for all three financing models at a medium to high CBO-scoring cost.

The NETF reached the following conclusions based on deliberations regarding financing considerations.

- The need for financial incentives for the first few in a series of new nuclear power plants should be viewed as a short-term requirement, limited both in time and in the number of plants that will need support. When the first few plants have been built, when capital costs have been reduced to the expected competitive levels, and when sufficient experience has been gained for the industry and the financial community to conclude that the new NRC licensing process is functioning as intended, then large-scale follow-on development of new nuclear plants should occur without further direct government financial incentives.

- No single incentive will stimulate construction of the first few in a series of new nuclear power plants in the United States. The relative value of various financing incentives is likely to vary depending upon the financing model, so the package of financial incentives should be sufficiently broad to permit debt and equity financing with a balanced capital structure under all three circumstances: new construction by a regulated utility, by an unregulated merchant generating company, or through a non-recourse project financing structure.

- Financing a new nuclear plant under the regulated utility model is achievable with the highest level of certainty and the least need for secured loans or loan guarantees, but it also poses potentially significant credit and equity risk for the sponsor. The NETF recommends that the Secretary of Energy engage governors and state rate regulators in discussions of possible regulatory approaches for advance approval of recovery of construction costs for a new nuclear plant, similar to those in place in some states for new coal-fired generation.

- Financing a new nuclear plant using the unregulated merchant generating company poses potentially greater challenges than for the regulated utility model. A secured loan or Federal loan guarantee and Federal PPA may have moderate to high value under this approach, depending upon the size and asset composition of the company and the availability of parent company support.

- Financing a new nuclear plant using a non-recourse project finance structure poses the greatest challenge in obtaining debt financing, but offers significant benefits to the project sponsor in lowering financing costs, credit rating risk, and earnings-per-share dilution. A secured loan or Federal loan guarantee will be required to obtain the debt financing under this structure, and an 80 percent loan guarantee will provide substantial benefits in the form of lower capital costs.

The NETF recommends, in addition to the 50/50 sharing of FOAKE costs, support for new reactors in the form of access to a basket of support programs, each up to a maximum of $250 million (2004 dollars) per reactor in cost to the government.[4] It is anticipated that these supported plants would be the first four reactors built in the United States of each of the new supported design types. The Secretary of Energy should make the final selection and have final approval for these reactors. The total cost to the government would be spread over a period, likely of at least 10 years, when these first 12 units would be built. These first 12 units and the subsequent 38 units (for a total of 50) using these designs would each repay the government $12 million (2004 dollars).

The NETF also recommends a consortium approach for developing the initial new nuclear plants, in combination with a package of financial incentives that can be adjusted based on the circumstances. The Secretary of Energy should encourage this approach as a means to provide efficient financing.

[4] Because it may be unlikely that there will be a default on a secured loan or a need to call on the Federal loan guarantee, the amount of the loan should be discounted in estimating the cost to the government. Thus, the $250 million in Federal support will provide for a loan that is considerably larger than $250 million.

CHAPTER 4
OTHER CHALLENGES TO NEW NUCLEAR GENERATION

There are a number of additional challenges to sustainable levels of new nuclear generation that must be addressed. These challenges include the following.

- Renewal of the Price-Anderson Act;
- Resolution of the issues associated with the disposition of spent fuel;
- Education and training of a new generation of engineers, reactor operators, technicians, and constructors to meet the demands of a new generation of power plants;
- Education of the public concerning nuclear generation; and
- Forthright examination of the proliferation implications of increased reliance on nuclear power.

THE PRICE-ANDERSON ACT

The Price-Anderson Act, passed by Congress in 1957 as an amendment to the milestone Atomic Energy Act of 1954, has provided the public with a no-fault insurance umbrella to pay liability claims in the event of an "extraordinary nuclear occurrence." The Act also sets limits on the monetary liability of companies for such accidents and defines the procedural mechanism for the coverage of claims.

The Act requires that evidence of financial protection in the event of a nuclear accident be shown for each nuclear power plant. That protection is provided in two layers. The first layer involves liability insurance protection of $300 million that must be purchased by every reactor operator. The second layer requires payment of a retrospective premium, equal to its proportionate share of the loss, up to a maximum of $100 million per reactor accident for each nuclear power plant. The U.S. public currently has the benefit of in excess of $10 billion of insurance protection required by the Act, all paid for by the nation's nuclear electric utilities. Since its inception, only $202 million in claims have been paid under Price-Anderson, with $70.8 million arising from claims and litigation costs from the 1979 accident at the Three-Mile Island plant in Pennsylvania.

Since 1957, the Price-Anderson Act has been extended three times for successive 10-year periods, and in 1988 it was extended for 15 years. Most recently, Congress extended the Price-Anderson coverage for commercial nuclear facilities through December 31, 2003, and through December 31, 2006, for Department of Energy facilities. Legislation to extend Price-Anderson coverage for an additional 20-year period was part of the comprehensive energy legislative package that was pending before the 108th Congress, but it was not enacted before adjournment. Because existing plants are indemnified for the life of their operation, existing power plants remain covered. But the termination of Price-Anderson coverage essentially forecloses any new nuclear plant construction. Passage of an extension of the Price-Anderson Act is essential to ensure that prospective new nuclear facilities will have the same indemnification coverage as existing plants and that institutions financing new nuclear construction are subject to defined risks.

The NETF, therefore, recommends that the Secretary of Energy, in conjunction with the nuclear utility industry, continue to work closely with Congress to ensure the timely and prompt passage of the extension of the Price-Anderson Act.

RESOLUTION OF THE NATION'S SPENT NUCLEAR FUEL ISSUES

The nation's reactors have generated an inventory of highly radioactive spent fuel from past operations, and this inventory will grow as operations continue in the future. The U.S. government is obligated by Federal law to accept the spent fuel from these operations and to dispose of it using funds that are now being collected from ratepayers. But the government has not yet fulfilled its obligation to accept spent fuel and has not established a licensed repository. As a result, spent fuel is accumulating at reactor sites, where it is stored in spent fuel pools or in licensed dry casks. Many point to the absence of a safe, established pathway for the disposition of spent fuel as a significant vulnerability of nuclear power, and some oppose an expanded reliance on nuclear power until such a pathway is established.

Surface storage of spent fuel can certainly be undertaken with adequate safety for many decades. The scientific and technical community is generally in agreement that disposal in a deep geologic repository is achievable and that such disposal provides an effective long-term means of isolating spent fuel from the human environment.[5] Moreover, other options (not examined by the NETF) may be feasible. Accordingly, the NETF concludes that the absence of a licensed repository is not a valid reason for postponing additional nuclear construction. Indeed, the issues associated with the disposition of spent fuel can and must be resolved even if there is no increased reliance on nuclear power.

Nonetheless, the NETF believes it is essential for the U.S. government to ensure that issues associated with the disposition of spent fuel are expeditiously addressed and resolved.

EDUCATION AND TRAINING OF A NEW GENERATION OF ENGINEERS, SCIENTISTS, AND TECHNICIANS

The U.S. nuclear power industry, like many industries, is challenged by the need to strike a critical balance between ensuring the security of our nation's critical electric supply system and maintaining economic competitiveness. Electric power is at the very core of economic competitiveness and security, and is central to the well-being of every person in the nation. Electricity is an essential commodity for every home, school, hospital, and business. The maintenance of the electrical infrastructure is thus absolutely critical. One important aspect of this infrastructure must not be neglected — the human element.

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[5] The NETF has not examined issues associated with a repository at Yucca Mountain and makes no comment about the suitability of that site.

A recent report by the public-private partnership, Building Engineering and Science Talent (BEST), *The Talent Imperative: Meeting America's Challenge in Science and Engineering, ASAP*, frames the issue. BEST asks: "What if America's engine of growth runs out of fuel? It runs on the brainpower of our brightest engineers, scientists and advanced degree technologists, a mere five percent of America's 132 million-person workforce….But what happens if America's engine of growth, our ability to create technologies and scientific breakthroughs, begins to sputter?"

Numerous studies and reports by the National Science Foundation, the Council on Competitiveness, the National Academy of Sciences, and the SEAB have concluded that Federal investments in the physical sciences and engineering have been stagnant for over 30 years. Similarly, U.S. industry has largely phased out its basic research programs and organizations. This has resulted in the erosion of the U.S. contribution in some important areas of science; but more importantly, it has discouraged students from pursuing careers in science, mathematics, and engineering. The BEST report noted that "twenty-five percent of our (U.S.) scientists and engineers will reach retirement age by 2010."

The Council on Competitiveness and the SEAB's Task Force on the Future of Science Programs at the Department of Energy previously concluded that there is a critical national need to increase national investment in frontier research; balance the nation's R&D portfolio in fundamental disciplines; expand the pool of U.S. scientists and engineers; and modernize the nation's research infrastructure. In addition, both concluded that a critical need exists to improve overall math and science education as a way to boost overall workforce skills and enhance the training and education of future scientists and engineers. Nowhere is the need for increased efforts in training scientists and engineers more evident than in the field of nuclear engineering, where U.S. enrollments had dropped to a low of 500 students in 1992. Through the efforts of Federal agencies, industry leaders, and academic leaders these numbers have grown to 1,300 students today. But these efforts must be sustained.

The NETF recommends that the Secretary of Energy continue to strengthen the Department's investment in the physical sciences and advanced engineering research; enhance its role in educating and training future scientists and engineers for careers in DOE-related technical areas; and establish strong programs of undergraduate, graduate, and post-doctoral fellowships or traineeships in the physical sciences and engineering. One important aspect of these efforts is the development of the manpower that is essential for the resurgence of nuclear technology.

PUBLIC ACCEPTANCE AND UNDERSTANDING OF THE BENEFITS OF NUCLEAR GENERATION

If the benefits of nuclear power are to be achieved, there must be public acceptance of this power source. Survey data suggest significant public support for nuclear power, but it is also the case that any increased reliance on nuclear power will be controversial with some segments of the population. Indeed, the critical role that nuclear power can, and should, play in responding to energy security and climate change does not appear to be widely understood.

The NETF recommends that the Secretary of Energy and the nuclear community more generally work to educate the public on energy supply and security issues. Efforts should be made to increase public understanding of nuclear energy and its role in ensuring a safe, secure, reliable electric power system for the nation that responds to environmental concerns. It would indeed be unfortunate if increased reliance on nuclear power were to become a divisive issue in the public arena.

NON-PROLIFERATION IMPLICATIONS OF NEW NUCLEAR GENERATION

One of the concerns associated with the expansion of reliance on nuclear power relates to its implications for the proliferation of nuclear weapons. A worldwide increase in utilization of nuclear power could lead to an expansion of enrichment capability and certainly would result in an increase in the inventory of spent fuel. The concern is that the enrichment capability might be used to generate Highly Enriched Uranium (HEU) and that spent fuel might be reprocessed to recover plutonium — the essential ingredients for the fabrication of nuclear weapons. This concern is irrelevant in connection with increased reliance on nuclear power within the United States. Nonetheless, the proliferation implications of increased worldwide reliance on nuclear power should be carefully considered. The United States serves as an important model for other countries, and enhanced reliance on nuclear power in the United States would no doubt serve to encourage other countries to follow the same path.

The NETF does not conclude, however, that these concerns can justify a U.S. policy to discourage increased domestic reliance on nuclear power. The development of nuclear technology elsewhere in the world is occurring and will continue to occur without regard to U.S. dependence on nuclear reactors for electricity generation. The answer to the proliferation issues associated with the development of nuclear capability around the world is aggressive efforts to preserve and enhance the safeguards regime that was established by the Nuclear Non-Proliferation Treaty. Regardless of U.S. energy policy, efforts to strengthen that regime should be a very high priority for the nation.

In addition, we conclude that an enhancement of the U.S. reliance on commercial nuclear power would serve our non-proliferation objectives. One of the legacies of the Cold War period is large nuclear weapons stockpiles. The secure disposition and disposal of excess nuclear weapons materials is central to U.S. national security policy. And, one of the most efficient and certainly the most thorough ways of disposing of that nuclear material is to burn it as fuel in commercial nuclear power plants.

In fact, in the 1990s, the United States reached an agreement with the Russian Federation to acquire and blend-down Russian stockpiles of HEU. Today, nearly half of the nuclear-generated electricity in the United States comes from more than 9,000 Soviet era warheads that have been blended-down for commercial use. Despite this achievement, there is enough known "surplus nuclear materials" throughout the world to supply a hundred 1,000 MW reactors for 20 years — basically the entire U.S. generating infrastructure. The destruction of excess weapons materials through burning them in reactors is certainly in the national security interest of the United States. And the addition of reactors to the U.S. fleet would allow that destruction to occur all the more rapidly.

Central to meeting U.S. non-proliferation goals is U.S. leadership in the very business it created. But American leadership in the commercial international field is seriously threatened, reducing our leverage with the rest of the nuclear world. In the early years, Russia and the United States together controlled almost 90 percent of the global trade in peaceful nuclear products and services. Today, although the United States has a healthy and thriving domestic nuclear electricity generating structure, the rest of the U.S. nuclear enterprise is almost out of business. As early as 1976, President Ford's administration lamented the fact that the U.S. share (and control) of the global trade in nuclear materials, hardware, and services had dwindled to 50 percent.

Several countries have slowly weaned themselves of any need for U.S. support, goods, or services. Virtually all U.S. fuel and hardware vendors have been absorbed into foreign corporations. By 1996, 15 other countries had developed partial or complete nuclear fuel cycle capabilities with limited, or no, U.S. or Russian involvement. Some of these countries (e.g., Japan, China, South Korea, Argentina, India, and Brazil) could become very competitive nuclear suppliers to the next growth era. Some have already established an independent multilateral cooperative network. China, for example, has developed indigenous cradle-to-grave capabilities. This means that other nations will reap the benefits of supplying nuclear goods and services to support the industrialization of developing nations and global energy demand and, by default, will have the capacity to define the character of the future global nuclear infrastructure.

The facts suggest that we could move into a new nuclear era that involves little or no participation by, or benefit to, the United States. Other countries have announced aggressive growth plans for commercial nuclear power and will move ahead swiftly, with or without the United States. If it appears to them that we do not intend to participate in keeping nuclear power as a key energy technology, those countries might decide to develop fuel cycle technologies and material-handling policies that meet lower non-proliferation standards. The influence of the United States will be respected in this sphere only to the extent that we participate in the development and deployment of nuclear technologies in the future.

The NETF concludes that the proliferation concerns associated with nuclear power development around the world are very serious and that U.S. interests — indeed, world interests — would be best served by efforts to encourage a robust commercial nuclear industry in the United States.

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CHAPTER 5
LEADERSHIP ISSUES

It is highly unlikely that there will be new nuclear plants constructed in the United States unless there is effective leadership in dealing with our national energy needs over the next few years. Although there is strong justification for moving forward with nuclear power, and although a streamlined regulatory and legal framework for such construction is largely in place, nothing constructive will happen without strong leadership in a number of areas.

The information provided to the NETF has confirmed that there is an interest in the private sector in new plant construction, although some additional government actions must take place before the first plants will be constructed. In this connection, the electricity industry must clarify its needs and prioritize its requests. In particular, the nuclear industry must also convey information to Federal policy makers in clear, sharply defined terms with specific recommendations for dealing with both the problems and the opportunities presented. The industry must recognize that the Federal government should not and cannot eliminate all the risks and vagaries of the energy markets for them. The utilities must develop a reasonable consensus position and present those needs clearly to the Administration and Congress for action. In this connection, we believe the most critical needs include some assistance to offset the higher capital costs associated with the first few nuclear plants, and establishment of regulatory and economic conditions that will make the first few projects viable and attractive to potential investors in both the equity and the debt markets, along with conditions that allow participants in those markets to finance the plants. These issues are discussed in detail in Chapter 3 and Appendix A.

The providers of electrical energy to the nation's homes and industry (i.e., the generating companies) are providing some of the critical initiative for moving forward. But their vision and commitment must be conveyed beyond corporate boardroom and trade association meetings and must also impact the public arena. The nuclear industry must undertake a vigorous and continuing communications program to make the case to the American public that nuclear power is a safe, reliable, and cost-effective part of our energy network and must continue to be a significant part of the growth of our energy supply. Of course, any such program must be based on a continued commitment to safe, reliable, and secure operations.

The principal contribution that government can make to the process is to provide, maintain, and support a regulatory and legal environment that eliminates needless uncertainty and delay from initiation of construction through plant startup. Much has already been accomplished in this direction over recent years, but it is becoming apparent that some additional action is required. Leadership from the Administration and Congress is necessary to encourage investment in new construction.

Although there is bipartisan support for nuclear power within the membership of both the House and Senate, there is some conflict within the leadership ranks. Consideration of energy supply issues should serve as a stimulus to resolve these differences.

In this time of concern about energy security, it is imperative that the President, the key members of the Administration, and Congressional leaders, come together to create an effective national program and a plan for its legislative implementation. We urge that the President identify this as a critical priority for the nation and that the Congress take the necessary steps to meet this priority.

The following key areas must be addressed by the policy leaders.

- A clear commitment to a national energy policy that includes recognition that nuclear power provides a reliable, stable contribution to energy availability and energy security without adverse environmental consequences.

- Resolution of current issues associated with the disposition of spent fuel.

- A reasonable level of Federal involvement to enable private-sector engagement in new construction. As discussed above, this would involve Federal policies to reduce fears that there might be devastating delays imposed by the legal process in the completion or startup of new plants, to address the higher costs of first units that are constructed, and to level the playing field for nuclear power with respect to other non-carbon-dioxide-emitting sources.

One additional, often overlooked, area in which policy leadership could make a very beneficial difference is in reestablishing the technology and fabrication capacity of the suppliers associated with the nuclear industry within the United States. For example, the manufacture of pressure vessels, pumps, valves, and other specialty nuclear components with its well-paying jobs and skills has moved offshore because there has been little or no market within the United States for nearly three decades. Government, business, educators, and labor leaders should come together to address this potentially extremely significant dividend from the revival of nuclear construction in America.

All of these critical issues are addressed in more detail elsewhere in this report. The important message to be emphasized is that with constructive leadership across the board, they are all resolvable.

CHAPTER 6
CONCLUSIONS AND RECOMMENDATIONS

The United States has been very well served by a fleet of nuclear reactors that has provided a safe, reliable supply of electricity meeting 20 percent of the nation's needs. In the past decades, the American nuclear industry has sustained the commitment and discipline to ensure the safety and effectiveness of nuclear power. All of the NTEF recommendations are predicated on the industry sustaining this focus, commitment, and discipline.

With the high volatility and the upward trend of the prices of oil and natural gas, the security risk associated with the inevitable increased reliance on imported natural gas for electricity generation, and the growing environmental concerns with emissions of greenhouse gases, it is critical that the United States at least maintain a significant proportion of nuclear power in the mix of electric energy generation. It is now imperative that the U. S. government act decisively to create the environment and incentives to ensure that the construction of new, safe and reliable nuclear generation capacity occurs expeditiously. Indeed, if nuclear energy is to continue to provide 20 percent of our electrical supply, approximately 50 gigawatts (i.e., 50 new 1,000 MW reactors.) of new nuclear capacity will have to be constructed by 2030.

For this to occur, some specific barriers, challenges, and issues must be addressed. The process for obtaining permits to construct and operate a nuclear plant has been considerably streamlined, but the new process has never been fully tested and confirmed to be valid or effective. The government must act to clear up the residual uncertainty in licensing and to minimize the threat of regulatory delay. Because the licensing process needs to develop further and evolve with new designs, and because it is in the national interest to ensure our energy security and reap the environmental benefits arising from the absence of the lack of carbon emission by nuclear power, there should be a program of government supported financial incentives to overcome the economic hurdles that would otherwise prevent the first few new plants from being built.

The Nuclear Energy Task Force (NETF) has evaluated the barriers, issues and challenges associated with financing, constructing, and deploying new nuclear power generation. The following conclusions/recommendations are the result of their evaluation.

LEGAL, INSTITUTIONAL, AND REGULATORY BARRIERS

The government must act to clear up the residual uncertainty in licensing and to minimize or eliminate the threat of the abuse of litigation as a means for delaying the operation of a well-constructed nuclear power plant. The NETF urges that NRC establish ITAAC that serve to ensure public health and safety, but that are no broader or more extensive than necessary.

There should be a concerted effort among the various affected regulatory bodies to coordinate their activities so a design that is suitable in one country does not have to be substantially modified to meet licensing requirements elsewhere. Indeed, coordinated activities could serve to enhance the technical scrutiny of new designs in ways that exceed the capability of any one country.

It is in the interest of all countries that seek to deploy new reactors to work together. Such coordination should be a high priority.

The government should support demonstration programs to reduce the first-time regulatory costs of the revised NRC licensing process with legislative support and funding for Early Site Permit (ESP) and combined Construction and Operating License (COL) demonstration programs jointly funded by the Department and industry.

FINANCIAL BARRIERS

The need for financial incentives for the first few in a series of new nuclear power plants should be viewed as a short-term requirement, limited both in time and in the number of plants that will need support. When the first few plants have been built, when capital costs have been reduced to the expected competitive levels, and when sufficient experience has been gained for the industry and the financial community to conclude that the new NRC licensing process is functioning as intended, then large-scale follow-on development of new nuclear plants should occur without further direct government financial incentives.

No single incentive will stimulate construction of the first few in a series of new nuclear power plants in the United States. The relative value of various financing incentives is likely to vary depending upon the financing model, so the package of financial incentives should be sufficiently broad to permit debt and equity financing with a balanced capital structure under all three circumstances: new construction by a regulated utility, by an unregulated merchant generating company, or through a non-recourse project finance structure.

Financing a new nuclear plant under the regulated utility model is achievable with the highest level of certainty and the least need for secured loans or loan guarantees, but it also poses potentially significant credit and equity risk for the sponsor. Accordingly, the Secretary of Energy should engage governors and state rate regulators in discussions of possible regulatory approaches for advance approval of recovery of construction costs for a new nuclear plant similar to those in place in some states for new coal-fired generation.

Financing a new nuclear plant using the unregulated merchant generating company model poses potentially greater challenges than for the regulated utility model. A secured loan or Federal loan guarantee and Federal Power Purchase Agreement (PPA) may have moderate to high value under this approach, depending upon the size and asset composition of the company and the availability of parent company support.

Financing a new nuclear plant using a non-recourse project finance structure poses the greatest challenge in obtaining debt financing, but offers significant benefits to the project sponsor in lowering financing costs, credit rating risk, and earnings-per-share dilution. A secured loan or Federal loan guarantee will be required to obtain the debt financing under this structure, and an 80 percent loan guarantee will provide substantial benefits in the form of lower capital costs.

As a means to provide the most efficient financing, the Secretary of Energy should encourage a consortium approach for developing the initial new nuclear plants, in combination with a package of financial incentives that can be adjusted based on the circumstances.

The government should provide financial incentives to overcome the uncertainties and economic hurdles that would otherwise prevent the first few new nuclear plants from being built with legislative support and funding for the following programs:

- A cost-sharing program for the First-of-a-Kind Engineering (FOAKE) costs inherent in building the first facility of a new design, whereby costs would be shared by the design vendor and the Federal government on a 50/50 basis, up to a maximum of $200 million (2004 dollars) of Federal contribution for each of three major competing design types, with the Secretary of Energy being given discretion to select the types to be supported. Each of the subsequent 50 units using these designs would repay the government $12 million (2004 dollars).

- A basket of support programs for up to four each of the supported designs, to provide efficient financial options for new construction in different circumstances (regulated utilities, unregulated merchant generating companies, and project-financed plants). This package of incentives would consist of secured loans and Federal loan guarantees; accelerated depreciation; investment tax credits, production tax credits, or both; and power purchase agreements (PPAs). The power company would elect a package of support not to exceed $250 million (2004 dollars) in cost to the government for each reactor.[6] The total cost to the government would be spread over a period, likely of at least 10 years, when these first units would be built.

OTHER CHALLENGES

Passage of an extension of the Price-Anderson Act is essential to ensure that prospective new nuclear facilities will have the same indemnification coverage as existing plants and that institutions financing new nuclear construction are subject to defined risks. Therefore, the Secretary of Energy should, in conjunction with the nuclear industry, continue to work closely with Congress to ensure the timely and prompt passage of the extension of the Price-Anderson Act.

Surface storage of spent fuel can certainly be undertaken with adequate safety for many decades. And the scientific and technical community is generally in agreement that disposal in a deep geologic repository is achievable and that such disposal provides an effective long-term means of isolating spent fuel from the human environment.[7] Moreover, other options (not examined by the NETF) may be feasible. Accordingly, the absence of a licensed repository is not a valid reason for postponing additional nuclear construction. Indeed, the issues associated with the disposition of spent fuel can and must be resolved, even if there is no increased reliance on nuclear power. Nonetheless, the NETF believes it is essential for the U.S. government to ensure that issues associated with the disposition of spent fuel are expeditiously addressed and resolved.

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[6] Because it may be unlikely that there will be a default on a secured loan or a need to call on the Federal loan guarantee, the amount of the loan should be discounted in estimating the cost to the government. Thus, the $250 million in Federal support will provide for a loan that is considerably larger than $250 million.

[7] The NETF has not examined issues associated with a repository at Yucca Mountain and makes no comment about the suitability of that site.

The Secretary of Energy should continue to strengthen the Department's investment in the physical sciences and advanced engineering research; enhance its role in educating and training future scientists and engineers for careers in DOE-related technical areas; and establish strong programs of undergraduate, graduate, and post-doctoral fellowships or traineeships in the physical sciences and engineering. One important aspect of these efforts is the development of the manpower that is essential for the resurgence of nuclear technology.

If the benefits of nuclear power are to be realized, there must be public acceptance of this power source. The NETF recommends that the Secretary and the nuclear community work to educate the public on energy supply and security issues.

The proliferation concerns associated with nuclear power development around the world are very serious and U.S. interests — indeed, world interests — would be best served by efforts to encourage a robust commercial nuclear industry in the United States.

LEADERSHIP ISSUES

In this time of concern about energy security, it is imperative that the President, congressional leaders, and the key members of the Administration come together to create an effective national program and a plan for its legislative implementation. The President is urged to identify this as a critical priority for the nation.

The following key areas must be addressed by the policy leaders:

- A clear commitment to a national energy policy that includes recognition that nuclear power provides a reliable, stable contribution to energy availability and energy security without adverse environmental consequences;

- Resolution of current issues associated with the disposition of spent fuel; and

- A reasonable level of Federal involvement to enable private-sector engagement in new construction.

An additional area in which policy leadership could make a very beneficial difference is in reestablishing the technology and fabrication capacity of the suppliers associated with nuclear industry within the United States.

The above actions will serve to establish an environment in which nuclear power can and should flourish.

APPENDIX A
FINANCIAL BARRIERS FOR NEW NUCLEAR PLANTS

DEFINING THE FINANCING CHALLENGES

Construction of the first new nuclear power plants in the United States is regarded as a relatively high-risk undertaking by both the electric power industry and the financial community. This perception is largely a result of past experience. Construction of a number of currently operating nuclear plants caused severe financial impacts on the companies that built them. Several factors contributed to these adverse financial impacts, including a poorly designed regulatory and licensing process; changing regulatory standards and requirements; the absence of design standardization and modular construction practices; the fact that nuclear technology was still evolving and had not reached today's level of technological maturity; rising interest rates; fluctuating electricity demand; and inexperience and mismanagement of the construction process.

The factors that caused past difficulties are being remedied. The new licensing system created by the Energy Policy Act of 1992 was designed to eliminate licensing delays, design changes during construction, unnecessary regulatory changes, construction management difficulties, and the unexpected cost increases that affected a number of the nuclear units now operating. Under the new system, new nuclear reactor designs and prospective sites will be thoroughly reviewed and approved by the Nuclear Regulatory Commission before construction begins and significant capital investment is placed at risk. As described in Chapter 2, companies will receive a combined license that authorizes both construction and conditional operation of the plant. This will eliminate the potential for unnecessary delay in the commercial operation of a completed plant caused by a license proceeding at the pre-operation stage. Although this new regulatory process is now in place, it has yet to be tested with a new application for a combined license. As a consequence, some residual uncertainty will remain until the initial plants successfully complete the licensing process and enter commercial operation.

Technology risk has also been addressed. The new designs to be deployed in the near term are evolutionary improvements on today's light water reactors, and certain of these new designs have been built successfully overseas. Light water reactor technology is well understood, and the industry is committed to building a series of plants using standardized designs, which will allow for lower capital and operating costs. Further, these new standardized designs will lend themselves to greater use of modular construction techniques, which are also expected to reduce construction costs and uncertainties. Despite these positive developments, several major challenges must be addressed before companies can be expected to commit to invest in new nuclear generating capacity, and to obtain the needed financing.

Although capital cost estimates differ somewhat among nuclear reactor vendors and by reactor types, it is clear that the first few new nuclear projects will have higher capital costs than later, follow-on projects. The industry presentations to the Nuclear Energy Task Force (NETF) stated that the first nuclear projects will have overnight capital costs in the range of $1,250 to $1,400 per kilowatt. Most of the higher cost is associated with the one-time investment of $300 million to $500 million per design for the nuclear reactor design and engineering work necessary to secure design approvals from the Nuclear Regulatory Commission (NRC) — the so-called First-Of-A-Kind Engineering, or FOAKE, costs. Later, when these initial costs have been recovered, follow-on nuclear projects are expected to be built at lower capital costs — in the range of $1,000 to $1,100 per kilowatt. The industry estimates that these lower so-called "nth-of-a-kind" costs can be achieved by the fifth or sixth unit built. Once "nth-of-a-kind" capital costs are achieved, nuclear plants are expected to be fully competitive with coal-based generating technologies and other available options for baseload electricity generation.

The first major challenge is to create the conditions under which the first few projects will be attractive to the investors providing the debt and equity capital needed to finance construction of the initial plants. Discussions with the financial community suggest that financing approaches must be found that will produce reasonable assurance of equity returns in the 12 to 15 percent range and yield a cost of debt in the 7 to 8 percent range typical of investment-grade securities (assuming normalized long-term interest rates). The second challenge is to provide sufficient financial support to offset the higher capital costs associated with the first few new nuclear plants (FOAKE costs) to ensure that the electricity produced by these plants will be competitive with other available baseload generating sources. And, the third major challenge is to create the conditions under which the first few nuclear projects can achieve a balanced capital structure, with appropriate amounts of debt and equity. (As discussed below, the appropriate balance between debt and equity will vary depending upon the financing model.) This balanced capital structure is essential to produce a project with an average cost of capital approximately comparable to other baseload generating projects that could be undertaken. Inability to access the debt capital markets for a substantial portion of the financing would force a project sponsor to finance entirely with shareholder equity, which would seriously impair the economic potential and competitive position of a new nuclear power project.

Although significant, these challenges can be addressed successfully through a combination of contractual arrangements among the project participants, potential rate regulatory support, and financial incentives from the Federal government. The risks and rewards of these first-of-a-kind nuclear projects can be apportioned equitably among (1) the companies that will build and operate the plants, (2) the electricity consumers who will benefit from the stable supplies of electricity produced by the plants, and (3) the Federal government.

Several combinations of tools and techniques can be used to achieve the desired results and facilitate construction of the next nuclear power plants in the United States. The specific combination of financing tools and techniques will likely vary somewhat from company to company and from project to project, depending on such factors as project structure (i.e., whether the project is developed by a single entity or a consortium of companies) and the regulatory status of the project (i.e., whether the project is built as a regulated plant subject to some form of state ratemaking approval or as an unregulated merchant plant).

Equally important, these financing challenges apply largely to the first few plants in any series of new nuclear reactors. As capital costs decline to the "nth-of-a-kind" range, and as investors gain confidence that the licensing process operates as intended and does not represent a source of unpredictable risk, follow-on plants should be able to obtain conventional financing without the support necessary for the first few projects.

ACCESS TO CAPITAL: CONSIDERATIONS FOR DEBT AND EQUITY INVESTORS

Debt Investors

The major risk that must be addressed for those who provide debt financing is the possible delay in operations, and hence of revenues, as a result of regulatory or licensing actions — i.e., the risk of regulatory or judicial actions, beyond the private sector's control, which have the potential to cause delays in operation of a completed plant that has met all design, safety and construction standards. Unless this risk is mitigated, the financial community has indicated that it will be impossible to gain access to debt financing from the capital markets at reasonable cost and in sufficient amounts to permit a balanced capital structure for the project. (The other factors that contributed to past difficulties have been addressed or are appropriate private-sector responsibilities.)

There are risks associated with any large, complex construction project, including the construction of a new nuclear power plant, and the private sector cannot expect the government to protect it against all risks[1]. For a new nuclear power project, however, the major risk is the risk of delay in commercial operation of a completed plant due to factors beyond the project sponsor's control, such as a court order enjoining operation of the plant. Depending upon the length of the delay in operation, the project developer could face severe financial stress--unable to operate a completed plant and generate revenue from the sale of electricity, but still obligated to service the debt, and cover operating and maintenance expenses, and to provide a return on equity.

Equity Investors

For equity investors, the investment decision process focuses on both a return of and a return on capital, where the pricing of the underlying equity is a function of the predictability of a company's projected earnings and cash flows as well as the dividends paid to the investor. The resulting share price, as evidenced by the forward Price/Earnings (P/E) multiple, measures the relative risk (versus other similarly situated companies) investors place as to whether a particular company will meet those financial projections and directly indicates how well management has executed its strategic goals. This is important because those decisions ultimately dictate the tactical and strategic options available to a company. The resulting share price (determined by the relative P/E multiple) affects its cost of capital and impacts its competitiveness in asset acquisition/construction opportunities, or in mergers and acquisitions (M&A) situations.

For example, consider a company that is contemplating the build of a 1,000 MW facility with overnight capital costs of $1,500 per KW that is financed with a 50/50 capital structure. For an electric utility with a $20 billion market capitalization, this results in (a) about 4 percent dilution from

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[1] Delays during construction, for example, or higher-than-expected costs resulting from mismanagement of construction are a private sector responsibility, and there are tools available to manage these risks. Major construction projects routinely include provisions for liquidated damages to protect project sponsors against construction mismanagement by vendors and engineering/construction companies. In the case of nuclear power projects overseas, these liquidated damage provisions amount to several hundred million dollars. Higher-than-expected costs during construction that are not the fault of the construction contractor must be covered by additional equity contributions from the project sponsor.

the funding of this project, assuming the equity portion is financed entirely with the issuance of new common stock; (b) working capital commitments on capital that is not earning a return until the project is operational; (c) the simultaneous cash pressures arising from the increased dividend requirements resulting from the new equity; and (d) the risk inherent with the project until the facility becomes operational.

These items, taken individually or together, will likely be a deterrent to management, and to investors, contemplating undertaking such a large construction project without some form of initial governmental backstop during at least the construction phase. While various structures are contemplated that could reduce the risk to both debt investors and equity investors (see below), both types of investors are unlikely to assume any of the risks associated with the new technology, in potential delays in the regulatory and licensing process, or in the construction process. It is these risks, combined with the decision to authorize an equity issuance and face the dilutive effects of the same — and the resulting share price erosion — that may be one of the more important hurdles a Board faces in determining whether or not to proceed with the development of a new nuclear facility. However, current experience demonstrates that managements are willing to assume operational and managerial risk once the plant is commercial.

THE IMPACT OF REGULATORY STATUS AND PROJECT STRUCTURE

Financing the next nuclear plants to be built in the United States is fundamentally a risk-management exercise, and the goal should be to apportion the risk among the potential beneficiaries.

Regulatory Status

The tools and techniques necessary to stimulate investment in the next nuclear power plants in the United States will likely vary depending on the state and regulatory environment in which the project is built. Approximately one-half of the states have restructured their electric power sectors and largely leave resource planning and adequacy determinations to the market. The remaining states continue to regulate suppliers of electricity according to traditional cost-of-service regulation. Companies able to develop new nuclear power projects in regulated states are likely to have additional flexibility and options that are not available to those in deregulated markets.

For example, a regulated entity could issue new equity to finance part of a new nuclear project without significant earnings-per-share dilution if state regulators were prepared to allow a company building the new nuclear plant to recover all or some of its investment during construction through established ratemaking instruments such as Allowance for Funds Used During Construction (AFUDC) or Construction Work in Progress (CWIP).

Some states that regulate electricity prices are taking steps to provide a greater measure of certainty of recovery for companies and investors willing to consider new generation investments, including environmental compliance costs and new plant construction. These initiatives may be particularly beneficial for the construction of more capital-intensive generating technologies, such as coal and nuclear, that offer the promise of greater price stability.

Rate compacts of this type would enable state regulatory agencies to facilitate private sector investment in new nuclear projects by providing assurance of investment recovery for projects prudently managed and completed. Even in deregulated markets, state public service commissions could help support the creditworthiness of well-planned, well-managed nuclear projects by authorizing long-term power purchase agreements between project developers and local utilities or load-serving entities that preserve the consumer's interest in power supplies at stable prices. State agencies can work with the private sector to define and develop innovative approaches to project structure that apportion risks and rewards equitably between companies and consumers.

Project Structure

Whether a new nuclear project is built as a regulated plant or a merchant plant, the private sector can also take steps to spread the risks associated with financing a new nuclear plant.

Although power plants are typically built and financed by a single company, this is not the only model for large, capital-intensive projects in a competitive commodity industry. In the petroleum industry, for example, large multi-billion-dollar offshore development projects are typically financed by a consortium of companies. (Similar precedents also exist in the case of the development of some of the early nuclear power plants in this country.) A similar consortium approach to new nuclear plant financing could produce substantial benefits.

For a sufficiently large consortium, the number of project sponsors reduces the challenge of earnings-per-share dilution to a more manageable level. Assuming a new nuclear project represents a $1.5 billion capital investment, and is financed with equal amounts of debt and equity, the $750 million equity investment presents a significant hurdle for a single entity. For a five-company consortium, however, $750 million represents only a $150 million equity commitment from each consortium member. Spread over a 5-year construction period, this represents a $30 million per year equity commitment, which is a more manageable undertaking.

Further, the consortium approach provides the opportunity to reduce the credit rating pressures associated with building a new nuclear plant. Using the above example, the credit rating agencies will assess the impact of the full $1.5 billion cost of the project, as well as the uncertainties associated with a large, first-of-a-kind nuclear construction project, in evaluating the project sponsor's credit quality. A large new investment of this kind could create credit rating pressure for a single company. A five-company consortium, however, would reduce the cost for any single sponsor to $300 million, reducing the risk of ratings pressure.

ALTERNATIVE FINANCING STRATEGIES

The NETF has considered three possible financing strategies that could be used to develop a new nuclear power plant in this country. The various alternative financial incentive proposals have been evaluated in the context of these three financing strategies.

Regulated Utility Model

A regulated utility in a state that has not elected to deregulate its power generation market could choose to develop a new nuclear plant under traditional cost-of-service rate regulation. This financing strategy would likely provide the highest degree of certainty in obtaining the needed debt and equity financing with the least need for secured loans or loan guarantees because the project would be financed as part of the utility's ongoing regulated operations. Debt investors, for example, are likely to be most comfortable with this approach because the lenders would have access, or recourse, to all of the utility's assets and revenues. (Debt investors lending to an unregulated merchant generating company would also have recourse to the assets and revenues of the merchant company, but they are likely to be more comfortable with the lower business risk of the regulated utility.)

This alternative would also expose the utility to potential credit rating pressure, although this pressure could be mitigated by a rate compact with state regulators or a consortium approach to spread the risk among several sponsors, as described above. The financial incentives likely to offer the greatest value for this approach would be the incentives to offset the higher costs of the initial plants (a cost-sharing mechanism for FOAKE costs, accelerated depreciation; and an investment tax credit, a production tax credit, or both). This alternative would likely receive only a limited benefit from a secured loan or Federal loan guarantee because the credit rating agencies may continue to view the project's cost as an obligation of the utility for rating purposes and because debt investors will likely already be comfortable with the protection afforded by the relatively low-risk regulated utility business.

Unregulated Merchant Generating Company Model

Especially in deregulated power markets, it is more likely that a new nuclear plant will be built and operated by an unregulated merchant generating company than a regulated utility. The unregulated merchant generator may be an affiliate of one or more regulated utilities within a holding company corporate structure or may be a standalone company. (Some large merchant generation companies owned by utility holding companies, such as Exelon Generation, now have a substantial component of operating nuclear units within their generation portfolio and have been successful in obtaining debt financing without a guarantee of the debt from their parent companies. This is due to the portfolio effect of having a large generation fleet with a combination of nuclear and non-nuclear generating assets. To date, a generating company with only operating nuclear assets has not obtained debt financing without support from its parent company.) Given its relatively greater exposure to commodity price risk, the rating agencies will typically require a less leveraged balance sheet (more equity and less debt) for a merchant generation company than for a regulated utility in order to achieve an equivalent credit rating. With its higher business risk profile, a merchant generation company seeking to build a new nuclear plant may face greater rating pressure than a regulated utility, although this risk could be mitigated to some degree by a long-term power purchase agreement for the new plant's output with a regulated utility affiliate or other load-serving entity, or by support from the parent company. A merchant generating company will also likely require a higher return on equity for a new nuclear plant investment than a regulated utility.

A merchant generating company will more probably require secured loans or loan guarantees than a regulated utility for a new nuclear plant. As is the case for the regulated utility model, financial incentives to recover the higher cost of the initial plants together with somewhat higher capital costs for the merchant project would include a cost sharing mechanism for FOAKE costs, accelerated depreciation, and an investment tax credit, a production tax credit, or both. In addition, a merchant generating company may benefit to a greater extent from a secured loan or Federal loan guarantee than is the case for the regulated utility project. As is the case with the regulated utility, the credit rating agencies may continue to view the nuclear project's cost as an obligation of the merchant company despite the secured loan or loan guarantee. However, the ability at the merchant company to attract debt financing for a new nuclear plant will depend upon the size and composition of its asset base, the strength of its revenues, and the extent of any parent company support. For example, a merchant generating company with a limited existing asset base and revenues, or a merchant generator with only nuclear assets and without significant parent company support, will likely require a secured loan or Federal loan guarantee in order to attract debt financing for a new nuclear project, similar to the project finance model discussed below.

Non-recourse Project Finance

Under a non-recourse project finance structure, debt investors lend to a single purpose entity whose only asset is the new power plant, and whose only revenues are from power sales once the plant enters commercial operation. These transactions are highly structured, with lenders having a lien on all project assets and with restrictions on dividends and distributions from the project to sponsors if the plant fails to perform as expected. In the event of a default, lenders only have recourse to the assets of the project — the plant and any contracts such as a power purchase agreement — and not to the other assets or revenues of the project sponsor. This project finance model has been used successfully to finance a number of gas-fired combined cycle generating plants and, in recent years, some plants using renewable energy resource have used established, proven technology, modular construction techniques, strong equipment purchase contracts to protect against the effects of construction delays, and long-term power purchase agreements. A project finance structure offers significant advantages to the project sponsor, including the potential to reduce capital costs by using a more leveraged capital structure (some gas-fired cogeneration projects have used capital structures with a debt component of 80 percent or higher); the ability to reduce earnings-per-share dilution by making equity contributions at the latter stages of project construction after proceeds from the debt component of the capital structure have been expended; and the ability to insulate the sponsor's other assets from claims by the project lenders in the event of a default by the project. As a consequence, the credit rating pressure for a sponsor using a non-recourse project finance structure is likely to be significantly lower than the other available financing models because the rating agencies will likely view the sponsor's exposure as being limited to the sponsor's equity investment in the project.

A sponsor seeking to finance a new nuclear plant using a non-recourse project finance model will face the greatest challenges in attracting debt financing for the project. The financial community has indicated that debt investors will be unwilling to lend under a non-recourse project finance structure to a new nuclear project, absent other protection against the risk of a default. (As noted above, to date, no company has been successful in obtaining debt financing for an existing single operating nuclear plant or a portfolio consisting only of operating nuclear plants, without support from a parent company with other substantial assets and revenues.) Therefore, the use of a non-recourse project finance structure for a new nuclear plant will require a secured loan or Federal loan guarantee for the debt component of the project's capital structure, making the secured loan or Federal loan guarantee the most valuable financial incentive for this financing alternative.

At the same time, certain of the characteristics of the non-recourse project finance model, such as the lower capital cost due to the lower equity component in the capital structure, and the ability to reduce earnings-per-share dilution by contributing equity capital to the project only after the proceeds of the debt financing have been used, may reduce the need for other financial incentives such as an investment tax credit and accelerated depreciation. As is the case with the other models, a cost-sharing mechanism for FOAKE costs, an investment tax credit, and a production tax credit will be valuable in offsetting the higher costs of the initial plants.

DISCUSSION OF FINANCIAL INCENTIVES

Cost Sharing for FOAKE Costs

One obstacle to expanding the nuclear power option in the United States is the extra costs associated with the first units of a design family for engineering work that will then be reused for building subsequent units. A vendor who can have confidence that many more units of a particular reactor design will be ordered and built could invest funds in the FOAKE costs, and spread those charges over multiple future units. In the current environment, however, there is reasonable uncertainty surrounding the actual number of future orders that would follow, leading vendors to anticipate loading all the FOAKE costs on the first few units ordered, which drives the price for the first plants to an unacceptably noncompetitive level.

Estimated design costs for the first units range from $300 million to $500 million. As it does routinely for new technologies, the Federal government can reduce the capital cost of the first few plants by sharing with industry some portion of the first-of-a-kind design and engineering expense as part of its energy research and development portfolio. The Department of Energy (DOE) has committed to this approach under its Nuclear Power 2010 program (although the minimal funding provided to date is substantially short of actual needs). The Department provides similar research and development (R&D) support in order to commercialize clean coal technologies, and the same approach is warranted for advanced nuclear plant development.

In light of the expected growth in demand for electricity, it is estimated that roughly 50 new nuclear plants must be built by 2030 if nuclear power is to continue to meet 20 percent of our electricity demand. If the Federal government were to assume the risk for half of the FOAKE costs, subject to recovery from the next 50 units to be built, and the reactor vendors would be responsible for an equal amount, the repayment of FOAKE costs by power companies using these designs could be kept reasonably low, thereby avoiding making any units, first or later, uneconomical.

For example, if the cost of the recurring design engineering for three reactor concepts is split between the Federal government and industry, then the total investment, choosing the midrange value of $400 million per design, is $1.2 billion. If for each reactor built a fixed royalty payment of $12 million is paid to the government, after 50 new units are constructed, the entire $600 million of government investment would be recouped. After the first 50 units of either design are built, the payments to the government would cease. A cost-sharing mechanism for FOAKE costs would have a high benefit for all three possible financing models for a new nuclear plant.

From a Congressional Budget Office (CBO) scoring perspective, a subsidy for FOAKE costs could likely result in relatively high cost scoring based upon the high probability of Federal funding within a relatively short budget horizon. But a royalty payment mechanism allowing the Federal government to recover the costs from the subsequent 50 units using the designs could mitigate that impact. Therefore, the NETF concludes that a sharing mechanism for FOAKE costs for the initial designs is likely to offer high value for all financing models with possibly medium CBO-scoring costs

Secured Loans and Federal Loan Guarantees

The relatively higher risks associated with nuclear power, manifested through higher interest rates or the unavailability of debt capital under certain financing approaches, as discussed above, can be mitigated through Federal government secured loans or loan guarantees. A secured loan or Federal loan guarantee can help ensure the availability of debt financing at attractive costs by providing lenders protection against the risk of the project's default due to regulatory and litigation risks. A secured loan or Federal loan guarantee provides default protection only for the debt component of the capital structure, not for the sponsor's equity investment.

A secured loan or Federal loan guarantee could be sized to cover a debt component of 50 percent, consistent with the capital structure for a regulated utility or unregulated merchant generating company, or of 80 percent, consistent with a non-recourse project finance capital structure, thereby allowing for greater leverage to finance the plant than would otherwise be available. In addition, a secured loan or Federal loan guarantee should result in a lower cost of debt financing due to the effects of Federal credit support. A reasonable assumption is that a secured loan or Federal loan guarantee would result in about a 0.5percent to 1.0 percent spread savings over the debt costs under the regulated utility financing model, and a somewhat larger spread savings under the other two financing approaches, than without the secured loan or loan guarantee. Such secured loan or Federal loan guarantees are common and can be structured with reasonable underwriting criteria to minimize the probability and amount of Federal payout.

Suggested underwriting criteria include the following.

- A requirement for a finding of economic soundness, taking into account a project's competitiveness relative to other sources of baseload power;

- Power purchase commitments from creditworthy counterparties (including affiliate companies with retail loan requirements) for at least 60 percent of a project's firm output after commencement of commercial operations for a period that is co-terminus with the guaranteed debt;

- The estimated total eligible capital costs not to exceed $1,500/KW of nameplate capacity;

- The estimated capital cost to be reasonably assured and technical risks to be adequately addressed;

- A substantiation to the government of the existence of adequate collateral to secure the loan or the loan guarantee;

- The debt benefiting from the secured loan or loan guarantee must not exceed a specified percentage of the total eligible cost and must be senior in lien priority to other sources of funds utilized to finance the project; and

- The financial strength of the loan recipient to be sufficient to implement the project and withstand potential delays prior to commercial operations.

As discussed above, a secured loan or Federal loan guarantee appears to have relatively low value for the regulated utility financing model, medium to high value for the unregulated merchant generating company model, and high value for the non-recourse project finance model. From a budget-scoring perspective, previous legislative proposals for secured loan or Federal loan guarantees for new nuclear plants have received relatively high budget cost scores, based upon the assumption that there is a high likelihood of default on the loans. However, the NETF believes that underwriting criteria have the potential to reduce the perceived default risk and thereby achieve a medium budget cost score.

Federal Purchase Power Agreement

The risk of regulatory or litigation delay could also be mitigated by using a power purchase agreement (PPA) that could provide for prepaying for power deliveries in the event a commissioning delay prevented the scheduled start of commercial operations. This would provide cash flow to cover debt obligations during the period until the plant entered commercial operation. This Federal PPA incentive appears to have relatively low value for the regulated utility financing model, but may have somewhat more value for the unregulated merchant generating company and non-recourse project finance models in protecting against the effects of relatively short-term regulatory or litigation delays.

Accelerated Depreciation

Accelerated depreciation is a form of fiscal policy that allows for more rapid recognition of tax benefits associated with targeted investment categories. Its benefit is tax related, reducing taxes in early periods; therefore, it is not a permanent tax savings. There is strong precedent for the accelerated depreciation option, as it has been used to encourage investment and economic development in prior fiscal policy. Accelerated depreciation proposals for the initial new nuclear plants have contemplated changing the Modified Accelerated Cost Recovery System (MACRS)[2] assumption for the plants from 15 years to 7 years. An accelerated depreciation incentive would likely have a medium value for all three financing models and would likely have a medium budget scoring cost.

Investment Tax Credit

The Investment Tax Credit (ITC) is a specified percentage of the tax basis of an asset taken immediately as a reduction in the firm's tax liability. A Strong precedent exists for the ITC option, as it has been used to encourage investment and economic development in prior fiscal policy. The ITC option has relatively high value for the project sponsor because it is known, quantifiable, and generally received at the completion of construction of the asset. Therefore, it is not dependent upon the ongoing operating performance of the asset. The value of the benefit from the option can also be increased by treating the ITC as a reduction in the in-service cost of the asset, and flowing

[2] Modified Accelerated Cost Recovery System. This method of depreciation moves depreciation up into the earlier years of an asset's life, allowing for faster capital recovery than standard methods of depreciation, such as "straight line" or "units of production."

through immediately the benefit by offsetting the amount of financing that would otherwise be required. ITC proposals of 10, 15, and 20 percent have been suggested as financial incentives for the initial group of new nuclear plants. The ITC option is likely to have both high value to the project sponsor and high cost from a budget scoring perspective because the benefit is available immediately upon the plant's entering commercial operation. Its value to a power company would be even greater if it could be taken during construction rather than only upon construction completion.

Production Tax Credit

Production tax credits are provided as direct permanent reductions to a firm's tax liability to encourage activity in certain endeavors promoting fiscal or social policy. Production tax credits are a function of the output of the facility qualifying for the credits, and the benefits occur over an extended period of time. This receipt of benefits over an extended time period tied to the actual operating performance of the plant makes these benefits somewhat less certain and less valuable to a new nuclear plant sponsor than the ITC. At the same time, the budget-scoring cost of this option is likely to be lower than for the ITC because the benefits are spread over an extended time period. Proposals for production tax credits for new nuclear plants have been computed as a function of MWh generation levels, beginning in the year in which the plant enters commercial operation. Production tax credits of $10 per MWh for 10 years, and $18 per MWh for 10 years, have been suggested for the initial nuclear plants. There is precedent for an $18 per MWh for 10 years production tax credit, which is already available for certain renewable generating resources, such as wind power. The production tax credit incentive appears to provide a medium to high benefit for all three financing models at a medium budget scoring cost.

CONCLUSIONS

The NETF has received detailed briefings on the issues and challenges associated with new nuclear power plant construction and financing from a diverse array of interests, including nuclear reactor suppliers, nuclear generating companies, large electricity consumers, the financial community, and other interested stakeholders. The following conclusions and recommendations have emerged from these briefings and the NETF's deliberations regarding financing considerations:

The need for financial incentives for the first in a series of new nuclear power plants should be viewed as a short-term requirement limited both in time and in the number of plants that will need support. The objective should be to provide a package of financial incentives sufficient to ensure the availability of the required debt and equity financing, and to make the initial new nuclear plants competitive on a levelized cost basis with other available baseload generation alternatives, including clean coal technologies, combined cycle gas-fired generation, and renewable energy resources. When the first few plants have been built, when capital costs have been reduced to the expected competitive levels, and when sufficient experience has been gained for the industry and the financial community to conclude that the new NRC licensing process is functioning as intended, then large-scale follow-on development of new nuclear plants should occur without further direct government financial incentives. The only encouragement necessary after development and licensing of the initial series of plants would be continued recognition that nuclear energy plays an essential role in U.S. energy policy.

No single incentive will stimulate construction of the first in a series of new nuclear power plants in the United States. Financing and building a new nuclear plant is a complex undertaking involving a number of discrete financing challenges and companies in differing business circumstances, and the relative value of various financing incentives is likely to vary depending upon the financing model. The package of financial incentives available to the Secretary of Energy should be sufficiently broad to permit debt and equity financing with a balanced capital structure under all three potential financing models: regulated utility, unregulated merchant generating company, and non-recourse project finance structure. The Secretary of Energy should seek, and the Congress should authorize, a package of financial incentives sufficient to make all three financing approaches achievable.

Financing a new nuclear plant under the regulated utility model is achievable with the highest level of certainty and the least need for secured loans or loan guarantees, but also poses potentially significant credit and equity risk for the sponsor. (Further, this financing model is unlikely to be available in the deregulated markets.) A package of incentives consisting of a sharing mechanism for FOAKE costs, accelerated depreciation, an investment tax credit, and/or a production tax credit appear to provide the greatest benefit in achieving a workable financing plan for the regulated utility model. The NETF recommends that the Secretary of Energy engage governors and state rate regulators in discussions of possible regulatory approaches for advance approval of recovery of construction costs for a new nuclear plant similar to those in place in some states for new coal-fired generation to further facilitate the financing of a new nuclear plant under this model.

Financing a new nuclear plant using the unregulated merchant generating company model poses potentially greater challenges than is the case for the regulated utility model. A similar combination of incentives, including the sharing of FOAKE costs, accelerated depreciation, an investment tax credit, and/or a production tax credit, has high value in providing the needed debt and equity financing under this model. In addition, a secured loan or Federal loan guarantee and Federal PPA may have moderate to high value under this approach as well, depending upon the size and asset composition of the company and the availability of parent company support.

Financing a new nuclear plant using a non-recourse project finance structure poses the greatest challenge in obtaining debt financing, but offers significant benefits to the project sponsor in lowering financing costs, credit rating risk, and earnings-per-share dilution. A secured loan or Federal loan guarantee will be required to obtain the debt financing under this structure, and an 80 percent loan guarantee will provide substantial benefits in the form of lower capital costs. In addition to the secured loan or Federal loan guarantee, this financing structure would also receive high value from the sharing mechanism for FOAKE costs, and a production tax credit, and some, but lesser, value from accelerated depreciation and the investment tax credit.

A consortium approach for developing the initial new nuclear plants, in combination with a package of financial incentives, can help reduce the credit rating and equity risk to individual sponsors, and should be encouraged by the Secretary of Energy as a means to provide the most efficient financing mechanism at the lowest possible cost to the Federal government.

APPENDIX B
ESTIMATE OF THE COST TO THE GOVERNMENT FOR FINANCIAL INCENTIVES

No.	Financial Incentive	Description of Incentives	Budget Score over 10 year period ($ Million)[1,4]	Examples of Financial Incentive Packages for Various Potential Project Structures [5] (FOAKE Incentive Not Included)					
				Regulated Utility	Budget Score ($ Million)	Unregulated Merchant Generating Company	Budget Score ($ Million)	Non-Recourse Project Finance Model	Budget Score ($ Million)
1	**Cost Sharing for FOAKE Cost**	Assume $400 million for each of up to three designs to be shared half by industry and half by government.	$600 Maximum (for 3 designs)						
2	**Secured Loan / Federal Loan Guarantee**	Standard capital structure with 50% equity and 50% debt. Loan guarantee covers 100% of loan.	$105			For a capital structure that has 50% debt and 50% equity. Loan guarantee covers 100% of loan.	$105		
		For a capital structure that has 80% debt and 20% equity. Loan guarantee covers 100% of loan.	$257					For a capital structure that has 80% debt and 20% equity. Loan guarantee covers 100% of loan.	$257
3	**Accelerated Depreciation (AD)**	Change MACRS class from 15 years to 7 years.[2]	$195						
4	**Investment Tax Credit (ITC)**	15%	$198	10%	$102	5%	$51		
5	**Production Tax Credit (PTC)**	$18/MWh for 10 years at 90% capacity utilization.[3]	$710	$12.5/MWh for 1.5 years at 90% capacity utilization.	$148				
6	**Power Purchase Agreement**	50% of Capacity for 18 months @ $35/MWh	$230			50% of Capacity for 244 days (8months) @ $35/MWh	$94		
Total					**$250**		**$250**		**$257**

Plant Characteristics:
- Design X has FOAKE of $400M
- Overnight Capital Costs: $1500/KWh
- Capital Structure : 50% Debt 50% Equity
- 1 Unit
- Capacity 1000 MW
- Capacity Utilization : 90%
- Project Credit Rating to Government: B
- Construction Time: 5 years

[1] Budget Horizon of 10 years. PTC and AD values change depending on horizon being considered.

[2] MACRS - Modified Accelerated Cost Recovery System

[3] $18/MWh is the same PTC for renewable energy investments.

[4] The total government package would be made up of paying for half of FOAKE for up to three designs and supporting up to the first 4 units of each design with an additional incentive up to $250 million per unit made up of a combination of partial benefits from 2 through 5. Thus, the total cost per unit would be no more than $450 million for the first of a design, and no more than $250 million for any follow-on reactor of that design. The total cost to the government would be no more than $3.6 billion.

[5] All figures in 2004 dollars

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APPENDIX C
SECRETARY OF ENERGY ADVISORY BOARD
NUCLEAR ENERGY TASK FORCE
TERMS OF REFERENCE

Scope & Objectives:

The Nuclear Energy Task Force (NETF) shall assess the issues and determine the key factors which must be addressed if the Federal government and industry are to commit to the financing, construction, and deployment of new nuclear power generation plants to meet the nation's electric power demands in the 21st Century. The NETF shall also provide the Secretary of Energy Advisory Board with an actionable plan to resolve these issues, resolve barriers and facilitate the deployment of new nuclear generation facilities. Because of the importance that nuclear power be considered in the relatively near-term, the NETF will consider only issues associated with thermal reactor systems using the current once-through fuel cycle. The scope of the NETF shall include, but not be limited to, the assessment of the following issues and key factors contributing to future power company and vendor decisions to deploy new nuclear generation plants and the development of an actionable plan for industry and government to resolve them:

- Federal and state regulatory uncertainties and related risks;
- Plant performance and operating-cost competitiveness issues and related risks;
- Construction cost and schedule uncertainties and related risks;
- Financing uncertainties and related business financial risks in a deregulated power market;
- Nuclear fuel and enrichment cost stability and related risks;
- Long-term waste disposal and spent fuel uncertainties and risks;
- Public acceptance uncertainties and risks; and
- Liability and accident indemnification uncertainties and risks.

Background:

Nuclear power has had a substantial role in the supply of electric power in the United States for over 30 years. The United States currently has 103 nuclear power reactors producing approximately 20 percent of the electricity consumed by the nation. Over the past twenty years the average capacity factor for U.S. nuclear power plants has increased from 60 percent to over 90 percent. Over this same period nuclear safety has increased, operating and maintenance costs have decreased, radioactive waste quantities have decreased as have worker exposures to radiation, and steady progress has been made on issues such as the long-term disposal of spent nuclear fuel.

Despite this record of achievement and the fact that nuclear power generation does not result in greenhouse gas emissions, no new nuclear power plants have been ordered in the United States since 1973. The rapid economic growth of the 1990s, the successful operation of existing plants over the last 15 years, increased oil and natural gas prices, and societal concerns over greenhouse gas emissions have all rekindled interest in nuclear-produced electricity as a means of meeting the nation's growing need for safe, clean and economical electricity generation.

In response to this growing interest, the Department of Energy has launched a series of initiatives designed to pave the way for new nuclear power plants and Congress has considered various incentives to prompt utilities to place orders for new plants. However, while some progress has been made, the financial issues, market challenges, and regulatory uncertainties have continued to discourage U.S. power companies from proceeding to order the next U.S. plant.

Description of the NETF's Duties:

The NETF shall prepare a report assessing the issues and determine the key factors which must be addressed if the United States is to commit to the building, financing and deployment of new nuclear power generation plants to meet the nation's electric power demands in the 21st Century. The NETF should take full note of, but not be bound by existing efforts pursued by the Department in this area of work. The NETF shall provide the Secretary of Energy, through the Secretary of Energy Advisory Board, with an actionable plan to resolve these issues, resolve barriers, and facilitate the deployment of new nuclear generation facilities.

Reporting:

The NETF shall report to the Secretary of Energy Advisory Board.

Estimated Number and Frequency of Meetings:

This NETF shall meet as required to assess the issues and determine the key factors which must be addressed if the United States is to commit to the building, financing and deployment of new nuclear power generation plants to meet the nation's electric power demands in the 21st Century. An estimated five meetings will be required to address this scope and prepare a final report.

Membership:

The NETF shall have approximately fifteen members, including at least two individuals who are also members of the Secretary of Energy Advisory Board. The NETF shall be bipartisan and co-chaired by former officials with broad public policy, regulatory or nuclear power experience. Members shall represent a balance of viewpoints pertinent to the scope and objectives of this study. The Chairman of the Secretary of Energy Advisory Board, in consultation with the Secretary of Energy, shall appoint the Chair (or Co-Chairs), as well as all other members.

Duration and Termination Date:

The NETF shall serve for approximately six months, subject to the extension or dissolution by the Chairman of the Secretary of Energy Advisory Board.

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APPENDIX D
ACRONYMS

ACRS	Advisory Committee on Reactor Safeguards
AFUDC	Allowance for Funds Used During Construction
BEST	Building Engineering and Science Talent
CBO	Congressional Budget Office of Nuclear Energy
CFR	Code of Federal Regulations
COL	Combined Construction and Operating License
CWIP	Construction Work in Progress
EPA	Environmental Protection Agency
EU	European Union
FOAKE	First-of-a-Kind Engineering
HEU	Highly enriched uranium
IAEA	International Atomic Energy Agency
INRA	International Nuclear Regulators Association
IT	Information Technology
ITAAC	Inspections, tests, analyses, and acceptance criteria
ITC	Investment Tax Credit
MACRS	Modified Accelerated Cost Recovery System
NETF	Nuclear Energy Task Force
NRC	Nuclear Regulatory Commission
OECD	Organization for Economic Cooperation and Development
PPA	Power Purchase Agreement
R&D	Research and Development
SEAB	Secretary of Energy Advisory Board
WENRA	Western European Nuclear Regulators Association

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