Draft Report - 12/93

Energy Infrastructure of the United States and Projected Siting Needs: Scoping Ideas, Identifying Issues and Options

**Draft Report of the
Department of Energy
Working Group on Energy Facility Siting
to the Secretary**

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December 1993

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Department of Energy
Washington, DC 20585

A Note to Stakeholders

The U.S. Department of Energy is conducting a study of our future energy infrastructure needs and constraints to successful siting of energy facilities. As an interim step, a Department of Energy working group on energy facility siting, chaired by my Office, has produced a draft report that presents preliminary findings, and provides a tentative list of ideas that may hold promise for ameliorating problems in the siting process. The draft report has been placed in the public reading room of the Department of Energy's Washington, D.C. Headquarters, in connection with a Federal Register Notice, attached. This copy of the draft report is provided to you for your convenience.

We welcome your comments on this draft report. Issues that you might want to address include: how well the report describes siting needs and problems; how the initiatives under consideration can be improved; and what additional initiatives ought to be considered. In addition, we welcome your suggestions regarding how to meet the future need for energy facilities, as well as your views about ways in which the Department, other Federal agencies, and State and local government can improve the siting process.

We hope you share our view that resolution of siting issues is important to improving our nation's energy efficiency, environmental quality, and economic productivity. Please direct your comments to Dr. Barry Gale, U.S. Department of Energy, PO-63, Washington, DC, 20585, by February 28, 1994.

Thank you in advance for your attention to this important issue.

A handwritten signature in black ink, reading "Susan F. Tierney".

Susan F. Tierney
Assistant Secretary for Policy, Planning
and Program Evaluation
United States Department of Energy

DEPARTMENT OF ENERGY

Availability of Draft Federal Report on Energy Facility Siting

AGENCY: Office of Policy, Planning and Program Evaluation, Department of Energy.

ACTION: Notice of availability for public comment.

SUMMARY: This notice announces the availability by the U.S. Department of Energy (DOE) of a draft report on energy facility siting *Energy Infrastructure of the United States and Projected Siting Needs: Scoping Ideas, Identifying Issues and Options; Draft Report of the Department of Energy Working Group on Energy Facility Siting to the Secretary* for public comment. The purpose of the draft report is to address key issues impeding the siting of energy facilities. The report presents data and analysis regarding energy service needs, infrastructure requirements, and constraints to siting of energy facilities. The report also presents a series of potential initiatives to help improve the overall siting process for energy facilities. The draft report is accompanied by a second volume that provides documentation on the methodology used to conduct the analysis.

DATES: Individuals wishing to present their views on the draft report should do so in writing by February 28, 1994.

ADDRESSES: A copy of the draft report and the documentation summary is available for inspection and reproduction at the public reading room of the U.S. Department of Energy, Forrestal Building, 1000 Independence Ave., SW., Washington, DC. The public reading room is open from 9 a.m. to 4 p.m.; you may contact reading room staff at (202) 586-6020. If you wish to have a copy of the draft report mailed to you directly, please contact Dr. Barry Gale at the address below.

Four copies of the written comments should be addressed to Dr. Barry G. Gale, Office of Policy, Planning and Program Evaluation, U.S. Department of Energy, 1000 Independence Ave., SW., PO-63, Washington, DC 20585.

FOR FURTHER INFORMATION CONTACT: Dr. Barry G. Gale, Office of Policy, Planning and Program Evaluation, U.S. Department of Energy, 1000 Independence Ave., SW., PO-63, Washington, DC 20585, (202) 586-6706.

SUPPLEMENTARY INFORMATION: The U.S. Department is issuing this draft report and the accompanying documentation summary under the authority provided by the Department of Energy Organization Act. The draft report is the result of over a year-long effort by staff representing DOE's various subdivisions reflecting diverse expertise and knowledge. The report examines the anticipated need for expanding the nation's energy infrastructure, and issues related to that potential growth, based on projections of energy supply and demand developed by the Energy Information Administration, with the goal of developing appropriate policy direction for the Department.

The draft report is organized into five chapters. Chapter 1, the Introduction, discusses the importance of ameliorating problems in the energy facility siting process, particularly in light of Administration goals. Chapter 2 details anticipated increases in energy infrastructure requirements for the following areas: Mining and processing facilities; drilling and extraction facilities; electricity generation; liquid fuel processing and conversion facilities; transmission, distribution, and storage; offsite radioactive waste treatment and disposal; and additional facility needs for science and engineering, environmental clean-up and waste management, and defense production. Chapter 3 describes various constraints to siting of the types of facilities discussed in chapter 2, while chapter 4 expands on the implications of siting constraints for Administration goals. Chapter 5 presents a tentative list for consideration by stakeholders of ideas and initiatives that might beneficially impact the siting process.

Respondents are welcome to express their views on any aspects of the report. Areas which commenters might want to address include:

1. The report's scope and accuracy—does it correctly identify important future energy infrastructure needs; is there additional information to support the report's findings or other views?
2. Siting constraints and issues—does the draft report adequately identify and discuss the most important siting constraints and issues? If not, what should be added?
3. The proposed initiatives—are there any with which you disagree, and if so, why? Are there any that you strongly

support, and if so, why? Are there others that are not included in the list?

The Department of Energy welcomes any suggestions related to the draft report and siting in general. This includes views about ways in which the Department, other federal agencies, and state and local government can improve the siting process.

Finally, the Department is open to suggestions for the design and conduct of effective stakeholder consultation processes on energy facility siting issues.

Issued in Washington, DC on December 1, 1993.

Susan F. Tierney,

Assistant Secretary for Policy, Planning and Program Evaluation.

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Department of Energy
Working Group on Energy Facility Siting
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EXECUTIVE SUMMARY

A Department of Energy (DOE) Working Group on Energy Facility Siting, chaired by the Policy Office with membership from the major program and staff offices of the Department, reviewed data regarding energy service needs, infrastructure requirements, and constraints to siting.

The Working Group found that the expeditious siting of energy facilities has important economic, energy, and environmental implications for key Administration priorities.

On the Economic/Environmental Side:

Our continued use of older, less efficient energy facilities will drive up the cost of U.S. energy, and hence, the cost of U.S. products, negatively impacting national competitiveness.

As energy facilities age, more environmentally benign new technologies can replace them. Present siting inefficiencies will delay our ability to bring these new technologies on line expeditiously.

In Terms of Energy:

Rapid expansion of natural gas use will require an expanded infrastructure of pipelines and other facilities that is not now in place.

Converting motor vehicles from oil to compressed natural gas will require a revamped infrastructure and delivery system.

Expanding the use of renewable energy will encounter difficult siting challenges, especially in the areas of land use, transmission access, and minimizing environmental impacts.

Even with far-reaching conservation and efficiency measures, new sites will be needed to maintain current electricity baseload, as well as to provide additional energy for future economic development.

- About 20 percent of the nation's electricity is generated by nuclear energy. Yet, several nuclear power plants were retired faster than expected and present nuclear sites are often unusable for non-nuclear-related purposes.
- About 23 gigawatts of electricity are now supplied by hydroelectric facilities whose current licenses expire before 2010. These facilities must be relicensed or replacement facilities sited.

- Although some large (700 megawatts and above) generating facilities will continue to be constructed, the trend is toward replacing large coal and nuclear power plants with smaller (50–250 megawatts) gas and renewable facilities, thus increasing the number of facilities needed to provide the same amount of power.

In Addition:

Facilities are needed to consolidate the storage of high- and low-level nuclear waste as well as hazardous wastes—wastes that are now spread in hundreds of sites throughout the country.

Current infrastructure will need selective, and in certain cases, substantial upgrading (power plants, pipelines, etc.).

Regional and local solutions will be required, with actions by the Federal Government also needed.

Resolution of siting issues will require extensive stakeholder participation.

The Working Group considered three broad categories of facilities of interest to the Department of Energy:

Private sector energy supply systems in which the Department of Energy has a program interest,

Public facilities under the control of other Federal agencies (other than the Department of Energy), public corporations, States, or localities, and

Facilities controlled by the Department of Energy (including labs, disposal sites, and the Power Marketing Administrations).

Although it's hard to forecast exactly what the need for new facilities will be, under any reasonable set of assumptions it is clear that there will be a significant need to site facilities in each of these categories in the near future. The purpose of this report is to provide a more concrete picture of the potential magnitude and composition of future siting needs. It is not a definitive projection, nor is it a statement of Departmental policy. It is, however, a valuable exercise that validates the need to site future energy facilities and sets a context for later discussions on siting constraints and possible ideas for meeting siting challenges. Using the Energy Information Administration's Annual Energy Outlook Reference Case as a baseline, the following needs were identified.

In the private sector and the public sector (outside the Department), a substantial number of new energy facilities will need siting by 2010. Encouraged by the Energy Policy Act of 1992 and Administration initiatives, renewable energy facilities are expected to emerge in highly increased numbers, such as 300 municipal solid waste plants, 120 geothermal plants, and additional biomass facilities, ethanol plants, and wind farms. The increased use of natural gas will require the siting of new pipelines and distribution facilities. Other additional energy facilities include an estimated 2,300 coal mines, 13,500 gas and 4,900 oil fields, 170 coal- and 925 gas-power plants, and additional petroleum refineries. Rising demand for electricity will also be accompanied by an increased need for transmission and distribution lines, and power substations.

The Department of Energy requires new science and engineering facilities, and environmental cleanup and waste management facilities to continue its mission. Resolution of issues surrounding the treatment, storage, and disposal of radioactive waste will continue to affect not only schedules for the siting and licensing of facilities such as the geologic repository for high-level waste and low-level waste disposal facilities, but transportation infrastructure as well.

The Working Group identified a number of constraints that will impact the siting of these new facilities—whether they are Department of Energy, public sector, or private sector facilities. Siting constraints can be caused by individuals or groups of individuals who disagree over relative costs and benefits of a particular site, including concerns over the environmental, socioeconomic, and health and safety impacts associated with the site, as well as equity and process issues. Siting constraints may also result from uncertainty, including issues related to evolving future legal and regulatory processes, lack of information about a newly introduced technology at a site, or economic issues such as market uncertainty, budgetary limitations, and investment costs. Constraints may also arise from organizational and institutional factors, especially when organizations involved are unable to function efficiently and cooperatively. The Working Group also identified those constraints that are unique to specific types of energy facilities.

The question that the Working Group then tackled was, given the extent of siting needs and the scope of siting constraints, what was the exact nature of the siting problem? Was it one that the Federal government could help ameliorate, or could market forces “solve” the problem on their own? After all, facilities have been sited in the past and continue to be sited at present, even in the face of a variety of difficult constraints.

The Working Group concluded that there was no easy way to ascertain the exact nature of the problem on a national basis. Each facility has its own unique set of characteristics and faces its own unique set of constraints, and would have to be evaluated individually. Yet one thing did seem certain: siting is becoming more difficult for all types of facilities. Siting inefficiencies cause, at a minimum, serious delays that result in adverse economic, environmental, and energy impacts. In certain cases, the siting process does not proceed at all and disrupts development of needed national infrastructure. It is also

clear that market forces alone, without additional direction or new incentives, cannot be relied upon to "solve" these problems.

What useful actions could the Federal government take? The Working Group prepared a tentative list of ideas based on field trips to States, presentations by stakeholders, and an offsite workshop. The tentative list is meant to serve as a point of departure for discussions with siting stakeholders. These stakeholder discussions will focus on actions that could be taken to remove inefficiencies as well as inequalities and to improve the siting process. The list of ideas is open to extensive revision based on stakeholder suggestions.

WORKING GROUP TENTATIVE LIST OF IDEAS

As a heuristic device, the list was divided into five major categories, although many of the ideas affect more than one category. The categories are Stakeholder Interaction, Equity/Environmental Justice, Strategic Planning, Reinventing Government, and Research.

Stakeholder Interaction

Establish a State/Tribal Siting Forum

Many opportunities may exist for interstate and regional cooperation with respect to land use and the siting of energy facilities. Facility siting issues and related environmental and energy service concerns vary widely in nature and extent among States and regions, and, as of now, no mechanism exists to exchange information, share ideas, and identify common siting-related issues among stakeholders. For instance, various States have experience with emerging energy technologies or have developed promising approaches for streamlining the permitting process. Both of these would be topics of interest to other State/Tribal siting officials as well as stakeholders of various sorts. The Administration, in cooperation with leading stakeholder organizations, should take the lead in establishing a State/Tribal siting forum, that would institutionalize a means of bringing States/Indian Tribes and other interested parties together to discuss and analyze siting related issues.

Focus: State/Tribal siting officials, stakeholder groups (industry, environmentalists) and other interested parties

Convene National Conference on Energy Facility Siting

There are legitimate competing interests among stakeholders when it comes to facility siting. Organizations and agencies have different missions, and even within a given organization, programs often have opposing goals and priorities. For progress to be made in

facility siting, a consensus-building process is needed to help reach working agreement among stakeholders on a wide variety of issues. For example, what are acceptable trade-offs among economic growth, energy services, and the environment? How should national goals relate to State and local goals? What is the best way to measure and mitigate impacts from siting? A national conference on energy facility siting, with participation by a broad range of public and private sector siting stakeholders, would be a powerful and visible first step toward fashioning a national consensus on siting.

Focus: Broad range of public and private sector stakeholders

Convene National Workshop of State and Tribal Siting Officials

State/Tribal siting officials have expressed a strong interest in meeting with their counterparts from other States and Indian Tribes to discuss a wide range of siting issues. Like other professionals, they feel a need to exchange ideas with peers, develop innovative solutions to common problems, and share lessons learned. Presently, national workshops and conferences that promote and support an integrated focus on facility siting issues do not exist. This initiative was proposed by the staff of the California State Energy Commission.

Focus: State/Tribal siting officials with professional interest in the field

Develop a State/Tribal Siting Handbook

The facility siting process could be enhanced by disseminating information among States and Indian Tribes on siting-related topics, as well as by improving and establishing channels for communication among States and Indian Tribes on siting issues. Several States have made significant advances in simplifying the siting process in their jurisdictions, embracing principles and employing internal procedures that are worthwhile and practical. State and Tribal siting officials indicate a strong need to share information and experiences amongst themselves, yet no systematic way to do so exists. This initiative would provide one such vehicle, a user-friendly handbook containing information most likely to be useful to State and Tribal siting authorities.

Focus: Information regarding Federal, State, and Tribal siting processes for use by States and Tribal officials

Equity/Environmental Justice

Develop Strategic Planning Process for Regional Burden-Sharing

Resistance to siting often results when those who stand to benefit from a facility are not the same as those who bear its risks and costs. Significant differences exist among regions in energy infrastructure needs, rates of economic growth, and resource availability and constraints. Moreover, many critical types of infrastructure cross jurisdictional boundaries, such as pipelines, roads, and electric transmission lines. A way needs to be found to develop strategies that take advantage of regional variations for mutual benefit and to allow States and regions to share infrastructure benefits and burdens. An example would be an agreement in which one State permits the siting of a liquid natural gas facility to provide fuel to adjacent States, and in return a recipient State agrees to a power plant within its jurisdiction that will generate electricity for other States in the region, where demand for power is growing.

Focus: Federal government assistance to States and Indian Tribes in developing regional burden-sharing process

Explore Feasibility of Mitigation Banks

The siting process is often impeded over disputes about siting-related impacts, the locus of responsibility for mitigating impacts, and the boundaries of eligibility for receiving compensation. These matters, that can be slow to resolve and costly to address, often serve as deterrents to investment in energy facilities. There may be ways for developers of an energy facility to offset the negative impacts of the siting of one facility, by mitigating impacts elsewhere: for example, by improving an adjacent, unaffected area such as a nearby State or national park. The Administration should examine the feasibility of the concept of the mitigation bank—a fund established and paid for by energy facility developers—to mitigate negative impacts from the siting of facilities.

Focus: The Department of Energy, in consultation with stakeholders, evaluates concept of mitigation banks

Evaluate Compensation Strategies to Distribute Siting-Related Costs and Benefits

Many siting delays stem from public opposition that is based on fears that the rewards and benefits of a proposed facility will not be distributed equitably. This is particularly true for minority communities. In many cases, public opposition can be ameliorated if the siting process follows certain principles. These include employing a cost-benefit distribution process that is perceived as fair and equitable, and appropriately compensating those

adversely impacted by a facility, with those benefiting from the project being the source of compensation. The Administration should identify and evaluate compensation program alternatives for energy developers and siting authorities, including potential Federal and/or State roles in implementing those programs.

Focus: The Department of Energy, in consultation with stakeholders, evaluates concept of compensation strategies

Strategic Planning

Explore Coordination of Public and Private Sector Investment Planning

The planning and selection processes for public investments are typically separate from those for private investment, even when the projects are geographically and functionally related. Frequently this results in inconsistent investment, often leading to significant public opposition and other siting obstacles that seriously delay or even halt the undertaking. Constructing new energy facilities can result in a significant increase in employment and affect regional economic growth. On the other hand, such growth can be disruptive in places where local infrastructure—roads, hospitals, etc.—cannot support it. The Administration needs a mechanism to foster public and private coordination for compatible investment.

Focus: State and private sector planning efforts, in coordination with Federal agencies

Develop Regional Siting Profiles

What is clear to planners now, but less so to the public, is that current energy facilities are aging, while the population and economy—and hence, the demand for energy services—are growing. Much of the public is unaware of siting needs and is not normally involved in decisions concerning future energy choices. Moreover, siting issues vary by region. Presenting energy and resource information on a regional basis should help the public and various stakeholders interested in siting better understand the issues and trade-offs that are likely to be faced as the Nation and the economy grow. Working with regional and State organizations, the Administration should collect and disseminate, regionally, standardized data on energy services and related topics.

Focus: Regional data on energy demand, supply, and infrastructure provided by the Department of Energy for use by States, Indian Tribes, and other stakeholders

Explore Feasibility of National Development Zones

One way to mitigate opposition to energy facility siting may be to concentrate generation capacity in relatively few places. Many communities around the country are experiencing severe economic pressures, as both public and private sector enterprises contract. There is reason to believe that, given appropriate environmental safeguards, such communities may be receptive to hosting new energy facilities or serving as a focal point for centralized energy development efforts. To the extent that these are also cogeneration facilities (i.e., produce two useful forms of energy from one fuel source) or are directly associated with the building or revitalization of an industrial capability, they may be especially welcome. The Administration should determine the feasibility of designating national development zones.

Focus: The Department of Energy, in consultation with stakeholders, evaluates concepts of National Development Zones

Reinventing Government

Establish an Interagency Siting Regulatory Action Panel

The need to resolve siting problems is likely to grow, as economic development needs and associated energy supply requirements collide with global climate change and other environmental concerns. The current processes for siting facilities are often unnecessarily complex and cumbersome. Facility siting is governed by a wide range of laws and regulations that, while individually meritorious, often have overlapping or even conflicting provisions. Presently, no institutionalized process looks comprehensively at siting-related regulations from the standpoint of their cumulative impact or inter-regulatory consistency. The Administration needs a Federal interagency working group—a permanent panel established by Executive Order—focused on coordinating Federal siting-related regulations and statutorily-driven regulatory requirements. The mission of this panel would not be to weaken regulations, but rather to rationalize their implementation, by eliminating areas of unnecessary overlap and inconsistency.

Focus: Federal regulatory requirements

Develop a Model Strategy for the Siting of Federal Facilities

Policies among the many Federal agencies siting facilities are often inconsistent regarding how to do business with potentially affected stakeholders. Policy and operational differences exist even among programs in a single agency. States and others who deal with the

Federal government run into both procedural and policy inconsistencies. In many Federal siting efforts, public opposition is a key obstacle to progress. Often, that opposition centers around two concerns: perceived inequities for the community that hosts the facility, and lack of input into the decision-making process by potentially affected stakeholders. Federal agencies that deal with hazardous and nuclear materials are particularly susceptible to public resistance. Communities that are targeted to accept these facilities often feel they are being asked to bear the burden for problems that are not of their own creation, e.g., hosting a storage facility for waste generated elsewhere. Much is known about public processes that foster agreement and prevent unnecessary siting delays. The Federal government, which deals with these kinds of issues continually, should have a consistent siting policy.

Focus: Model strategy to help site Federal facilities

Pilot-Test the Model Siting Policy in a Region

Public opposition can seriously delay or even prevent the siting of facilities. However, evidence indicates that involving the public and other stakeholders in a participatory decision making and communication process will both facilitate public acceptance and lead to better quality decisions. The U. S. government sites numerous facilities, from small energy research laboratories to large, controversial radioactive waste management projects. The government also has a mission interest in private sector facility siting, such as natural gas pipelines and renewable facilities, the need for both of which is likely to greatly increase in the near future. The Administration should focus on a specific regional problem—such as repowering needs in the Southeast—and working with State and regional stakeholders develop and verify a model siting policy.

Focus: Test effectiveness of policy for siting a Department of Energy facility

Evaluate Federal Organizational Arrangements for Coordinating Facility Siting

Siting is a complex “umbrella” subject, with a variety of programs and policy issues falling within its domain. Some of these issues are legal and regulatory; others are related to the mission interests of an agency, and the discretionary policies and programs that the agency administers. Many Federal agencies are involved in the siting of facilities, and their processes and organizational arrangements are not always clear to those outside their agencies. Individuals and organizations who need to interact with agencies on siting issues often find obtaining information or even locating the appropriate office difficult and confusing. Even within the Federal government, those concerned with siting issues often find it difficult to identify their counterparts in other agencies. This initiative would produce and disseminate

a Federal directory or “road map” describing the roles and responsibilities of key agencies with siting responsibilities.

Focus: Federal agency organizations responsible for facility siting

Evaluate Alternative Siting Uses of Surplus Defense Facilities

As defense installations are consolidated and shut down, many communities will be faced with a loss of employment and income, and will likely be interested in exploring options to revitalize their local economies. At the same time, the Office of Environmental Restoration and Waste Management is continuing to decontaminate and decommission numerous Department of Energy facilities to open these sites to alternative development. Despite environmental problems, these surplus sites should be thought of as national assets. The Administration, in cooperation with public and private stakeholders, should evaluate these sites for alternative and innovative uses—particularly for regional energy facilities, or as test-beds for prototype energy technologies.

Focus: Defense (or other Federal) sites for either private or public (State, Federal) energy facility use

Establish Department of Energy Site Selection Administrative Order on Facility Siting to Streamline Internal Department of Energy Procedures

The Department of Energy makes many siting decisions each year for a wide variety of facilities and programs. Several different orders and guidance affect these activities. This initiative calls for developing a Department of Energy administrative order to consolidate and streamline guidance on procedures governing the siting of Department of Energy facilities. The administrative order would expand current guidance, and if necessary consolidate existing guidance and orders to clarify the roles and responsibilities of the Office of Organization, Resources, and Facilities Management; the Office of Policy, Planning and Program Evaluation; and other program and staff offices in siting decisions involving Department of Energy facilities. The administrative order should reflect and be consistent with policy decisions made by the Secretary on stakeholder involvement and other siting-related issues. The administrative order will be developed by a working group that would include participation by the Office of Organization, Resources, and Facilities Management; the Office of Policy, Planning and Program Evaluation; Program Secretarial Officers; field elements; and others who have experience and interest in, and responsibility for, the siting process.

Focus: Internal Departmental efforts to rationalize procedures for siting DOE facilities

Assess Siting Implications of Recommendations of Task Force on Radioactive Waste Management

Public trust and confidence are essential for any facility to be sited, especially for activities dealing with radioactive and hazardous waste. This is also true with regard to public trust and confidence in Department of Energy and its efforts to site its own radioactive and hazardous waste facilities. In 1991, a Task Force on Radioactive Waste Management was established and asked to recommend "measures the Department might take to strengthen public trust and confidence in the civilian radioactive waste management program." The mandate of the Task Force was later expanded to include the environmental restoration and defense waste management program. The Task Force did not conduct a management audit, but rather concentrated on the specific issue of public trust and confidence. Its recommendations cover both interactions with external parties and Department of Energy internal operations. This initiative would assess those recommendations with an eye toward developing plans for implementation.

Focus: Internal Departmental efforts to enhance public confidence and trust in its efforts to site Department of Energy facilities

Establish Department of Energy Office of Facility Siting Policy

The Department of Energy is in the siting business, both directly as an agency that sites its own facilities, and indirectly in terms of its constituent programs' mission interests. In both cases siting is a complex issue, calling for an integrated policy focus, collaboration among a number of disciplines, and the cooperation of a variety of organizations and constituencies. A key responsibility would be to provide leadership for the Department in the area of facility siting environmental justice, including setting standards for socioeconomic assessments to ensure against disproportionate impacts on low income and minority populations when a facility is sited. This would be done in close coordination with the Department's Office of Minority Economic Impact. Moreover, energy facility siting policy is increasingly an international issue, with ramifications for global climate change, sustainable development, and national competitiveness. It is becoming increasingly important to assess siting programs and approaches in other agencies, States, localities, and other countries for "lessons learned," including those related to non-energy facilities, to determine worthwhile features of those programs with potential applicability to siting. A Department of Energy Office of Facility Siting Policy would provide a focal point to address these and related issues.

Focus: Internal Department of Energy organizational initiative

Research

Develop a Siting Research Agenda

Decision makers who deal with facility siting require knowledge and expertise in a wide variety of disciplines. In addition to understanding the technological aspects and physical impacts of a facility, siting managers and policy makers who want to maximize their effectiveness need to be well grounded in political and social processes, resource economics, and management and organizational theory. Although the Department conducts extensive research into basic science, little research is focused on basic *social* science, with only a few studies conducted strictly from the standpoint of facility siting. In partnership with siting stakeholders, work needs to be done to survey and assess the existing body of work, and determine an agenda for priorities for further research. For example, areas ripe for detailed study include: effective methods for changing risk perception, the economic consequences of siting delays, and how to develop a continuing consensus for decisions.

Focus: Internal Departmental initiative focusing on long-term research efforts related to siting

1.0 INTRODUCTION

Effective energy facility siting policies can accelerate national economic growth, speed up the availability of cleaner fuels, and advance environmental progress—all high priority Administration goals. The current infrastructure will need selective upgrading; existing facilities may be replaced before their life-cycle is complete; conservation alone cannot negate the need for new facilities; regional solutions are required; and DOE's emphasis on natural gas and renewables creates new siting challenges.

Resolution of siting issues requires public participation. Our legal and regulatory systems seek to protect and encourage public participation in policy decisions. The laws and regulations that govern our environment, health and safety, and public involvement processes reflect legitimate social and political concerns, and provide a rational structure through which disagreements can be aired and resolved.

1.1 REPORT VIEWS ENERGY FACILITY SITING AS CRITICAL TO ADVANCING ADMINISTRATION GOALS

This report addresses two critical questions facing the Department of Energy at this time: Why is energy facility siting important, and what useful actions can the Federal government take in helping alleviate problems? The short answer to the first question is that effective energy facility siting policies can accelerate national economic growth, speed up the availability of cleaner fuels, and advance environmental progress—all high priority Administration goals.

Now, if you were to ask the man on the street about *his* concerns over energy facilities, he might point to waste disposal sites for nuclear waste, or perhaps mention high voltage power lines affecting property values and maybe even his family's health.

These are important issues that the Department is currently attempting to address. There are also facility siting issues that are just beginning to percolate, and that have become more critical as a result of the Energy Policy Act of 1992 and new Administration policy directions.

1.1.1 Department of Energy Promotes Integrated “Three E” Strategy

A major policy objective outlined by the Department of Energy is the integration of the “three E’s”—energy, environment, and economy. From DOE’s perspective, a key factor in balancing economic growth and environmental protection is energy production and use. Finding the appropriate balance point between energy supply and demand and maintaining the optimum mix of energy fuels and resources will be crucial to our future environmental and economic well-being.

How do we find this balance point? In previous years, we could automatically increase supply by exploring for new resources, building new energy production plants, increasing generating capacity, and siting and constructing more pipelines and power lines. In recent years, a paradigm shift has taken place, driven by awareness of the total costs of producing energy while mitigating environmental impacts. More utilities are adopting demand-side management and integrated resource planning; both identify efficiencies in the way Americans produce, transmit, and consume energy.

According to an Energy Information Administration study, “Electric Utility Demand-Side Management,” 363 electric utilities had designed demand-side management programs in 1990, up from 311 in 1989; during 1990 those 363 utilities spent \$1.2 billion and cut peak load approximately 24,331 megawatts. Energy Information Administration analysts estimate that in 1992, U.S. electric utilities will spend approximately \$1.88 billion on demand-side management programs, cutting overall peak load by some 30,578 megawatts (Energy Information Administration 1993c).

For similar environmental and economic reasons, DOE also hopes that the energy mix used to meet total U.S. demand will change. An example is the Administration’s desire to move away from coal and oil to natural gas, which in production is less likely to impact the local environment, and which when used as a transportation fuel will reduce harmful emissions, thereby improving air quality. Another example is targeting DOE research and development and technology transfer programs toward renewable energy sources such as hydropower, wind, and solar thermal.

1.1.2 The Current Energy Situation Affects Siting Issues in at Least Five Major Ways

The conclusions we draw from the current energy situation are these:

- 1) *The current infrastructure will need selective upgrading.* Facilities are aging, and many of the oldest plants require expensive retrofitting to bring them into compliance with the Clean Air Act Amendments of 1990 and other current environmental standards, as well as increasingly strict State regulations.
- 2) *Existing facilities may be replaced before their life-cycle is complete.* New technologies, environmental externalities, and the market's response to fuel choices will impact utilities' decisions to maintain or close certain plants. The Trojan nuclear power plant in Rainier, Oregon, typifies the cost considerations facing utilities and the public service commissions that regulate them; Portland General Electric permanently closed the 17-year old plant in 1993, less than halfway through its anticipated 40-year life span.

An additional consideration is that continued use of older, less efficient facilities drives up the cost of U.S. energy. The cost of American-made products increases in turn, negatively impacting productivity as a measure of national competitiveness.

- 3) *Conservation alone cannot negate the need for new facilities, especially when adding projected energy resources for future economic development.* Here are some significant statistics:
 - The Energy Information Administration's Annual Energy Outlook 1993 Reference Case projects total U.S. energy consumption to climb from 84.6 quadrillion British thermal units in 1990 to 106.7 quadrillion British thermal units in 2010, despite increased efficiency in virtually every sector of the economy.
 - About 20 percent of the nation's electricity is generated by nuclear energy. Yet, as the Trojan case illustrates, several nuclear power plants were retired faster than expected, and present nuclear sites are often unusable for non-nuclear-related purposes.

- Although some large (700 megawatts and above) generating facilities will continue to be constructed, the trend is toward replacing large coal and nuclear power plants with smaller (50-250 megawatts) gas and renewable facilities, thus increasing the number of facilities needed to provide the same amount of power.
- 4) *While siting issues can be generalized to the national level, regional solutions are required.*

The siting of new energy facilities will be a function of supply and demand. The natural gas industry illustrates this principle. As stated in an American Gas Association report, *New Pipeline Construction; Status Report Year-End 1992*:

A large segment of the pipeline construction activity in 1992 was directed toward delivery of supplies to areas of increasing natural gas consumption. Five major expansion projects were completed or began construction into the growing California market (Mojave, Kern River, Transwestern, El Paso, and Pacific Gas Transmission), and projects were constructed into the Northeast utilizing Canadian gas (Iroquois and Tennessee) and domestic supplies (Transco, CNG and Texas Gas). Major construction activity also occurred in areas of burgeoning gas supplies, such as the San Juan Basin, the Rocky Mountain States and the Mobile Bay area.

A related regional issue is the use of compressed and liquefied natural gas for transportation, an attractive alternative for meeting air quality standards. The American Gas Association predicts that by 2010, the number of compressed natural gas vehicles on the road will have increased from 30 thousand today to 6 million. The regional response to compressed natural gas and liquefied natural gas usage ranges from siting of pipeline extensions and refueling stations to liability issues faced by service station owners and operators.

Renewables can also be treated as a regional issue, in that energy generation facilities must be sited where resources exist. For wind, the industry predicts growth in the Pacific Northwest, California, Nevada, Minnesota, and Wisconsin. The Northeast is now also

beginning to experiment with wind power, with likely locations for new sites in Vermont, Maine, and upstate New York.

A final issue is actually a potential solution to another regional problem, the economic and job losses associated with the closure of military bases. A good fit might be bases located in the Western part of the U.S. that could be used as sites for new wind farms or solar thermal generation facilities.

In sum, effective integration of economic development, energy demand and supply, and environmental quality takes place at the regional level, where the impacts of one of the E's upon the other two are more easily conceptualized and measured.

5) *DOE's emphasis on natural gas and renewables creates new siting challenges.*

The impact of the Administration's promotion of natural gas use was touched on briefly in describing a regional approach to siting energy facilities. To reiterate, as demand moves to less conventional locations and uses, new infrastructure will be needed.

An additional factor facing the natural gas industry is the need for new port facilities to handle imports of liquefied natural gas. A Gas Research Institute report published in February 1992, "Potential for Long-Term Liquefied Natural Gas Supplies to the United States," States that:

The 1992 edition of the Gas Research Institute Baseline Projection expects all existing U.S. terminals to be operational by the mid-1990s. All existing terminal capacity would be fully utilized by the year 2000 to meet growing U.S. demand. Some imports during the 1990s will require the construction of new liquefaction capacity and new ships.

Regarding renewables, wind power is more of a concern than solar thermal. As a wind industry representative suggests, siting issues faced by independent power producers and utilities are reasonably similar to any request for major new construction or facilities. The

NIMBY (“not in my backyard”) factor is prevalent for wind, too. Environmental issues relating to land use, construction of roads, potential disruption of local flora and fauna including, but not limited to, avian pathways, and aesthetic issues are some of the siting concerns that wind producers must address.

1.1.3 Resolution of Siting Issues Requires Public Participation

In considering resolution of siting issues, it is important to remember that our legal and regulatory systems seek to protect and encourage public participation in policy decisions. The laws and regulations that govern our environment, health and safety, and public involvement processes reflect legitimate social and political concerns, and provide a rational structure through which disagreements can be aired and resolved. An oil industry representative expressed this sentiment well:

More contentious (than procedural issues) is determining how environmentally appropriate you have to be, what should be sited, are there things which should not be sited. There are competing social interests when people who live with the facility don’t receive benefit from it.

Who are the stakeholders? Siting decisions involve a wide range of public and private sector stakeholders, including:

- *Industry*, which seeks an economic and regulatory context that makes it economically feasible to bring facilities on line.
- *Host communities*, that need to feel that the benefits of accepting a facility outweigh the costs. This is particularly true when the community is not a direct user of the energy produced at the facility, as happens with port facilities, new finds of natural gas deposits, and renewables that must be placed where the resource exists as opposed to the direct need.
- *States*, that play key roles in siting decisions, handling many of the complexities of inter-agency coordination. Few if any significant facility siting actions can take place without State approval and cooperation. Public service or utility commissions that regulate utilities at the State level are a special subset of this stakeholder group.

- *Environmental and other interest groups*, who often serve as watchdogs of the public interest, and who are organized at both national and local levels. They are influential in helping shape public opinion and may use the legal and regulatory system to delay or even halt siting efforts that they feel are ill-conceived. They need to feel confident that adverse impacts will not occur as a result of the sited enterprise.
- *Federal agencies*, that have varying authority and missions related to energy facility siting. Some site facilities themselves; others have oversight and regulatory authority over a variety of aspects pertaining to both public and private sector siting activities. Such agencies include not only DOE, but also the Federal Energy Regulatory Commission, Department of Defense, the Environmental Protection Agency, the Department of Interior, the National Park Service, and the Nuclear Regulatory Commission.

Little can be accomplished in the absence of public trust and support. Successful siting will depend on establishing creative and effective relationships among all stakeholders. The parties involved will need to establish a level of trust and respect for each others' held values before reaching a consensus that will enable facility siting to proceed expeditiously. As stated by Peter J. Johnson, Administrator of the Bonneville Power Administration from 1981 to 1986:

Rather than giving up authority, we discovered that involving the public in decision making is a powerful tool for increasing the authority and legitimacy of the decision-maker; for getting staff to question unwarranted assumptions and to generate creative solutions to seemingly intractable problems; and for improving the effectiveness of policy- and decision-making processes. In fact, public involvement is such a valuable tool that I now believe corporate and governmental managers who become proficient in working directly with stakeholders and affected third parties will have a distinct competitive advantage in meeting their mission, whether it is public service or improved profits.

1.2 SCOPE AND DEFINITIONS

1.2.1 Scope Extends Beyond Energy-Related Facilities

This report addresses not only energy-related facilities, but also discusses non-energy facilities that belong to DOE itself, as well as those in which DOE has a mission interest. Numerous siting

decisions are made every year in addressing DOE-owned and operated facilities. Many of these decisions are of a non-controversial nature, such as the siting of a new administration building at an existing DOE National Laboratory where no new land will be acquired, or a road upgrade or relocation within the boundaries of a site. The definition of siting therefore encompasses a range from every-day decisions garnering little public interest to major decisions that engender great controversy and require extensive stakeholder involvement. Table 1.1 summarizes the key types of facilities addressed.

Table 1.1 Types of Facilities Addressed

	Energy Related	Non-Energy Related		
		Science & Technology	Defense Production	Environmental Cleanup
DOE Facility	Strategic Petroleum Reserve	National Laboratories	Production Facilities	Waste Isolation Pilot Plan
	Naval Petroleum Reserves	Superconducting Super Collider	Naval Petroleum Reserve	DOE Defense Cleanup Sites
	Monitored Retrievable Storage			Waste Treatment Facilities
	Power Marketing Administration Facilities			
	Repository			
DOE Mission Interest	Oil	Other Research and Development Facilities	Production Facilities	
	Natural Gas			
	Coal Renewables¹			
	Liquid Fuels			
	Nuclear Power			
	Low Level Nuclear Waste			
	Onsite High Level Waste			

¹ Includes waste-to-energy

1.2.2 Definitions Clarify Parameters of Report

Many of the terms used in facility siting are imprecise. The definitions below are working definitions for the purposes of this report. They are intended to clarify the parameters of the report, while taking into account the wide variety of facilities relating to DOE missions. Draft DOE Order 5400.1, that establishes a lexicon for communications concerning siting issues, serves as a reference for several of these terms.

Infrastructure: Facilities involved in exploring, producing, extracting, converting, refining, and/or distributing energy; managing waste and the by-products of energy-related processes; conducting basic research, development, and demonstration related to energy production and use; and supporting other aspects of DOE's mission.

Facility: A physical plant, structure, or group of developed units, including associated functional systems such as parking lots, lighting and communication systems, the construction or operation of which requires a license, permit, or other form of official approval (e.g., an approved environmental impact statement).

Siting: The process (public involvement, permit application and gathering, land acquisition, etc.) leading up to the decision whether, where, and when to locate infrastructure; decisions as to the type of facility; and the construction or expansion of any aspect of the infrastructure, to the point of operation or functioning.

DOE Facility: A facility owned or operated by the U.S. Department of Energy, or for which the Department has the lead role in siting or maintaining.

DOE Mission Interest: A facility that falls within the scope of concern of a DOE program.

1.3 ORGANIZATION OF THE REPORT

The report has five chapters:

Chapter 1.0 Introduction

Describes the study's background, purpose, and scope, as well as providing working definitions of key terms used in the report.

Chapter 2.0 Energy Infrastructure Requirements

Provides an analysis that estimates the amount of facility infrastructure required to meet projected energy goals and identifies gaps between what is in place and what may be needed.

Chapter 3.0 Siting Constraints

Identifies regulatory, institutional, economic, and other factors that impede progress in siting facilities.

Chapter 4.0 Siting Constraints: Consequences for Administration Goals

Discusses consequences of failing to deal with obstacles to siting, implications of these consequences for developing policy options, and a universe of preliminary initiatives that address siting obstacles.

Chapter 5.0 Working Group Tentative List of Ideas

Provides ideas regarding policies and programs that DOE could undertake on its own or in concert with stakeholders that would beneficially impact the siting problem and that could meaningfully inform strategic energy policies and plans.

2.0 ENERGY INFRASTRUCTURE REQUIREMENTS

A sufficient and reliable supply of energy is essential to maintaining the health of the nation's economy. Growing economic activity, an increasing population, and an improving standard of living are factors that contribute to the 15% rise in demand for energy services projected by the Energy Information Administration for the period between 1990 and 2010. While demand-side management programs will bring about more efficient use of energy supply, aging equipment and environmental standards will inevitably cause existing facilities to become obsolete or simply too costly to operate. In addition to new facilities needed to replace retiring infrastructure, others will be required to meet the projected increase in energy demand.

Although it's hard to forecast exactly what the need for new facilities will be, under any reasonable set of assumptions it is clear that there will be a significant need to site energy facilities in the near future. This Chapter provides a more concrete picture of the potential magnitude and composition of future siting needs, and sets a context for later discussions. A substantial number of new coal mines, gas and oil fields, coal- and gas-power plants, petroleum refineries, and electric plants will need siting by 2010. Encouraged by the Energy Policy Act, renewable energy facilities such as geothermal plants, biomass facilities, ethanol plants, solar thermal plants, and windfarms are expected to emerge in highly increased numbers.

Rising demand for electricity will also be accompanied by an increased need for transmission and distribution lines and power substations. The increased use of natural gas will require the siting of new pipelines. Resolution of issues surrounding the treatment, storage, and disposal of radioactive waste will continue to affect schedules for the siting and licensing of facilities such as the geologic repository for high-level waste, low-level waste disposal facilities, and transportation infrastructure. In addition, DOE will require new science and engineering facilities and environmental cleanup and waste management facilities to continue its mission.

2.1 ENERGY INFRASTRUCTURE REQUIREMENTS IN THE UNITED STATES EXPECTED TO INCREASE

The energy infrastructure of the U.S. is a fundamental contributor to one of the highest standards of living in the world. The benefits of having a ready and sufficient supply of energy are so effortlessly obtained that energy services can easily be taken for granted. The rock-solid reliability

of our energy service infrastructure, however, can only be maintained through periodic upgrading and replacement. Like other areas of our national infrastructure, our energy service infrastructure is aging and portions of it are reaching retirement. In addition, economic growth is expected to increase the need for new energy services.

Popular concern for the environment continues to hold our energy facilities to increasingly higher environmental standards. As a result of environmental regulations, some facilities can simply no longer operate cost-effectively and must be replaced, even though they may still have some useful operating life remaining.

This Chapter will focus on assessing the potential energy facility siting needs that might be required in the future. The purpose of this assessment is to provide a more concrete picture of the potential magnitude and composition of future siting needs. It is not a definitive projection, nor is it a statement of Departmental policy. It is, however, a valuable exercise that validates the need to site future energy facilities and sets a context for later discussions on siting constraints and possible ideas for meeting siting challenges.

2.1.1 Energy Services and Energy Efficiency Are Related

The term *energy service* came into common use during the 1970s to distinguish between the consumption of energy and the resulting service that energy provides. Thus, consumers are viewed as demanding not electricity itself, but rather the lighting, heating and other energy services electricity supplies. Basing an analysis on energy services, rather than on energy consumption, allows for consideration of alternative means of providing services for less energy. Compact fluorescent light bulbs, for example, supply as much lighting as incandescent bulbs at a far lower rate of energy consumption. Architectural designs that incorporate skylights can allow for the lighting of buildings without electricity. The energy service demanded by commuters—getting to work—can be met by mass transit for considerably less energy in most cases than by conventional automobiles.

Similar distinctions can be made on the energy supply side. At the electrical outlet, electricity supplied by natural gas turbine plants is indistinguishable from electricity supplied by nuclear

power plants. Nevertheless, these plants vary greatly in their operating efficiencies, emissions characteristics, capacity and other factors. A diverse set of demand- and supply-side technologies and approaches is necessary for providing efficient and effective energy services.

The term integrated resource planning describes the process of planning future energy services through analysis of the benefits and costs of all options. Utilities and other energy planners use integrated resource planning to arrive at optimal means of providing energy services at lowest overall cost. Integrated resource planning takes into consideration the life-cycle costs of every demand- and supply-side option.

Utilities are exploring the use of demand-side management to improve the efficiency of end-use applications, such as household appliances, as an alternative to constructing new plants.

Integrated resource planning allows utilities to consider demand-side management programs on an equal footing with supply-side capacity additions. In order to increase the efficiency of energy services, the Energy Policy Act of 1992 promotes the increased use of integrated resource planning by utilities. Integrated resource planning can be expected to encourage significant investments in conservation and renewable energy technologies in the future.

2.1.2 The Need for Energy Infrastructure Is Increasing

Regardless of increased energy efficiency and new approaches used to provide future energy services, the number of energy services needed will almost certainly rise. The Energy Information Administration's Annual Energy Outlook 1993 Reference Case projects total U.S. energy consumption to climb from 84.6 quadrillion British thermal units in 1990 to 106.7 quadrillion British thermal units in 2010, despite increased efficiency in virtually every sector of the economy. The Energy Information Administration projections take into account the effects of integrated resource planning and other Energy Policy Act energy efficiency provisions.²

² EIA projections do not take into account recently passed energy taxes. The effect of these taxes had not yet been incorporated into the EIA projections at the time this report was prepared.

The projections, for example, include estimates that demand-side management programs by utilities may reduce peak capacity demand for electricity by almost 10 percent by the turn of the century. Overall, the Energy Information Administration Reference Case shows each dollar of the nation's total production of goods and services as requiring over 15 percent less energy input per dollar of Gross Domestic Product by the end of the 20-year forecast period.³

Nevertheless, growth in total energy services provided will result from continued growth in the national population and the economy. Even assuming a constant standard of living, population growth would translate into increased numbers of housing units, household appliances, automobiles and industries. These elements of the economy will drive an increase in total energy services.

Prior to 1973, growth in energy consumption roughly paralleled growth in the economy. Since then the ratio of energy consumption to economic output has declined, partly as a result of increased energy efficiency. The Energy Information Administration projects that total energy use per dollar of real Gross Domestic Product will decline from 17.3 thousand British thermal units per dollar in 1990 to 14.6 thousand British thermal units per dollar in 2010—a radical drop from the 23.1 thousand British thermal units per dollar rate in 1970 (Energy Information Administration, 1993a, p. 89).

The use of more efficient technologies has meant that most energy services now require less energy than they did two decades ago. However, the shift away from manufacturing to service industries accounts for some of the decline in energy intensity. New policies to promote an increased level of manufacturing to boost employment and exports may result in larger-than-projected energy service needs in the industrial sector.

The trend toward increased electrification, substituting electricity for other energy sources, has paralleled economic growth over the past three decades. In the past 30 years, the advent of greatly increased plug loads for household appliances and computers and of electric building environmental control systems such as air conditioning, ventilation, and heating, has more than

3 A report by the Union of Concerned Scientists (*America's Energy Choices: Investing in a Strong Economy and a Clean Environment*) estimates potential savings from energy efficiency gains as high as 30 percent in some sectors by 2010.

quadrupled electricity use in buildings and tripled electricity's share in total building energy use (Energy Information Administration, 1992b).

This trend is projected to continue as building floorspace increases with population growth and as technological advancement continues to favor electricity over other energy sources. The Energy Information Administration projects that total use of electricity will rise by 37 percent between 1990 and 2010, taking market share away from both natural gas and oil. Some future technology changes, such as a major shift toward electric vehicles, could drastically step up electricity demand. The need to site new electric power infrastructure will be greater than ever if such shifts occur.

Before 1970, U.S. energy infrastructure relied almost exclusively on new supply for meeting increased energy service demands and for replacement of retiring capacity. While we now have a greater selection of technology options for meeting energy service needs, choices will be required. Barriers to the siting of new energy facilities and to the successful implementation of demand-side measures must be overcome. Higher cost and less reliable energy supply will be the result of failing to take decisive action.

This report addresses the particular institutional problems associated with siting of supply-side infrastructure in the U.S. between now and 2010. Although there are important institutional barriers to overcome on the demand side, these barriers are different in nature and usually do not involve siting issues.

2.1.3 The Energy Information Administration's Annual Energy Outlook Is Consistent with Similar Forecasts

This report uses information from the Energy Information Administration publication *Annual Energy Outlook With Projections to 2010* (DOE, 1993a) as a basis for projecting future energy use. The Energy Information Administration is an independent statistical agency chartered by Congress, and does not represent the interests of any particular energy source or technology. We chose the Energy Information Administration projections because they cover the broad array of

energy technologies and use common macroeconomic assumptions for all energy sources. Other forecasts may differ from the Energy Information Administration projections; in general, though, forecasts of the Energy Information Administration are consistent with projections from a variety of industry groups (see Tables 2.1a and 2.1b).

Table 2.1a Comparison of Annual Energy Outlook with Other Projections for Select Fuels

Fuel	1990	2010			
	EIA	EIA Reference Case	WEFA	GRI	DRI
Coal Production (million short tons)	1,029	1,362	1,317	1,260	1,348
Petroleum Production (million barrels/day)	8.9	7.4	6.8	9.3	8.9
Nuclear Capacity (gigawatts)	99.6	102.4	102.2	107	113.2

Table 2.1b Comparison of Various Projections for Natural Gas Supply (Quads)

Natural Gas Source	1990	2010							
	EIA	EIA Reference Case	Natural Gas Strategic Plan	NPC(1)	NPC(2)	WEFA	GRI	DRI	AGA
Domestic Production	18.5	20.8	20.0	21.3	18.2	22.9	22.9	20.6	22.5
Imports	1.5	4.3	3.7	3.7	3.2	3.2	na	3.4	na
Total	20	25.1	23.7	25.0	21.4	26.1	na	24.0	na

na=not available

Source: EIA and EIA Reference Case: *EIA Annual Energy Outlook with Projections to 2010* (January 1993)
Natural Gas Strategic Plan and Multi-Year Program Crosscut Plan, FY 1993-1998 (April 1992)
 NPC(1): National Petroleum Council Reference Case 1 (Moderate Energy Growth Scenario), *The Potential for Natural Gas in the United States* (December 1992)
 NPC(2): National Petroleum Council Reference Case 2 (Low Energy Growth Scenario), *The Potential for Natural Gas in the United States* (December 1992)
 WEFA: The WEFA Group, *Energy Analysis Quarterly* (Summer 1992)
 GRI: Gas Research Institute, *Implications of the GRI Baseline Projection of U.S. Energy Supply and Demand*, 1993 Edition (August 11, 1992), and *Draft of GRI93 Baseline Projections* (August 21, 1992)
 DRI: DRI/McGraw-Hill, *Energy Review* (Second Quarter 1992)
 AGA: American Gas Association, *1992 AGA-TERA Base Case* (January 1992)

Note: The Energy Information Administration estimates include projected effects from the currently funded provisions of the Energy Policy Act of 1992. The Natural Gas Strategic Plan, WEFA, DRI, GRI, and AGA estimates do not account for any of the Act's provisions.

The Energy Information Administration prepared its estimates by projecting trends in economic growth, world oil price, fuel supply, and energy efficiency. Using various assumptions for these

trends, and taking into consideration existing legislation and regulations, the Energy Information Administration formulated seven scenarios for changes in energy use through the year 2010. In addition to a Reference Case, projections are made for the following cases: High Economic Growth, Low Economic Growth, High World Oil Price, Low World Oil Price, High Oil and Gas Recovery, and Low Oil and Gas Recovery.

The Reference Case, which this report uses for its figures, incorporates mainstream, mid-level assumptions for the trends listed above. These include an annual economic growth rate of 2.0 percent, a gradual rise in the world price of oil to \$29 per barrel in 2010, and economically recoverable oil and natural gas resources of 94 billion barrels and 892 trillion cubic feet, respectively. Using these assumptions, the Energy Information Administration calculates an annual growth of 1.2 percent in overall energy demand. The Energy Information Administration also makes macroeconomic assumptions for Gross Domestic Product, housing stock, commercial floorspace, the index of manufacturing gross output, and disposable income (Table 2.2). The Reference Case should not be considered the most probable scenario; it should be used as a baseline for comparing additional Energy Information Administration scenarios and projections by other agencies and organizations.

Table 2.2 Key Assumptions for Energy Information Administration Reference Case Projections

Macroeconomic Assumption	1990	2010	Change
Gross Domestic Product (\$1987 billion)	4,885	7,278	49%
Population (million)	249	283	14%
Occupied Housing Stock (million)	93.4	109.1	17%
Commercial Floorspace (billion square feet)	62.9	89.5	42%
Index of Manufacturing Gross Product (1987 = 100)	103	169	64%
Disposable Income (\$1987 billion)	3,538	5,041	42%

2.1.4 Quantification of the Need for Facilities by Type Is Complex

Several analyses, including the Energy Information Administration Annual Energy Outlook, contain projections of aggregate energy production and consumption by fuel type and sector. None, however, translates these projections into detailed information on the numbers of plants and sup-

porting facilities of all types needed in the future. Such translations are difficult, particularly for mid- to long-range estimates.

New and largely unpredictable technology breakthroughs, the extent of public acceptance of types of facilities, energy market shifts, and demographic changes can lead to wide variations in the assumptions underlying estimates of future facility requirements. Some existing facilities may be expanded or renovated to accommodate additional capacity needs, so that the siting of some new facilities may be postponed or avoided altogether. Attempting to quantify ancillary facilities such as pipelines, transmission lines, and storage terminals requires an additional layer of assumptions.

Nevertheless, rough quantification of the numbers of facilities needed in the future serves the purpose of this Chapter by offering a look at the relative magnitude of various siting requirements. These estimates also provide a reality check by translating energy data into physical structures, a more tangible measure. Using the energy use projections from the Reference Case of the Annual Energy Outlook, this report estimates the number of facilities that will be needed in 2010. The procedures used to convert the Reference Case projections to facility siting requirements are not in conflict with any major assumptions used by the Energy Information Administration to develop the Reference Case. As shown in Tables 2.1a and 2.1b, the Reference Case projections are consistent with projections from a variety of industry groups. Use of these industry group projections to quantify the number of facilities would result in estimates of roughly the same magnitude.

As shown in Figure 2.1a, the Energy Information Administration projects minor changes in the relative shares of fuel types contributing to total primary energy production between 1990 and 2010. The share of domestic petroleum production is projected to decline from 25 percent to 19 percent as oil imports increase. Primary production from coal and renewables is expected to account for an increased share of total production, that will rise by 13 percent. Figure 2.1b contains estimates of domestic energy consumption for 1990 and 2010. Figure 2.1c includes consumption broken down by domestic production and imports.

Figure 2.1a Primary Domestic Energy Production in 1990 and Projected Domestic Primary Energy Production in 2010

Figure 2.1b Domestic Energy Consumption in 1990 and Projected Domestic Energy Consumption in 2010

Figure 2.1c Domestic Consumption by Supply Source

Tables 2.3a, b, & c present the Energy Information Administration Reference Case projections for energy production and capacity in 2010. Between 1990 and 2010, oil imports are projected to rise from 15.3 to 25.8 quadrillion British thermal units, with natural gas imports increasing from 1.5 to 4.3 quadrillion British thermal units. A net 25 quadrillion British thermal units, or 23 percent of energy consumed, is projected to be imported in 2010, up from 16 percent in 1990. These projections are indicative of the amount of new energy infrastructure needed by 2010.

Table 2.3a Energy Information Administration Reference Case Energy and Capacity Projections for 2010

Domestic Energy Production (quads)				Net Imports (quads)		
Resource	1990	2010	Change	1990	2010	Change
Oil	17.9	15.3	-14.5%	15.3	25.8	69%
Natural Gas	18.5	20.8	12.4%	1.5	4.3	187%
Coal	22.2	28.8	29.7%	-2.6	-4.9	88%
Nuclear	6.2	6.9	11.3%	-	-	-
Renewable/Other	6.5	10.7	64.6%	-	-	-
Total	71.3	82.5	15.7%	14.2	25.2	77%

Note: negative numbers indicate exports

Table 2.3b Energy Information Administration Reference Case Energy and Capacity Projections for 2010 (continued)

Electric Generating Capacity (gigawatts)			
Resource	1990	2010	Change
Oil and Natural Gas	216	282	31%
Coal	305	352	15%
Nuclear	100	102	2%
Hydroelectric	75	77	2%
Geothermal	2.6	8.5	227%
Solar Photovoltaics	0	0.01	-
Solar Thermal	0.4	1.9	375%
Wind	1.4	6.3	350%
Biomass and Other Wastes	6	8.1	35%
Municipal Solid Waste	2	11.4	470%

Table 2.3c Energy Information Administration Reference Case Energy and Capacity Projections for 2010 (continued)

Energy Consumption for Electricity Generation (quads)			
Resource	1990	2010	Change
Oil	1.3	1.8	38%
Natural Gas	3.5	6.7	91%

and in total resource yield. Uranium production also involves nonconventional mining technologies such as *in situ* leaching and the processes that yield uranium as a by-product.

The processes for mining various resources are similar. Exploration involves identifying prospective areas with geologically favorable characteristics and developing data about surface and subsurface conditions by mapping, sampling, drilling, and logging. In areas determined to contain sufficient resources, the resource-bearing strata are disrupted by digging or blasting, collected and either milled or ground into uniform size, and then often transported to a second location for separation, consolidation, and further processing. Subsequent processing usually involves additional mechanical and chemical procedures for fuel purification and refinement. The specific processes used vary according to energy resource, quality of ore, and intended use.

2.2.1 Coal

Recent trends in coal production reflect an increasing shift to very large surface mines in the western region of the U.S. Numerous small mines east of the Mississippi River have closed in recent years, while the 25 largest surface mines are all located in the western region. The total number of mines decreased from over 4,000 in 1982 to 3,022 in 1991, with only 2,394 mines producing more than 10,000 short tons each per year (Energy Information Administration, 1992c). Average coal mine production increased from roughly 200,000 short tons in 1982 to 330,000 short tons in 1991 as a result of advances in mining technology, the consolidation of small mining operations, and the development of large western mines.

The Energy Information Administration projects that U.S. coal production will yield the equivalent of approximately 28.8 quadrillion British thermal units in 2010, up from 22.0 quadrillion British thermal units in 1991. Translating these projections into numbers of coal mines required in 2010 involves forecasting the average size of coal mines in the future. Such forecasts are risky because many factors determine production at a particular site, including coal prices and utility demand for coal types of varying energy and sulfur contents. For the purposes of this report, however, average mine productivity is assumed to increase to 400,000 short tons per year by 2000 (the midway point of the time frame). Under this assumption, a total of roughly 3,300 coal

mines would be required to yield the 2010 level of coal production projected by the Energy Information Administration Annual Energy Outlook. This value is calculated by converting the Energy Information Administration energy use estimate to tons of coal production required and then dividing the total production by the average coal production per mine.

Not all of the 3,300 coal mines will require siting, however. Some existing mines will continue to produce up through 2010. The average longevity of existing mines can be estimated by dividing the average coal resources per mine (9.2 million tons) by the annual production rate (330,000 tons per year), resulting in average longevity of 28 years. Whether longevity of mines will change depends on whether more productive mines developed in the future will also contain more recoverable resources. This is highly possible, as the resources at western mines are huge in comparison to eastern deposits. Nevertheless, assuming an average longevity of 28 years, approximately 70 percent (20 years divided by 28 years), or 2,300 mines, will need to be sited between 1990 and 2010.

2.2.2 Uranium

Uranium is recovered in the U.S. by conventional and nonconventional mining methods. Conventional mining includes underground and open-pit mining; nonconventional methods include *in situ* leaching, heap leaching, and recovery of uranium as a by-product of phosphate and copper mining. Eight conventional mines operated in 1991, significantly fewer than the 19 open-pit and underground mines operating in 1985. Nonconventional methods, that are generally less costly than conventional mining, accounted for 56 percent of production in 1991, as conventional mines have continued to close (Energy Information Administration, 1992g). Total U.S. uranium concentrate production peaked in 1980 at 43.7 million pounds and dropped to less than 8.0 million pounds in 1991 (Energy Information Administration, 1992b).

The infusion of large quantities of previously produced uranium into the current global market has created a situation in which uranium producers are not so much competing with one another as with the huge inventories of excess uranium. These inventories have accumulated worldwide as a result of much lower use of nuclear power than previously projected. In addition, some portion of

the uranium stockpiles previously dedicated to nuclear defense purposes can be expected to appear in the commercial market. The Energy Information Administration projects that domestic production will range from 7 to 8 million pounds annually between 1993 and 2000, then gradually rise to 12 million pounds in 2005 as inventories are drawn down (Energy Information Administration, 1992g). It is unlikely that new uranium mines will be needed before 2010.

The need for new fuel enrichment and assembly fabrication facilities before 2010 is uncertain. Global enrichment capacity is currently at about 47.6 million separative work units, including the approximately 14 million separative work units capacity in the former Soviet Union (Energy Information Administration, 1992f). The Energy Information Administration estimates that the global nuclear capacity will require roughly 30 million separative work units per year until 1995 and between 36 and 44 million separative work units per year between 2006 and 2010. In addition, there are now large international stockpiles of enriched uranium. State-of-the-art technologies for uranium enrichment are much more energy-efficient than conventional methods, making replacement of existing facilities potentially cost-effective. The Energy Policy Act mandates the lease of existing DOE uranium enrichment facilities to the newly established U.S. Uranium Enrichment Corporation, and plans for a new enrichment facility in Louisiana have been proposed.

2.3 DRILLING AND EXTRACTION FACILITIES

Exploration for liquid and gaseous fossil fuels entails geophysical and geological mapping of the underground strata coupled with exploratory well drilling. Of the oil and gas wells drilled in 1991, about 23 percent of oil and gas exploratory wells were estimated to be successful (Energy Information Administration, 1992b).

2.3.1 Natural Gas

Natural gas consumption has increased during the past few years, while gas exploratory drilling has remained at low levels and surplus gas production capacity has declined. As the capacity of

currently producing wells declines, a sufficient number of wells must be added each year to ensure adequate supply.

Offshore production of natural gas has become an increasingly important component of gas supply, accounting for about one-fourth of total domestic production in recent years. However, the recent moratorium on off-shore drilling has limited production in the Gulf of Mexico until after 2000. Other areas are also restricted on an annual basis through the Congressional appropriations process.

At the end of 1990, an estimated 978 trillion cubic feet of recoverable natural gas had been found in over 45,000 U.S. fields, including fields containing both gas and oil reserves. Only 18 percent, or roughly 178 trillion cubic feet, of this recoverable gas remained in 1990 as proved reserves⁴ available for future use (Energy Information Administration 1992b). These proved reserves are the equivalent of approximately 183 quadrillion British thermal units, or roughly 9 years' worth of gas production at the projected annual average production rate of 20 quadrillion British thermal units per year between 1990 and 2010. The Energy Information Administration projects that natural gas production will rise from 18.7 quadrillion British thermal units annually in 1990 to 20.8 quadrillion British thermal units annually in 2010.⁵ If these projections are accurate, new discoveries, new technologies or other modifications to proved reserves will be needed to supply the Energy Information Administration's production forecast. An additional 11 years of production (20 years minus 9 years of current reserves), or 216 quadrillion British thermal units, will be required by 2010.

The number of new gas fields needed to produce the additional 216 quadrillion British thermal units can be estimated by making an assumption about the average production for a gas field. From 1980 to 1990, 9,835 new gas fields accounted for an increase in recoverable gas of approximately 157 quadrillion British thermal units. Between 1980 and 1990, it required 62.6 new

⁴ Proved reserves refers to the estimated quantities of gas from known oil and gas fields that can be recovered with reasonable certainty under existing economic and operating conditions.

⁵ The latest DOE Natural Gas Strategic Plan has usage estimates of 23 quadrillion British Thermal Units by 2000. They are also projecting shortfalls in gas supply by 2025 (DOE, 1992h).

fields to produce each additional quadrillion British thermal unit of gas (9,835 fields divided by 157 quadrillion British thermal units). Thus, 13,500 new fields will be required to produce an additional 216 quadrillion British thermal units between 1990 and 2010 (216 quadrillion British thermal units multiplied by 62.6 fields per quadrillion British thermal units). Potential changes in oil and gas prices and emerging technologies can significantly affect these estimates by impacting economic feasibility of recovering gas reserves.

2.3.2 Petroleum

Oil exploration and the rate of oil well drilling respond to the price of crude oil. Costs of delivering crude to the market are greatly affected by transportation distances and by adverse development and production conditions, such as the extreme climates of Alaska's North Slope and the difficult access for deep water drilling in the Gulf. As the productivity of conventional wells declines and domestic production becomes more costly, expanded U.S. oil exploration and production is increasingly financially attractive only when crude oil prices are high.

Compliance with the Clean Air Act Amendments of 1990 also influences the economics of oil production. Oil companies expect that compliance with State and Federal environmental regulations will significantly impact the number of new drilling projects they undertake. If waste disposal regulations under the Resource Conservation and Recovery Act are extended to include oil production wastes, the offshore oil industry will be greatly affected. Compliance costs could cut into industry profit margins, reducing the amount of capital available for exploration.

As of 1990, roughly 46,000 U.S. oil and gas fields have produced a total of 161.5 billion barrels of crude oil. Reserves remaining in the fields as of 1990 amounted to 27.6 billion barrels. These reserves can be expected to last approximately 12 years, given an average production rate of 6.1 million barrels per day (estimated from Energy Information Administration projections for 1990–2010). Thus, approximately 8 years (20 years minus 12 years reserves) of additional production would be required to meet Energy Information Administration's projections. This would amount to 17,217 billion barrels (8 years multiplied by 6.1 million barrels per day multiplied by 365 days per year). Assuming that the average field yields the historical average of

3.5 million barrels per field, roughly 4,900 new fields would be required to meet the additional production (17,217 billion barrels divided by 3.5 million barrels per field). The number of new oil fields required could be lower as enhanced recovery techniques or a rise in oil prices make recovery from existing fields more economically feasible.

Further development of most existing oil fields is not expected to present siting difficulties, as most oil field leases have been arranged to include sufficient land for further drilling. Topography, the size and shape of the oil reservoir, and oil prices affect the number of wells required at each site, that can range from a few to hundreds of wells.

On the other hand, siting difficulties are an issue for some offshore leases in the Florida Gulf Coast and in other coastal areas where public opposition blocks further development. Drilling along the Outer Continental Shelf off the California coast has been the focus of public opposition since a well blowout in Santa Barbara in 1968. New development perceived to endanger other environmentally sensitive areas such as the Arctic National Wildlife Refuge has also encountered public opposition. Leasing, exploration, and construction activities can also be sources of opposition to siting. Objections to increased helicopter and boat traffic and competition for harbor berthing space can hinder the development of offshore facilities as well.

After oil is brought to the surface, small pipelines carry it to a part of the production site known as the tank battery. In addition to storage tanks, the tank battery contains equipment for preparing the oil for distribution. This equipment separates the oil from other contents of the pumped stream before shipment by pipeline or tanks to refining facilities. Projected increased shipment of petroleum will require new distribution and storage facilities of this nature.

2.4 ELECTRICITY GENERATION

A wide variety of energy sources can be used to generate electricity. In most cases, a central plant converts the energy source into electrical current provided to end users through the electricity transmission and distribution system, or grid. Plants can range in capacity from less than one megawatt, typically in remote locations, to thousands of megawatts and can contain multiple

generating units. For the purposes of this report, generating units are grouped by fuel category and estimates are provided on a national basis. A brief discussion of non-utility generation is included at the end of this section.

2.4.1 Existing Facilities

Schedules for additions and retirements of generating units are well documented. Table 2.4 presents Energy Information Administration data on the number of generating units in operation at the end of 1991 by fuel type and utility plans for additions and retirements between 1992 and 2001.

Table 2.4 1991 Electricity Generating Capability and Planned Additions and Retirements by 2001

Resource	1991 Capability		Planned Additions by 2001		Planned Retirements by 2001	
	Number of Units	Summer Capability** (gigawatts)	Number of Units	Summer Capability** (gigawatts)	Number of Units	Summer Capability** (gigawatts)
Coal	1,248	300	27	10	13	0.8
Gas	2,065	126	262	22	68	2.2
Oil	3,259	72	70	3.5	75	2
Hydroelectric	3,476	92	88	2.5	33	0.05
Nuclear	111	100	3	3.5	1	0.17
Other*	101	3.5	39	2.6	-	-

* Other includes solid waste, solar, waste heat, wind, and wood.

** Summer capability is the maximum load that a unit can carry under certain conditions without exceeding approved limits of temperature and stress.

Source: Energy Information Administration,
Inventory of Power Plants in the United States, 1991.

Table 2.5 presents the results of analysis of fossil-fueled generating capacity by the Argonne National Laboratory's ARGUS utility sector model of U.S. generating unit age and capacity by fuel type and region. This analysis contributes information on scheduled unit retirements and repowering of existing facilities. Table 2.5 presents by fuel type the percentage of 1989 capacity that is expected to remain in 2010.

Table 2.5 Retirements of Fossil-fueled Generating Capacity Projected by ARGUS

1989 Electricity Generating Capacity Projected to Remain in 2010 (gigawatts)			
Fuel	1989	2010	Percent Remaining
Conventional Coal	294	281	96%
Oil	75	70	93%
Base and Peak Gas	113	108	96%

Source: Argonne National Laboratory

The Energy Information Administration Reference Case projections forecast that 195 gigawatts of new electricity generating capacity will be added between the end of 1990 and 2010 to meet projected demand. This is in addition to forecast increases in existing unit outputs (including utilization of any existing excess capacity), extensions of existing unit lives, and imports. Of the projected capacity needs, non-utilities are expected to supply roughly 36 percent. Utilities and non-utilities have already announced plans to provide two-thirds of the required new capacity needed by 2000. More than 50 percent of additions through 2000 will come from gas-fired electricity generation.

2.4.2 Coal-Fired Power Plants

Energy Information Administration projections for coal-fired electricity generation capacity show a net increase in capacity of 47 gigawatts between 1990 and 2010, as shown in Table 2.3.

ARGUS data would indicate that roughly 13 gigawatts of conventional coal capacity is scheduled for retirement by 2010; Energy Information Administration estimates are higher. For its Annual Energy Outlook 1993 Reference Case, the Energy Information Administration projects that 66.5 gigawatts of new coal-fired plant capacity, measured in terms of summer capability, will be added by 2010. Energy Information Administration supporting analysis for the National Energy Strategy assumes an average plant size of 250 megawatts for coal units constructed in the future, although planned capacity additions through 2000 indicate an average size of 400 megawatts per unit.

Using the actual plans as a basis, roughly 170 new coal-fired units will be needed by 2010. New

sites required for these new units would be fewer, because some new plants could be constructed on existing sites and some facilities could contain multiple generating units.

Disposal of waste streams from emissions treatment mandated by the Clean Air Act Amendments of 1990 needs to be considered for the siting of new coal-fired facilities. Solid waste from scrubbers and other treatment equipment must be collected and transported to disposal sites without harm to the environment. Coal combustion wastes may be reclassified as hazardous under Resource Conservation and Recovery Act regulations, that may restrict the number of allowable disposal sites and raise disposal costs.

2.4.3 Gas- and Oil-Fired Power Plants

The Energy Information Administration projects a 31 percent net rise in total capacity from 216 gigawatts to 282 gigawatts for gas-fired and oil-fired power units between 1990 and 2010, as shown in Table 2.3. ARGUS data indicates that approximately 10 gigawatts of capacity of these units will retire by 2010; Energy Information Administration estimates are higher. Energy Information Administration projections show that 92.6 gigawatts of new gas- and oil-fired power units will be added by 2010, with about 46 percent of this new capacity already planned. Utilities are expected to increase the use of combined cycle power generation by nearly 10 percent annually over the period, while non-utilities are expected to favor natural gas and renewable energy as fuel sources. Plans for capacity additions through 2000 include units with an average size of 100 megawatts. Using this assumption, 925 new units of this type will be needed before 2010. As in the case of coal-fired facilities, some may not require new siting because some new plants could be constructed on existing sites and some facilities could contain multiple generating units.

2.4.4 Nuclear Power Plants

In 1992, 110 operating U.S. nuclear power facilities with a total capacity of 100 gigawatts produced a record 619 billion kilowatts of electricity. Improved performance of existing nuclear power units, expected to be long-term, accounted for an increase in output from previous years. No new reactors have been ordered since 1978. In 1993, Comanche Peak 2 was completed and

began commercial operation. Two units are actively under construction, out of seven reactors that have construction permits. Seven units are projected to retire by 2010 (three between 1992 and 2001, another five between 2001 and 2010). The nuclear industry is developing new standard plant designs. These designs that include two advanced light-water reactors—one with a capacity of 1300 megawatts and the other with a capacity of 600 megawatts. The larger-sized units will be improved versions of current light-water plants while the 600 megawatt units will incorporate passive safety features.

The Energy Information Administration Annual Energy Outlook Reference Case projects that nuclear power plant capacity will grow to 102 gigawatts by 2010, as shown in Table 2.3. One newly-ordered 600 megawatt units and 2 of the five indefinitely deferred units are forecast by the Energy Information Administration to begin operation before 2010. Five of the 12 units eligible for licensing renewal during the forecast period, accounting for 2.8 gigawatts, are projected to be relicensed. In addition, 7 existing units, totaling 3.8 gigawatts, are assumed to be retired after 40 years' operation.

In November 1992, the Nuclear Regulatory Commission established the procedures, criteria, and standards for licensing renewals extending operating licenses of nuclear power plants for up to 20 years beyond the original 40 years. The Energy Policy Act establishes one-step licensing for nuclear power plants, combining construction permits with operating licenses. These provisions are taken into account by the Energy Information Administration projections, that also assume that:

- Progress will made on the high-level waste repository, and that interstate compacts for low-level nuclear waste will be established;
- The Price-Anderson Amendments Act of 1988 will be renewed;
- A form of vendor acceptance of fixed-price contracting, or risk-sharing, will be available to utilities;
- Regulators will ensure utilities an adequate return on their investment in nuclear power plants; and

- Units licensed before 1982 will be able to obtain redefinition of the 40-year licensing period, so that this period would start with the issuance of the operating license, rather than the construction permit.

Should any of these assumptions prove false, and it seems likely that some may, estimates of future nuclear capacity would have to be revised downward. Siting of radioactive waste facilities is discussed in Section 2.6.

2.4.5 Renewable Energy Electricity Generation

Conversion of renewable energy to electricity encompasses a wide range of technologies. Renewable energy facilities use mechanical processes such as the powering of turbines by wind, steam, or falling water, chemical processes such as combustion of biomass, and photoelectric process such as conversion of sunlight in photovoltaic cells. These technologies are often land-intensive, and siting difficulties for renewable energy facilities often evolve from concerns over land or resource use. Siting for these facilities tends to generate less public opposition than siting for other types of facilities. Nevertheless, objections to land use for renewable energy facilities are becoming more prominent. Financial constraints tend to affect the siting of renewables more often than conventional facilities, with the exception of nuclear power.

The Energy Policy Act mandates a permanent 10-percent investment tax credit for solar and geothermal projects and a 10-year production credit for wind and biomass plants that are brought on line between 1994 and 1999. The Energy Policy Act also provides for access to utility transmission lines by independent power producers for wholesale sales of electricity. This legislation is expected to result in additional electric generating capability from wind, solar, biomass and geothermal sources. The Energy Information Administration Annual Energy Outlook 1993 projections referred to below include this additional 3 gigawatts capacity, that is about 20 percent more capacity than would have been expected without the legislation.

2.4.5.1 Biomass

Power plants can be fueled directly by the incineration of biomass or by combustion of fuels derived from biomass, such as the gas from biomass gasification. Facilities using agricultural

biomass, including wood residues, forestry culls, and agricultural wastes, require large land areas for growing biomass crops. Under favorable conditions, approximately 40,000 acres, or 62.5 square miles, of arable land will support a 100-megawatt biomass-fueled power plant. For the operation to be cost-effective, the facility must be centrally located within this land area. Herbaceous biomass crops require storage during winter months and disposal for combustion by-products, primarily landfill for ash.

The Energy Information Administration projects that the capacity of power plants fueled by biomass and other wastes will rise 35 percent from 6.0 gigawatts to 8.1 gigawatts between 1990 and 2010. Most agricultural biomass-fueled power plants range in capacity from 10 to 100 megawatts; an average size of 50 megawatts was used in an interlaboratory study for planning purposes and is used here for estimation. If all of the projected new capacity were to be fueled by agricultural biomass, approximately 41 new plants using 820,000 acres, or 1,281 square miles, would be needed by 2010.

2.4.5.2 Municipal Solid Waste

Power plants fueled by municipal solid waste require both processing of fuel prior to incineration and disposal for ash waste streams. Despite the thorough regulation of their emissions and the good performance of newer plants, municipal solid waste plants raise concerns over air emissions and solid wastes. Incineration of municipal solid waste often precludes the recycling of some recoverable materials.

The Energy Information Administration projects that municipal solid waste power plant capacity will increase from 2.0 gigawatts in 1990 to 11.4 gigawatts in 2010. Of the 140 municipal solid waste plants in operation in 1991, 80 generated electricity. An additional 60 municipal solid waste power plants with an average capacity of 30 megawatts were in various stages of planning and construction (Governmental Advisory Associates, 1991). (Sizes of plants range from 10 to 80 megawatts, with 20 megawatts plants being common). Assuming an average capacity of 30 megawatts, roughly 300 new municipal solid waste plants would be needed to account for the increase projected by the Energy Information Administration.

2.4.5.3 Geothermal

Geothermal power plants are designed to bring the heat of the earth up to the surface in the form of steam, that is used to drive turbines. Existing geothermal electricity generation relies on hydrothermal, or heated water, resources. The U.S. geothermal power industry has been in existence for over three decades; by the end of 1990, there were 2.6 gigawatts of capacity installed at 70 plants in California, Nevada, and Utah. The Energy Information Administration projects that geothermal capability will rise to 8.5 gigawatts by 2010.

Geothermal plants typically range from 35 to 110 megawatts. The DOE Office of Energy Efficiency and Renewable Energy planning assumes 50 megawatts as an average size geothermal plant. These figures indicate that roughly 120 new plants will be needed by 2010. Many of these plants could be grouped at geothermal resource sites, so that the number of new sites is likely to be less than the number of new plants. The Geysers geothermal facility in California has an installed capacity of roughly 2 gigawatts from plants ranging in size from 15 to 110 megawatts.

2.4.5.4 Hydroelectric

Hydroelectric power plants range in size from under one megawatt to thousands of megawatts. Smaller systems are situated on smaller streams and may not be productive year round, as stream flows vary with the seasons. Larger projects incorporate large water reservoirs to overcome the problem of seasonal stream flow. Both the use of land for reservoir storage and the use of rivers for power production have been the focus of siting conflicts.

Pumped-storage systems derive power from water pumped from lower reservoirs to higher reservoirs during off-peak hours, using conventional electricity sources. During peak hours, water is released from the higher reservoirs to generate power. Licensing of pumped-storage facilities is similar to licensing of conventional hydroelectric plants, but processing times are longer. The Energy Policy Act allows developers of hydroelectric projects to contract for the preparation of Environmental Impact Statements, which should expedite siting.

Many older hydroelectric projects are due for license renewal¹ after 30 to 50 years of operation. Approximately 23 gigawatts of hydropower capacity is due for relicensing before the end of 2010. The Electric Consumers Protection Act of 1986 requires the Federal Energy Regulatory Commission to give equal consideration to alternate uses of waterway, including conservation, fishing, wildlife reserves, and recreation. Since 1986, hydroelectric projects have lost an average of 8 percent of capacity to these alternative uses as a result of relicensing.

The Energy Information Administration projects that hydroelectric capacity will rise from 75.1 gigawatts in 1990 to 76.9 gigawatts in 2010. According to Table 2.4, 88 hydroelectric plants with a total of 2.5 gigawatts will be added between 1992 and 2001, while 33 plants with a total of 0.05 gigawatt will be retired during the same period. Assuming an average plant size of 26 megawatts based on actual planned facilities, these planned additional plants will provide sufficient capacity to account for Energy Information Administration projections. These estimates could vary if licensing processes result in a substantial loss of capacity at existing facilities or higher costs for new facilities.

2.4.5.5 Solar

Two categories of solar-powered generating plants have been commercialized: solar thermal and photovoltaic plants. Both require relatively large sites for the amount of electricity they generate. Solar thermal line concentration systems focus sunlight on tubes bearing liquids to transfer heat. Central receiver solar thermal systems employ a field of mirrors, or heliostats, to concentrate sunlight on a focal point. These active solar thermal systems convert radiant heat into electricity via turbines or engines. Photovoltaic systems use arrays of photoelectric cells to convert solar radiation directly into electric current. Photovoltaic and some solar thermal systems are modular and can be installed in small increments in relatively short lead times. This is an advantage where a relatively small capacity is needed but future growth in demand is projected.

One constraint to siting large solar facilities is the availability of large tracts of land in areas where adequate solar resources exist. Small, dispersed photovoltaic applications, such as those installed

on rooftops for individual household use or stand-alone photovoltaic systems for remote, off-grid applications, encounter no such constraints. A utility/government conference held in December 1991, "Photovoltaic for Utilities: Developing a National Photovoltaic Strategy for Utilities," identified first costs and institutional constraints as greater barriers to the development of large systems than land availability. The need to provide for electricity storage or to restructure the electricity transmission system to accommodate the intermittent availability of solar power stands in the way of widespread use of photovoltaics.

Solar photovoltaic generating capacity is projected to remain below 50 megawatts in 2010; hence, no future solar photovoltaic generating facilities were estimated. The Energy Information Administration projects that solar thermal capacity will rise from 0.4 gigawatt in 1990 to 1.9 gigawatts in 2010. Two central receiver designs are expected to be commercialized: central towers with a capacity of 200 megawatts and dish Stirling systems that use a field of Stirling engines and that range in capacity from 30 to 200 megawatts. DOE anticipates that the 200 megawatt systems will reach commercialization by 2010. Assuming an average size of 200 megawatts, roughly 8 new solar thermal plants would be needed by 2010.

2.4.5.6 Wind

Over the past decade, wind turbines have been deployed in clusters of "windfarms," also known as "wind plants." Windpower has been favored for its relatively low environmental impact. Whereas windpower was once used primarily for mechanical water pumping, electricity generation now predominates.

Turbines for windpower plants range from 18 to 600 kilowatts, and the majority of turbines installed to date have been in the 100 kilowatts range. Recently, turbine installations more often have a capacity greater than 200 kilowatts. Windpower systems are modular, and total capacity of a plant varies according to the number of turbines installed. Capacity is highly dependent on topography, the height of the turbines, and wind speeds. Power produced varies with the cube of wind speed.

There are several public concerns that impede the development of windpower: its visual impacts on surrounding landscapes, high noise levels, interference with radio and television signals, and possible bird kills through the disruption of avian pathways. The intermittent generation of power complicates windpower supply of electricity to the grid and limits utility investment. Changes in utility regulation and tax incentives mandated by the Energy Policy Act are expected to increase the use of windpower in some States. Some State regulatory reforms have favored windpower, notably in California and Hawaii where competitive solicitations have been set aside for renewable energy projects.

Wind plants must cover a fair amount of land to provide significant capacity. Land used for wind plants can simultaneously be used for crops and grazing. On average, wind turbines occupy about 5 to 10 percent of the land devoted to wind plants; recent installations in Europe require even less. Wind plants therefore face fewer land-use constraints than most other renewable energy facilities.

By 1990, over 14,000 wind turbines, with a capability of roughly 1.4 gigawatts, had been installed in California. The land requirements for these wind farms range from 15 acres per megawatt for linear arrays to 80 acres per megawatt for widely spaced arrays. Topography determines wind characteristics and therefore the size, height, number and spacing of wind turbines. The Energy Information Administration projects that U.S. windpower capacity will increase from 1.4 gigawatts in 1990 to 6.3 gigawatts in 2010. If the average land area for wind plants is assumed to be 50 acres per megawatt, the new land requirements for windpower by 2010 would be roughly 246,000 acres. Ten percent of that land (24,600 acres) would be unavailable for other purposes.

2.4.6 Non-Utility Electricity Generation

Non-utility generators independently own and operate power plants, often on a small scale, and sell electricity to the utility grid. Industrial cogeneration systems, for example, use steam required for industrial processes to also drive turbines producing electricity. Cogeneration supplies power for manufacturing processes and at the same time provides revenue from the sale of excess power

to the grid. Electricity generation by non-utility generators is on the rise both in absolute terms and as a percentage of total U.S. power generation.

The Energy Policy Act is spurring growth in purchases of electricity from non-utility generators. Non-utility generators became important suppliers to utilities after the Public Utility Regulatory Policies Act was enacted in 1978. The Public Utilities Regulatory Policies Act guaranteed certain classes of non-utility generators a market for any excess power they generated. As a result, non-utility generator sales to utilities grew by more than 30 percent annually in the early 1980s. Recent Public Utilities Holding Company Act reforms that remove obstacles to open competition are expected to further stimulate non-utility generator sales, creating a new class of wholesale electric power generators.

In 1990, non-utility generator capability was 43.0 gigawatts. By 2010, non-utility generator capability is expected to account for 113.8 gigawatts, or 13 percent, of total U.S. summer generating capability. Of the non-utility generator capacity expected to come on line between 1990 and 2010, over 32 percent is expected to be gas-fueled, nearly 32 percent coal-fueled, only 4 percent oil-fueled, and 31 percent powered by renewables and other sources.

2.5 LIQUID FUEL PROCESSING AND CONVERSION FACILITIES

2.5.1 Alcohol Fuels

Alcohol fuels, such as ethanol and methanol, are made from either biomass materials or fossil fuels. Ethanol is made from fermentation of cellulosic materials and corn; corn is used for about 95 percent of U.S. ethanol production. Municipal solid waste represents a potential source of cellulosic materials for ethanol production. Methanol can be produced from a variety of sources, including natural gas, coal, biomass, and cellulose. Currently, natural gas is the most economical source of methanol.

The transportation sector is projected to consume most of the alcohol fuels produced in the future; alcohol is a ready substitute for a portion of the oil consumed in vehicles. The consumption

of ethanol-blended fuels has increased dramatically since 1980. The Clean Air Act Amendments of 1990 set air emissions standards that make the use of these fuels attractive. The Energy Policy Act extends the current 5.4 cents per gallon exemption on the Federal excise tax on 10-percent ethanol blends with gasoline and provides an income tax deduction for the purchase of an alternative-fuel vehicle.

The Energy Information Administration projects that U.S. ethanol production, primarily from corn, will increase from 0.06 quadrillion British thermal units in 1990 to 0.24 quadrillion British thermal units in 2010. Of the 56 U.S. ethanol production-related facilities operating in 1987, only 17 had production capacities over 10 million gallons per year, equivalent to a processing capacity of roughly 230 tons per day of corn feedstock (U.S. Department of Agriculture, 1988). Future ethanol plants are expected to be able to process 2,000 tons per day of feedstock. Plants with five times as much capacity are possible in some regions.

Plants processing 2,000 tons per day produce between 74 and 81 million gallons per year of ethanol, or about 5.6 to 6.3 trillion British thermal units annually. Assuming that all new domestic ethanol production is derived from this type of facility, roughly 30 new plants of that size will be needed by 2010 according to Energy Information Administration projections. If these quantities of ethanol were to be produced solely from municipal solid waste, approximately 36 plants would be needed, since municipal solid waste processes yield less fuel per plant.

Facilities producing alcohol fuels from biomass crops require large land areas, as well as land for disposal of wastes. In the continental U.S., a plant processing 2,000 tons per day of biomass crops would need roughly 125,000 acres of arable land. The estimated 30 plants needed by 2010 would occupy 3.8 million acres. Solid waste from each of these plants would total 36,000 to 66,000 tons per year, in addition to between 2,000 to 4,000 tons of sludge, all of which would require disposal. This waste may be usable as a landfill additive, however.

Ethanol facilities consuming 2,000 tons per day of municipal solid waste would require access to waste from a city approximately the size of Chicago and some of its suburbs. A plant of this size

would produce up to 130,000 tons of solid waste annually from the 730,000 tons of solid waste consumed each year.

2.5.2 Petroleum Fuels

Crude oil is shipped from production facilities to refineries, where it is transformed into petroleum products. Crude oil distillation capacity is one measure of the petroleum refining industry's ability to meet demand. In 1991, 202 petroleum refineries ranging in capacity from 1,000 to 400,000 barrels of crude oil per day were in operation.

Energy Information Administration projections indicate that nearly 21 million barrels of refined petroleum products per day will be supplied in 2010, up from 17 million in 1990. These figures would suggest that roughly 53 new refineries (assuming an additional 4 million barrels per day divided by the 1990 average capacity of 76,000 barrels per day) would be needed by 2010 to supply the projected increase. However, only 87 percent of the existing refinery capacity was utilized in 1990. This indicates that 13 percent of refinery capacity is unused and could be used to meet additional demand. However, refineries probably cannot run at 100 percent capacity for an entire year. Maximum capacity utilization is probably in the low to mid 90 percent range. On the other hand, continued increases in refining efficiency in the production of light fuels may decrease the need for new refineries. Changes in the proportion of refined petroleum products that are imported would also affect the need for refineries in 2010.

2.5.3 Synfuels

Synthetic fuels from coal and natural gas are not projected to increase from current low levels of contribution to the nation's energy mix before 2010. No siting needs for synthetic fuel facilities are forecast in the near future.

2.6 TRANSMISSION, STORAGE, AND DISTRIBUTION

2.6.1 Electricity

Transmission and distribution lines, substations, and switching equipment facilities are required for transmitting and distributing electricity from power plants to end-users. The siting of transmission and distribution lines has sometimes been opposed on the basis of aesthetic impact, noise, interference with TV and radio reception, and disruption to farming or other land uses. Continued development of suburban and rural areas tends to increase the difficulty of identifying acceptable routes for transmission and distribution lines.

More recently, concern over reports of alleged adverse health effects caused by long-term exposure to the electromagnetic fields surrounding high-voltage power lines has been an underlying factor in public resistance to power line installation. In general, the issue of electromagnetic fields is a problem for distribution as well as transmission lines and substations. Indeed, most of the human exposure to electromagnetic fields from power lines is due to distribution lines and home wiring rather than transmission lines.

To date, a causal relationship between electromagnetic fields and human health has not yet been conclusively established. However, until the scientific uncertainties have been resolved it appears that concern over possible health effects and their impacts on property values in proximity to power lines are expected to grow.

New transmission and distribution lines and substation installations are required for the following reasons:

- Older transmission and distribution lines and substations need to be replaced or upgraded, often for higher voltages.
- New transmission and distribution lines and substations allow for more efficient use of existing power generation facilities, deferring construction of new power plants.

- As utility grids become increasingly interconnected, modification of older transmission and distribution lines and substation facilities accommodates new power requirements.
- It is sometimes necessary or preferable to replace overhead transmission and distribution lines in residential or commercial areas with underground lines.
- New power plants generally require new transmission and distribution facilities.

In 1990, the total length of overhead transmission and distribution lines in the U.S. was 352,127 miles. Underground and submarine lines totaled 5,166 miles (Energy Information Administration, 1991e). Future need for transmission and distribution lines depends on uncertain factors, such as the location of future power plants. This report does not attempt to project the need for new transmission facilities in 2010.

2.6.2 Liquid Fuels and Natural Gas

Storage facilities and four major transportation modes—water, highway, rail, and pipeline—form a system that moves crude oil from wells to refineries, and distributes refined products to consumers. Over time in the U.S., new sources of oil have been located at an increasing distance from major consuming areas. Distance, geography, technology, and economics influence the types and amounts of transportation and storage used. In the future, as U.S. crude oil production declines, the transportation and storage system will need to adapt to new sources and types of liquid fuels delivered to U.S. refineries. Some alterations that may occur are the addition of pipelines, changes in the use of existing pipelines, and enlargement of port facilities.

Pipelines and waterborne vessels provide most of the domestic petroleum transportation, with some petroleum transported by trucks. Waterborne vessels move mostly crude oil, whereas pipelines convey a large share of refined products. Pipelines are nearly always located underground. One exception is the Trans-Alaska Oil Pipeline, for which durability of the pipeline seals and potential undesirable environmental effects have precluded subterranean placement in permafrost regions.

In 1990, the total length of oil pipelines for transporting both crude and refined products in the U.S. was between 170,000 and 180,000 miles (Oil Pipeline Research Institute, 1990). The mix of crude oil pipelines and refined product pipelines has varied slightly over the last few years, although the combined total has remained relatively constant. In 1990, there were roughly 39,000 miles of crude oil gathering pipelines, 59,000 miles of crude oil trunk pipelines, and 78,000 miles of refined product pipelines.

Most imported liquid fuels are transported over water. Port facilities are needed for transferring petroleum from ships to land. California has the only land-based port in the contiguous United States capable of handling very large crude carriers. The Louisiana Offshore Oil Port, a storage and transportation facility 18 miles offshore in the Gulf of Mexico, can accommodate ultra-large tankers and is connected to shore facilities by a 48-inch diameter pipeline. Smaller port facilities are numerous, and available data on total capacity has not been aggregated for this study.

In 1990, 112 port facilities in the U.S. received either crude oil or refined products in the U.S., totaling more than 358 million long tons (2205 pounds) equivalent of 15 quadrillion British thermal units (Energy Information Administration, 1991e). Many ports were considered under-utilized in 1990. The marked variability among ports in amounts of oil received in 1990 implies that total import capacity is probably much greater than total oil shipments would indicate. The number of future expansions that would be needed to receive oil imports in quantities projected by the Energy Information Administration is uncertain.

In 1988, U.S. gas pipelines totaled 1,168 thousand miles in length. Field and gathering lines accounted for 92 thousand miles, transmission lines 275 thousand miles, and distribution mains 800 thousand miles. A total of about 20 thousand miles of gas pipeline of all types was installed during 1988 (American Gas Association, 1989).

Projections for oil and gas pipeline installations in the mid- and long-term, beyond those already scheduled for the next few years, are highly uncertain. Pipeline additions are more dependent on the location of new sources and distribution areas than on levels of production or consumption.

Imports and exports of natural gas are transported as pipeline gas from Canada or Mexico or as liquefied natural gas via ship and truck. Pipeline imports from Canada are projected to increase through 2010, assuming that no significant difficulties are encountered in building new pipelines or increasing existing pipeline capacity. The Energy Information Administration projects that Mexico will become a net exporter of gas to the U.S. by 2009. Pipeline expansion projects to cross the Mexican border have been proposed that would increase capacity by almost 2 billion cubic feet per day (Energy Information Administration, 1993a). Gas exports from Mexico will require a change in Mexican export policy.

Alaska has significant gas resources in addition to its oil reserves. Two major gas pipeline projects have been planned for several years: one from Prudhoe Bay to Valdez, where gas could be liquefied for export by ship, and the other to deliver gas from Alaska to the lower 48 States. Financial and environmental constraints impede the progress of these projects. Potential markets exist for Alaskan gas from both projects, but the high cost of transporting the gas makes development of these resources cost-effective only if natural gas prices rise and remain at predictably higher levels than current prices.

Imported natural gas not entering the country by pipeline arrives by ship in the form of liquefied natural gas, that is presently imported only from Algeria. The current worldwide surplus of natural gas liquefaction capacity far exceeds spare transport capacity, especially for trade across the Atlantic. As of January 1991, there were seven idle tankers available worldwide for carrying liquefied natural gas (Energy Information Administration, 1991a). An anticipated shortage of liquefied natural gas vessels over the next several years could present U.S. operators with the difficult task of securing additional shipping capacity to transport liquefied natural gas in order to either expand current operations or reopen idle facilities. Liquefied natural gas can be imported through four existing liquefied natural gas terminals in the U.S. These terminals have a total capacity of 0.8 trillion cubic feet and are expandable to 1.3 trillion cubic feet. The Annual Energy Outlook projects an increase in imports of liquefied natural gas from Algeria, and possibly from Venezuela, Nigeria, and Norway. New import terminals may be necessary to meet the increased imports. Siting of liquefied natural gas terminals may raise environmental concerns relating to coastal zone management.

As described in Section 2.3.1, liquefied natural gas is pumped from ships at import terminals and either stored or regasified and transported by pipeline. Import facilities can serve as useful storage facilities for liquefied natural gas, either imported or domestic. One U.S. facility was used entirely for storage of domestic liquefied natural gas in 1988 (American Gas Association, 1989).

Oil facilities are typically located along transportation routes to accommodate the different rates at which various transportation modes can handle oil and refined products. Fuels may be detained for transfer to another line, for repairs on the line, or to be measured and recorded. Crude oil and petroleum products are stored in bulk in above-ground tanks, underground tanks and caverns, and offshore storage facilities. Above-ground tanks are the most common type of storage in the U.S. Underground tanks are used primarily for storing gasoline and diesel fuel at service stations. Caverns are used primarily for crude oil and liquefied petroleum gases.

At the beginning of 1991, there were about 840 million barrels of working storage capacity at refineries and gasoline blending plants in the U.S. Because tanks are continuously filled and emptied, they are used on average at about one-half of their capacity.

Natural gas is stored either in underground pools (old reservoirs, salt domes, aquifers) or as liquefied natural gas in above-ground containers. In 1988, there were 393 storage pools in 27 States with a total capacity of 7.8 trillion cubic feet. At the beginning of 1989, storage at domestic liquefied natural gas facilities totaled 70 billion cubic feet and storage at import terminals totaled 11 billion cubic feet (American Gas Association, 1989).

2.7 OFFSITE RADIOACTIVE WASTE TREATMENT AND DISPOSAL

2.7.1 Monitored Retrievable Storage

New and existing nuclear power plants will require a disposal facility for spent fuel to protect human health and the environment from the radioactive decay products that result from the fission process. Between now and the time when a permanent repository can be sited and constructed,

there is a need for temporary storage. One option envisioned is a Monitored Retrievable Storage facility.

Currently, all spent fuel rods in the U.S. remain in temporary storage pools or dry cask storage at reactor sites. Storage capacity at many commercial reactors is nearing regulatory limits. Utilities operating these reactors will soon have to apply for permission either to expand their on-site storage pool volume, to increase the allowable capacity within the existing pools, or to employ another form of temporary storage, such as in dry casks, in order to continue operation.

Monitored Retrievable Storage designs may incorporate waste handling, repackaging, and storage facilities at the site. While not planned as a long-term storage site, the Monitored Retrievable Storage is likely to be required to meet many of the qualifications of a long-term storage facility.

2.7.2 Repository for High-Level Radioactive Waste

The Nuclear Waste Policy Act of 1982 mandated that spent fuel and high level radioactive waste from the nation's civilian power plants be stored in a permanent repository. The Act also mandated that within two years of enactment, the President should evaluate the suitability of a repository for the disposal of high-level radioactive waste resulting from defense activities. This repository is to be constructed in a deep, mined, geologically safe location, so as to protect both the population and the environment from the radioactive materials during the thousands of years that they remain potentially dangerous.

The Nuclear Waste Policy Act Amendments of 1987 specified that Yucca Mountain in Nevada be studied to determine its suitability as the site for the repository. If Yucca Mountain is found suitable, DOE plans to apply for a license to build the repository there in 2001. The licensing and construction processes are expected to take several years, with the current schedule calling for waste acceptance beginning in 2010. In 2007 DOE is to evaluate the need for a second repository site.

2.7.3 Low-Level Radioactive Waste Facilities

The Low-Level Radioactive Waste Policy Act of 1980 and the associated Amendments Act in 1985 assigned to the States the responsibility of disposing of the low-level radioactive waste⁶ generated within each State's borders, except for certain waste that is the responsibility of the Federal government. The Low-Level Radioactive Waste Policy Amendments Act sets forth a series of milestones, incentives, and penalties related to the schedule for development of new disposal sites. It encourages States to form regional compacts in order to fulfill their responsibilities under the law, maintaining that the disposal of low-level radioactive waste can be most safely and effectively managed on a regional basis.

Two States, South Carolina and Washington, now have operating low-level waste sites. The Washington site serves seven States in the Northwest Compact and four States under contract with the Rocky Mountain Compact. South Carolina will continue to accept low-level waste for disposal through 1995 from the eight States in the Southeast Compact and from most out-of-region generators until July 1994. Nine compacts have thus far been formed encompassing 42 States, and by late 1991 a total of 13 States, including both members and non members of compacts, planned to develop new disposal sites to be operational sometime in the mid to late 1990s (DOE, 1992).

Public opposition in most designated host States has been a significant factor affecting progress towards siting low-level radioactive waste disposal facilities. Lawsuits have been filed that have challenged an individual State's siting process, and in other cases challenged the constitutionality of the Low-Level Radioactive Waste Policy Amendments Act of 1985. In Texas, one lawsuit was successful, and the State Authority was ordered to restore the site to the condition it was in before site characterization was started. In addition, the Authority was prohibited from conducting any further studies at the site. In North Carolina, a judge issued a restraining order against the State Authority, temporarily prohibiting the State from continuing with any on-site characteriza-

⁶ Including classes A, B, and C low-level radioactive wastes, as defined in Title 10, Code of Federal Regulations, Part 61. Such wastes include those generated from reactors, hospitals, and other activities performed by Nuclear Regulatory Commission/Agreement State licensees.

tion. Additional public concerns have been raised over the issue of treatment and disposal of "mixed waste" containing both hazardous and radioactive wastes.

These types of external opposition to selecting, characterizing, and licensing sites for new disposal facilities resulted in delays in the States' schedules to meet the Low-Level Radioactive Waste Policy Amendments Act's January 1, 1992 milestone; January 1, 1993 deadline; and the January 1, 1996 final target date. The majority of States report that since access to disposal facilities is disrupted, they will rely on on-site storage by the generator as the primary means of managing low-level radioactive waste until new facilities become available. However, concern has been expressed in many quarters that some vital services to society, such as medical diagnostic or therapeutic applications, could be disrupted due to limited and costly storage capacity.

2.7.4 Transportation Infrastructure

Some form of dedicated transportation system will be necessary to deliver waste from its current locations to both the Monitored Retrievable Storage and the permanent repository. Whether the system will incorporate road or rail transport or a combination of the two and what portions of the system will involve public facilities are as yet undecided. However, that the system will have to meet stringent safety and security requirements is beyond doubt. Occupational Safety and Health Administration standards will apply to the system for vehicle drivers and support facilities (e.g., refueling stations). Applicable Department of Transportation standards will address driving safety and road preservation (e.g., transport weight) concerns. Gaining approval for this system will introduce new complexities. Most likely, the system will be required to meet all regional regulations in States through which it passes, as well as applicable State and Federal regulations.

2.8 ADDITIONAL FACILITY NEEDS

2.8.1 Science and Engineering Facilities

Most of the basic research facilities operated by the Department of Energy are funded through the Office of Energy Research. Core research activities of the Office of Energy Research include basic

and applied research in high energy physics, nuclear physics, fusion energy, information technologies, chemistry, biology, life sciences, materials, earth and environmental processes, and advanced engineering, mathematical, computational, and computer sciences.

Fundamental science and engineering research is of major importance for meeting long-term national goals in technology development, energy supply, economic development, national security, and environmental protection. Up-to-date research facilities are an essential component in carrying out these research activities. However, quantifying the number of facilities that will be required to achieve national goals is an extremely difficult exercise because the relationship between research in its early stages and end products such as power plants and industrial technologies is indirect.

During the period between 1990 and 2010, major new facilities are likely to be needed in each of several primary program areas, including fusion energy, advanced materials, structural biology, high energy physics, and nuclear physics. Some of these facilities will take the form of major upgrades to existing facilities and some may be "greenfield" sites. Separate environmental studies will be required for each upgrade, at a minimum to produce a Finding Of No Significant Impact under the National Environmental Policy Act. Significant site selection activities as well as extensive environmental analysis and compliance efforts for siting new facilities between now and 2010 will be required.

2.8.2 Environmental Cleanup and Waste Management Facilities

Many DOE sites contain nuclear and hazardous waste-contaminated soils and other waste remaining from civilian and defense-related research and development and weapons production activities. Current plans call for the clean-up or stabilization of all of these sites, that may require the siting and construction of treatment and disposal facilities. Not all sites will necessarily require construction of a dedicated facility, as it may be possible to transport certain wastes to centralized facilities for processing and disposal. In addition, the private sector may be able to process portions of the waste in existing facilities, so that not all future treatment facilities will have to be new.

The Office of Environmental Management is preparing a programmatic environmental impact statement that will address these issues and identify sites where construction of new waste treatment facilities will be recommended. Data on numbers and types of new facilities are not yet available. Once the report has been completed, site-specific Environmental Impact Statements will be required prior to facility implementation.

2.8.3 Defense Production Facilities

The DOE Office of Defense Programs has the responsibility for the production, storage, maintenance, and surveillance of the Nation's nuclear weapon stockpile. The Office of Defense Programs has established an Office of Weapons Complex Reconfiguration to determine the future size, structure, and location of weapons-related facilities operated by DOE. Several options and issues related to reconfiguration of the complex are siting efficiencies gained by locating two or more facilities within the same site, alternative technologies for use at the sites, and current trends toward downsizing the nuclear complex. Primary considerations for siting Office of Defense Programs facilities are security, cost, and environmental impacts.

The Office of Weapons Complex Reconfiguration is studying where to relocate the nuclear production activities conducted at the Rocky Flats Plant near Denver, Colorado. The Office is also analyzing how to reconfigure the storage, processing, and component manufacturing activities for nuclear materials currently located at the Savannah River Site near Aiken, South Carolina, Oak Ridge Reservation, Tennessee, and the Pantex Plant near Amarillo, Texas. In addition, the Office is studying the consolidation of nonnuclear component production facilities currently conducted at the Mound Plant, in Miamisburg, Ohio, Pinellas Plant, in Largo, Florida, the Kansas City Plant, in Kansas City, Missouri, and the nonnuclear activities at the Rocky Flats Plant. The reconfiguration of selected research and development activities at the three National Defense Laboratories (Los Alamos National Laboratory, Los Alamos, New Mexico; Sandia National Laboratory, Albuquerque, New Mexico; and Lawrence Livermore National Laboratory, Livermore, California) is also being considered.

Following the completion of an Environmental Assessment and publication of a Finding of No Significant Impact, the Department is proceeding with consolidation of the nonnuclear activities by terminating the weapons complex activities at Mound and Pinellas, and the nonnuclear activities at the Rocky Flats Plant, and relocating them to the Kansas City Plant, Savannah River Site, Sandia National Laboratory, and the Los Alamos National Laboratory. Decisions regarding the relocation of the nuclear manufacturing activities previously conducted at Rocky Flats and reconfiguration of nuclear storage, processing, and component manufacturing of nuclear materials have not yet been made. Reconfiguration includes analyzing three alternatives: no-action; upgrades to existing facilities; and the construction of new facilities. Under the no-action alternative, nuclear activities previously conducted at Rocky Flats would be conducted at the existing facilities of the Los Alamos Laboratory and the Lawrence Livermore Laboratory. The reconfiguration of other nuclear and research and development activities would not occur. Under the upgrade of existing facilities alternative, the activities from Rocky Flats would be performed at Los Alamos. Other nuclear activities would be upgraded at the sites where they are currently located to meet environmental, safety, health, and mission requirements. Under the third alternative, potential sites currently being considered for the construction of new facilities to perform the plutonium functions previously performed at Rocky Flats and reconfiguration of any or all of the other nuclear storage, processing, and component fabrication activities are: 1) the Idaho National Engineering Laboratory, near Idaho Falls, Idaho; 2) the Savannah River Site; 3) the Oak Ridge Reservation; 4) the Pantex Plant; and 5) the Nevada Test Site, near Las Vegas, Nevada. It should be noted that under the no action and upgrade alternatives, the Rocky Flats Plant and the Hanford site near Richland, Washington, would continue to provide plutonium storage capacity.

Each of the proposed steps under examination requires separate documentation regarding environmental, cost, and security implications, and must also consider public reaction to the proposals. Politicians and the public may react very differently to facilities proposed for their regions. Some will focus on the jobs and other related economic benefits to be gained from accepting such a facility, while others will oppose it on the basis of environmental, philosophical, or other reasons. All of these factors are integral parts of the Reconfiguration Program and will contribute to any final decisions made regarding the future structure and operation of the complex. Because the

study is in preliminary stages, however, further details on the siting needs of Office of Defense Programs facilities through 2010 are not yet available.

2.9 ANALYSIS INDICATES NEED FOR EXTENSIVE ADDITIONS AND REPLACEMENTS TO THE NATION'S ENERGY INFRASTRUCTURE

The foregoing analysis indicates that extensive additions and replacements to the nation's energy infrastructure will be needed to supply the energy service levels projected by the Energy Information Administration for 2010, despite increased energy efficiency. Table 2.6 provides an overview of estimates contained in this report; Figure 2.2 presents the information as a percentage of current number of facilities, by type.

Although it is hard to forecast exactly what the need for new energy facilities will be, under any reasonable set of assumptions it is clear that the need will be real and will be significant enough to merit serious consideration. Using the Low Growth Case and assumptions from the *Annual Energy Outlook*, for example, would still result in only minimal changes in siting needs (2,100 coal mines vs. 2,200 for the Reference Case; 13,260 gas fields vs. 13,500; 4,800 oil fields vs. 4,900; 120 coal-fired plants vs. 170; etc.). Even if the projections shown in Table 2.6 were too high by an order of magnitude (which is much higher than the most conservative assumptions), there would still be a serious siting need (220 coal mines; 1,350 natural gas fields, 490 oil fields, 17 coal-fired plants, etc.). Please refer to the accompanying Documentation Report for further details.

Table 2.6 Representative List of Estimated Numbers of Energy Facility Additions and Replacements Needed by 2010 with Percentage Additions

Energy Facility	Current Number	Estimated Additions and Replacements	Percent Additions*
Coal Mines	3,022	2,200	73%
Natural Gas Fields	45,000 **	13,500	na
Oil Fields	46,000 **	4,900	na
Coal-fired Power Plants	1,248	170	14%
Gas- and Oil-fired Power Plants	5,324	925	17%
Nuclear Reactors	111	3	3%
Municipal Solid Waste Power Plants	80	300	375%
Geothermal Plants	70	119	170%
Hydroelectric Plants	3,476	88	3%
Solar Thermal Plants	1	8	800%
Ethanol Plants	56	30	54%

* Current numbers given for oil and gas fields are cumulative and include all fields ever developed in the U.S.

** Estimated new facilities needed in 2010 as a percentage of current number of facilities.

na = not applicable

Please refer to the chapter text and Documentation Report for underlying assumptions and derivation.

Figure 2.2 Estimated Number of Facility Additions and Replacements Needed by 2010 as a Percentage of Current Number of Facilities, by Type

Several types of facilities not included in Table 2.6 are nevertheless highly significant elements of the nation's energy infrastructure. Table 2.7 lists some of these additional siting needs. For example, the siting of radioactive waste disposal sites is especially critical to the continued operation of nuclear power plants. Extensive additions to gas pipelines will be needed, given projected large increases in both domestic gas production and gas imports.

Table 2.7 Projected Changes in Facility Siting Needs by 2010

Type of Facility	Siting Needs to Increase by 2010	No Increase in Siting Needs by 2010
Uranium Mines and Enrichment Facilities		X
Gas Pipelines	X	
Distribution and Transmission Lines	X	
Science and Engineering Facilities	X	
Facilities	X	
Defense Production Facilities	X	

The Energy Policy Act is expected to encourage the development of renewable energy sources of many types, including wind, photovoltaics, biomass, solar thermal, geothermal, and municipal solid waste. Sites will be required for all of the facilities needed for increased consumption of renewable energy. Coastal facilities, including refineries, storage facilities, and pipelines will be needed to accommodate expected increased imports of liquid fuels. Additional oil and gas fields must be developed if oil and gas consumption rises according to current projections. New demand for electricity will be accompanied by an increased need for transmission and distribution lines and power substations. Even if the balance of supply- and demand-side technologies differs from projections, new facilities will be required as a result of the retirement of existing capacity.

It is important to recognize the interdependence of facility types in this report's estimates. For example, an increase in natural gas-fired electricity generation will require additional siting of natural gas production fields, transmission pipelines, and liquefied natural gas import facilities. The importance of the relationships between these ancillary facilities and the primary energy genera-

tion plants cannot be overstated. Energy facilities are not independent entities, but are rather components of an overall *system*. In many cases, failure to site one component of the system prevents operation of others. Successful siting of all types of facilities will be needed for the achievement of a reliable, cost-effective, and environmentally acceptable energy service infrastructure for the future.

2.10 REFERENCES

REFERENCES

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2.11 PERSONAL COMMUNICATIONS

<i>Person</i>	<i>Organization</i>
Nort Haberman	Department of Energy, Nuclear Energy
David Streets	Argonne National Laboratory
John Flynn	Department of Energy, Efficiency and Renewables
Thomas Russo	Federal Energy Regulatory Commission, Hydropower
Al Jalacic	Department of Energy, Efficiency and Renewables
Sigmond Gronich	Department of Energy, Efficiency and Renewables
Simon Friedrich	Department of Energy, Efficiency and Renewables
Jim Rannels	Department of Energy, Efficiency and Renewables
Ken Humphreys	Pacific Northwest Laboratory
Steve Sohinki	Department of Energy, Defense Programs

Nona Shepard	Department of Energy, Radioactive Waste
John Lum	Department of Energy, New Production Reactor
Jerry Gerstein	Department of Energy, Environmental Management
Luther Smith	Department of Energy, Energy Information
Noel Balthasar	Department of Energy, Energy Information
B.D. Hong	Department of Energy, Energy Information
David Morehouse	Department of Energy, Energy Information
Randal Swisher	American Wind Energy Association
Terry Plummer	Department of Energy, Environmental Management

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3.0 SITING CONSTRAINTS

Siting constraints increase the time and cost of the siting process. Constraints cause delays in bringing facilities on line and can even prevent their being brought on line at all. They can also inhibit the number of facilities proposed.

Individuals or groups of individuals who disagree over the relative costs and benefits of a particular site are one source of constraint. Another is uncertainty about how to resolve systems-related or technical issues. Examples include jurisdictional overlap in the legal and regulatory process, lack of information about a newly introduced technology to be deployed at the proposed site, or economic uncertainties. Constraints can also arise from organizational and institutional factors, especially when organizations involved are unable to function efficiently and cooperatively.

Each type of energy facility has some siting constraints unique to that type. Constraints that must be considered in siting off-shore oil and gas drilling, for example, are clearly different from those that would affect a wind farm or a waste treatment and disposal facility. Analysis of constraints must therefore be tailored to the type of facility being proposed.

It seems evident that siting is becoming more difficult for all types of facilities.

Chapter 2 discussed the possible future need for various types of energy facilities. This chapter provides an overview of factors, called constraints, that may significantly influence the ability to site these facilities. For example, they can increase the time and cost of the siting process, causing delays in bringing facilities on line or preventing the successful completion of the siting process. Constraints can also inhibit the number of facilities proposed.⁷ This can drive up energy costs as well, because an alternative to a potential facility may be more costly than a new facility would have been.

Depending largely on the perspective of the stakeholder, a constraint may either be viewed as an obstacle (an unreasonable and unnecessary barrier to siting progress) or a burden (a justifiable and

⁷ Constraints in this category are indirect, rather than direct, in that they occur before the siting process is initiated. However, they are included in this discussion because they are an important factor in the ability to meet energy policy goals, and they are frequently linked to other constraints more directly affecting the siting process itself.

necessary business cost that safeguards the public health and the environment). Siting proponents, business competitors, regulators, and environmentalists will tend to interpret constraints differently.

Constraints that affect siting are interrelated. One kind of constraint frequently leads to others. For example, public opposition often leads to complex and demanding laws and regulations, which in turn result in economic risk and payback uncertainty for investors. The existence of these linkages points up the need for careful analysis before concluding which constraints should be targeted for attention, and what approaches should be taken to ameliorate impacts.

Siting constraints are dynamic. They grow or recede in importance as a consequence of changing circumstances. Environmental conditions, regulations, social values, technology, and economic conditions are among the factors that could change during site planning. Constraints specific to a particular location or type of facility may also vary over time in terms of apparent importance. As a result, problems that seemed simple to resolve may become more complex.

Constraints are in many cases based on interpretations of past siting experience and on judgments about how current regulations and public attitudes will affect siting in the future. For example, in recent years, Federal, State, and local agencies, and the public at large have increasingly viewed environmental quality and protection as important. Reflecting these concerns, new laws and regulations, such as the Clean Air Act Amendments of 1990 and the Coastal Zone Management Act, have been adopted. Many constraints are based on anticipation of difficulties and siting delays related to the implementation of this legislation. Interpretations of past siting experience are also used for facilities for which no recent siting experience exists. These include nuclear power plants and synthetic fuel facilities.

3.1 SITING CONSTRAINTS RELATED TO AGREEMENT

3.1.1 The Concept of Public Acceptance

The concept of public acceptance involves two broad notions. First, the public is not a monolithic or homogeneous body. It is composed of many different stakeholders whose perspectives, con-

cerns, and interests vary widely. The ability to identify stakeholders, understand their attitudes and concerns, and recognize how they see each other, is essential in achieving public acceptance.

Second, public acceptance *does not* mean unanimous consent. It does not imply that all stakeholders accept the facility without reservation or that they share the same views about every aspect of the facility and its impacts. Public acceptance *does* mean that sufficient support exists to site the facility without excessive delay or constraints, and that a working consensus exists on how the project may proceed. For such acceptance to occur, stakeholders must have a basic trust in the decision making process. They must believe the process is fair, that it considers the right factors, and that it gives individuals and institutions who should be involved the opportunity to participate.

Before public acceptance of a new facility is achieved, the stakeholders involved must often overcome many constraints, frequently focused on conflicts over costs and benefits.

3.1.2 Conflicts Over Costs and Benefits Manifested in Public Opposition

Disagreement among stakeholders over the advantages and disadvantages of a proposed siting is often a significant barrier in siting facilities in the U.S. Plans for both energy and non-energy facilities may be viewed quite differently by those affected. When any stakeholder group uses the political and legal process to challenge the siting of facilities, disagreement is frequently characterized as "public opposition." Opposition may be limited to the local area affected by the proposed facility ("Not In My Back Yard") or it can extend country-wide ("Not In Anybody's Backyard"). It can be directed at the siting of a particular facility in a specific location, or be directed broadly to an entire type of facility (for example, a nuclear power plant or a new dam for a hydroelectric facility). Public opposition is a frequent source of long-term barriers to siting a particular facility or facility type.

In recent years, the public's confidence in organizations and institutions of all types has diminished. This decline in trust may be an underlying factor in public opposition. It is often not an easy task to determine the true reason for public objection to a proposed siting. The stated position

may not be the true root of the opposition, but one seen as providing a stronger political or legal position against the facility than does the root issue.

Although public opposition to facilities is not new, its importance to facility siting has increased over the past three decades. Citizens are increasingly insisting on a direct voice in decision-making, refusing to vest authority for such decisions in their elected officials. They are frequently prepared to oppose decisions with which they disagree. As a result, public opposition has become an increasingly potent constraint on the siting of facilities. It is no longer sufficient for facility proponents to reach agreement with elected officials, community leaders, and regulators; they must also reach agreement with the interested public. Groups who are concerned about environmental values often favor participatory decision making processes.

3.1.3 Questions Concerning the Need for the Facility

When proposed land uses or facilities are locally undesirable, the need for the facility is likely to be challenged. Opposition can be expected to increase if a clear and compelling demonstration of need cannot be made. As the Integrated Resource Planning process becomes more visible, this type of question is likely to become more frequent (e.g., on the basis of market demand for electricity), as well as questions about whether the type of facility proposed is the best way to meet the need (e.g., a coal-fired plant as opposed to a wind facility). In some areas where facility needs were grossly overestimated during the late 1970s and early 1980s, challenges to the current forecasts of need are particularly severe (Peelle and Reed, 1991). Low-level radioactive waste facilities proposed by regional compacts, as well as monitored retrieval storage for interim storage of spent fuel from commercial nuclear power plants, have been challenged on the issue of need. Oil and gas facilities are frequently challenged on the grounds that non-polluting fuels should be used to reduce environmental or human health impacts.

In current practice, proponents of a facility do not seek to validate the need for a proposed site as part of proposal development. Those who oppose the facility, on the other hand, are not required to consider how forecast needs can be met, if not by the proposed facility. As a result, these two important issues—whether some facility is needed and whether a specific proposal to meet pro-

jected needs should be approved—are not clearly and separately addressed. If they were, it would be easier for stakeholders to discuss the trade-offs involved in the delay or failure to site the proposed facility. The demonstration of need is also complicated by the long lead time required to site and construct a facility. Thus, the siting process often begins based on an anticipated, not current or pressing, need.

Integrated Resource Planning requires that the entire existing system be examined at the facility planning stage to identify the least costly approach, or combination of approaches, to meeting an area's energy service needs. It is likely, therefore, that the need for a specific facility will be more fully discussed and documented before a specific proposal is made. It remains to be seen whether the use of Integrated Resource Planning in the facility siting decision process, as well as the public's awareness of how the process is conducted, will foster greater public acceptance of new facilities when they are proposed.

3.1.4 Environmental and Socioeconomic Impacts

Stakeholders may oppose a facility because they believe it could have harmful environmental and socioeconomic effects. Common concerns include degradation of air and water quality, changes in land use patterns, increased traffic and congestion, excess demands on local facilities, and strains or long-term changes in the community's social organization. Such issues have been raised with increasing frequency over the past three decades. Depending on the nature and magnitude of the potential impacts, opposition may be limited to the local area or broadened to the regional or national level. A facility may fail to win public acceptance because citizens believe it will hurt *global* environmental quality or will contribute to the incremental destruction of special environmental settings such as wetlands, coastal zones, habitat areas of endangered species, and migratory corridors. Opposition to a proposed facility can also arise based on objections to the visual impact of the structure on its natural setting.

In some instances, opposition based on concern for environmental or socioeconomic impacts can be addressed through effective mitigation and monitoring programs. However, conflicts over the nature, magnitude, and acceptability of these impacts can significantly delay siting. In addition, the

mitigation measures needed to achieve acceptability can affect program design and costs. States have sought to ensure that the environmental and socioeconomic impacts of facility sites are acceptable to the public by establishing complex and increasingly stringent environmental laws and regulations.

3.1.5 Health and Safety Concerns

Opponents of a proposed facility or technology may also object to it based on its possible impact on the health and safety of workers, nearby residents, and even, increasingly, national or global society. Plans for facilities that use or generate radioactive materials are frequently challenged on this basis. Similarly, public concerns regarding the effects of electromagnetic fields are increasingly important when new transmission and distribution lines are proposed or sited.

3.1.6 Natural Resource Constraints and Use Conflicts

Some are concerned that as our country's reserves of oil and natural gas are depleted, the capacity of domestic production facilities will decrease and we will be forced to rely increasingly on foreign energy supplies. A number of domestic areas in which new oil and natural gas might be located are difficult to access, complicating an internal solution to the problem. In some locations, the existing infrastructure needed to support the facility is lacking (i.e., roads, housing, and communications). The difficulty of conducting operations to retrieve oil or natural gas from certain areas, such as frontier areas or deep water, is also a significant deterrent. If any of these conditions exist and are further complicated by market or regulatory uncertainty or constrained development budgets, the obstacles might be insurmountable.

Conflicts over resource use underlie many regulatory and public opposition issues associated with siting for energy facilities. This is especially true of new hydroelectric facilities, which are seen to compete with fisheries management and recreation. Similarly, offshore oil and gas facilities are seen as competing with commercial fishing. In areas experiencing resource constraints (for example, water limitations) or resource degradation (for example, water or air pollution), new

facilities are likely to face public opposition or stringent regulatory requirements aimed at protecting existing resources and current patterns of resource use.

In areas in which land development is expanding, conflicts related to facility siting may be expected. New energy facilities are likely to be viewed as a threat to existing development. Disrupted plans for residential development generate particularly strong opposition. As a greater proportion of open land is developed, it is increasingly difficult to “go out beyond the edge of town” to build a facility. Facilities that require long corridors, such as pipelines and transmission lines, are especially affected.

Such conflicts over resource use will probably intensify in coming years. As available land decreases and the need for energy facilities escalates, it will become harder to negotiate acceptable trade-offs. As the size and number of renewal energy facilities increase, such conflicts will take on greater importance in siting decisions. Many of the new facilities will demand changes in land use practices. The magnitude of the land area required for some facilities—especially biomass facilities—adds to the difficulty. Already, disputes have arisen about the harvesting of biomass for energy use in Michigan.

3.1.7 Equity, Environmental Justice, and Process Issues

Frequently, those who stand to benefit from a facility are not those who bear the environmental, socioeconomic, health and safety risks and/or costs of the facility. This mismatch in costs and benefits also provides fuel for public opposition. This is particularly true for large-scale facilities that serve national or regional markets from a single location. In such cases, the local-level sacrifice perceived in hosting the facility is not balanced by an equal local-level benefit. Examples include the proposed high-level waste repository, the monitored retrievable storage facility, low-level radioactive waste sites, power transmission lines, large hydroelectric plants, and regional incinerators.

A concern receiving increasing national attention is that poor, minority, and/or rural communities are recipients of a disproportionate share of locally undesirable facilities. In such cases, facility

plans are frequently challenged on grounds of equity or fairness issues; siting delays or even cancellations may result. In recent decades, social attitudes toward hosting such facilities have changed, making siting more difficult. Fewer people accept such facilities out of a sense of community responsibility, motivated by the collective social benefit the facility offers.

Equity and fairness issues are often linked with issues about consent and process—issues identified in the literature as of critical importance in the current U.S. environment. Where the process is seen as unfair or inequitable, the outcome is frequently judged unacceptable and the proposed facility is opposed (Peelle and Reed, 1991; Branch, Orians, and Holthoff, 1992). There is growing consensus that the “Decide, Announce, Defend” approach to siting is no longer workable and should be replaced by siting methods that emphasize early participation by those affected, and that offer opportunities for sharing, negotiation, and joint decisionmaking (Peelle and Reed, 1991; Armour, 1991; Douglas and Wildavsky, 1982; Rayner and Cantor, 1987). Chapter 4 provides further discussion of this point.

3.2 CONSTRAINTS RELATED TO SYSTEMS UNCERTAINTY

3.2.1 Uncertainties in the Legal and Regulatory Process

Laws, and the regulations that interpret them, reflect social and political values and interests. They guard our health and environmental safety, protect our property rights, and ensure the stability and effectiveness of our public and civic processes. In this sense, laws and regulations are not constraints. However, once enacted, laws and regulations introduce uncertainties in the siting process that must be acknowledged, since they frequently increase both timelines and costs.

A new facility may encounter barriers arising from individual laws and regulations or from a combination of several applicable laws and regulations (e.g., the National Environmental Policy Act in combination with wetland regulations). As a society, the U.S. is noted for its inclination to use lawsuits as a way to resolve conflict. Given the increasing time courts require to resolve legal issues, legal challenges can be an effective way for opponents, and perhaps even business competitors, to delay facility siting decisions. Although these constraints are generally not

insurmountable, they definitely contribute to siting delay, effort, and cost. In some cases, they prove a significant disincentive to facility development.

State regulations can also add to the complexity of the siting process. The trend is for States to act on their own authority to regulate activities in response to environmental or other public concerns. The "new Federalism" has led to some siting disputes that pit States' rights against Federal authority. This issue is an important component in the conflict over Yucca Mountain, for example. Such conflicts arise frequently in cases that involve the disposal of radioactive waste.

3.2.1.1 Conflicting Policies, Laws, and Regulations and Repetitive Reviews

Complaints are widespread that overly complex, cumbersome, and inconsistent laws and regulations are making the siting of new facilities unnecessarily time-consuming and expensive. Conflicts between regulations can be inadvertent or intentional. Deliberate contradictions may reflect competing values or positions by different agencies or levels of government. In some instances, the conflict involves jurisdictional disputes concerning the fundamental rights and powers of different levels of government. In other instances, regulations focused on one objective hinder the achievement of other objectives. For example, coastal zone management regulations seriously constrain oil and gas development and facility siting.

Often, multiple jurisdictions claim regulatory authority over aspects of the siting process. Multiple Federal and multiple State agencies may identify requirements for such projects as nuclear power plants and hydroelectric facilities, and each may claim some review authority. Project proponents complain that multiple reviews unnecessarily increase both the cost of siting and the time required to complete it: documentation requirements are significant, and the process of obtaining the necessary reviews and approvals can be lengthy. Lack of effective coordination among regulatory bodies and failure of regulators to meet review and approval schedules aggravate this problem (Armour, 1991; Choi, 1984). In addition, inconsistent requirements of the various agencies may pose a barrier.

Even if conflicts between regulatory requirements can ultimately be resolved, resolution often requires extensive negotiation, litigation, or both, adding further uncertainty to the siting process. Frequently, the conflict results from varying legal interpretations that must be resolved through litigation. This is the case for the Waste Isolation Pilot Plant and Yucca Mountain repositories, as well as for transuranic and high-level waste facilities currently under development by the Federal government. The potential for costly and time-consuming legal conflicts constitutes a significant disincentive to investment and project initiation.

3.2.1.2 Overly Restrictive Requirements and Interpretations

Some industry representatives believe that overly restrictive regulations increase the difficulty of siting facilities without contributing to environmental protection, public or worker safety, or consumer protection. For example, many regard the NO_x emission and visibility standards established in the Clean Air Act Amendments as overly restrictive.

Many proponents of energy facilities hold that the interpretation placed on these requirements by some Federal agencies, such as the National Park Service, are also overly restrictive. An extreme contention is that, should the National Park Service position be implemented, coal and oil will be eliminated as usable fuels in many parts of the country. Some aspects of the Coastal Zone Management regulations are also commonly viewed as unnecessary barriers to energy development. In some cases, stakeholders share a consensus that existing regulations are outdated and/or overly restrictive. More commonly, however, a regulation viewed as overly restrictive by one stakeholder has strong support from some other interested party or agency.

3.2.1.3 Unclear and Unstable Requirements and Regulatory Procedures

Another difficulty that constrains siting is an unclear or unstable regulatory and legal environment, which increases the risk that a proposed project will not be sited within an established time frame or budget. Siting initiatives can be delayed in anticipation of new regulations (such as the Clean Air Act Amendments) because of the regulatory uncertainty created by the impending action. They can also be delayed by iterative changes to the regulations. This occurred to the nuclear

power industry during the 1970s, when siting and construction decisions could not keep ahead of changes in the governing regulations. It is generally agreed that there is a “shakedown” period for a new regulation during which it is especially difficult and time-consuming to steer a facility through the regulatory process. Whatever the source, any instability or lack of clarity in the regulatory environment can act as a disincentive to investment.

3.2.1.4 Lack of Public Confidence in Regulatory Compliance

If the public does not have confidence and trust in the facility manager or its regulators, opposition to the proposed siting is much more likely. A key factor in public support is the trust that the facility owner or operator will operate the facility safely and in compliance with regulations and permit requirements, and that regulators will maintain appropriate vigilance and act to ensure compliance when necessary. Strong opposition is to be expected when the proposed manager of the facility has a history of poor management; violation of agreements, permits, or regulations; or of misrepresentation, secrecy, or deceit in dealing with regulators and the public. It can also occur when regulators have failed to detect serious violations in a timely manner, respond appropriately to citizen concerns, or take aggressive corrective actions. In recent years, for example, the Federal Energy Regulatory Commission has formed a compliance division that ensures that the environmental conditions in hydroelectric licenses are implemented. The Federal Energy Regulatory Commission also is authorized to levy fines and revoke licenses for non-compliance.

3.2.2 Scientific and Technical Uncertainty

Scientific or technical uncertainty can constrain siting by making it difficult for a project proponent to demonstrate that a facility will meet regulatory requirements. Similarly, the regulatory agencies may not have enough scientific information or technical data to assess the acceptability of a project. When definitive answers to questions concerning project characteristics and impacts are delayed or unavailable, public opposition may grow. In response to scientific and technical uncertainty, additional studies may be required, delaying completion and raising costs.

Constraints resulting from this kind of uncertainty are most likely to occur during periods of change, such as when new technologies are being introduced or when a facility is being subjected to new regulations. For example, scientific uncertainty in regard to well placement has been a primary constraint on off-shore oil and gas exploration and development.

Similarly, it is difficult to predict confidently that current technology will be adequate through long regulatory time frames—for example, the 10,000-year period referenced in safety criteria for nuclear waste repositories. In such cases, the regulatory agencies themselves may not know what information is needed to achieve approval and public acceptance.

It should be noted that this type of constraint is not limited to new technologies or new regulations. Continued uncertainty about potential health effects of electromagnetic fields acts as a significant constraint on the siting of new transmission and distribution lines.

3.2.2.1 Lack of Performance Data for Innovative Facilities

Projects may also be delayed on the grounds that the facility's performance is not well understood or has not been sufficiently demonstrated, making its ability to meet regulatory requirements questionable. If there is concern about the safety of the technology or facility, it may be difficult to get permission to perform the tests necessary to generate the needed documentation. This is likely to be the case for new advanced nuclear power plant designs (for example, advanced liquid metal reactors) and hazardous waste treatment facilities (such as incinerators and vitrification plants). It is particularly problematic for facilities that are not only first-of-a-kind, but one-of-a-kind, such as the nuclear waste repository facilities, where all the burden of developing and implementing new regulations falls upon the individual facility. Deep water and Arctic offshore oil and gas facilities also face this difficulty.

3.2.2.2 Inadequate Understanding of Impacts

Even if the performance of the facility is not in question, a project may be delayed because the facility's impacts are not well enough understood or documented. Depending upon the type of

impact in question, this can cause considerable delay and expense—particularly if the problem requires an understanding of impacts on an environment that is also not well understood (for example, wetlands) by an innovative technology for which operating experience is not available. Potential socioeconomic impacts fall into this category. Establishing agreement about the documentation needed to demonstrate compliance can take extensive time and effort, even with a cooperative regulatory agency.

3.2.3 Economic Uncertainties

Constraints on site development may arise from economic factors as well as scientific or technical ones. Economic factors that discourage the construction of new facilities include an increase in the cost of site development or construction, limited economic benefits, or an increase in the economic risk associated with facility investment. These disincentives may result either from laws or regulations (such as those involving tax or price structure) or from direct market forces. For example, competition for capital and higher rates of return is drawing U.S. oil and gas industry investments overseas and reducing exploration in the U.S.

Energy-related businesses—production, transmission and distribution, and storage—are capital intensive, and require long lead-times from the planning stage to facility utilization. Regulatory uncertainties and anticipated public opposition pose unanswerable questions for facility backers: Will public pressure halt the development and construction of the facility? Will applicable regulations change during construction, increasing the investment of time and cost required to build the facility? Because of such dilemmas, investors in these facilities must be willing to accept little or no short-term payback.

Although return on investment is not a significant consideration for public agencies (except for public sector utilities), budgetary considerations can and do impact siting decisions. Budgetary constraints can result in the delay, deferment, or even cancellation of potential siting initiatives. Some of DOE's proposed projects are in danger of delay or possible cancellation because of competing demands for limited funds.

As greater attention is given to equity and environmental justice issues, facility proponents are increasingly mindful of the need for sufficient returns to compensate losers in the siting equation. In some cases, economic pressures applied to facility sponsors have resulted in useful reformulations of the problem, or in innovative and creative initiatives such as Integrated Resource Planning programs.

3.2.3.1 Tax Structure and Price Structure

Tax and price structure can affect facility construction by encouraging or discouraging investment in certain areas. The effect may be a direct one. For example, Federal tax policies have been used to encourage the development of new energy technologies (e.g., nuclear power or renewables) and to encourage domestic (as opposed to foreign) oil production. Another direct effect on siting decisions followed from the Tax Reform Act of 1986, which placed limits on local governments' ability to finance waste-to-energy facilities with Federally tax-exempt funding. Restrictive price structures, such as those that were imposed on the natural gas industry, also directly affect siting initiatives.

The State business climate, State corporate income tax, worker's compensation, and the State government's attitude toward industrial development can also affect siting decisions in direct or indirect ways. For example, uncertainty about possible changes in tax or price structures, whether at the State or Federal level, can act as a disincentive to investment in new facilities.

3.2.3.2 Market Uncertainty

Market uncertainties can also affect the timing and number of siting initiatives. Lengthy delays can aggravate the effect of this type of uncertainty. New facilities that require large and capital-intensive investments are especially vulnerable. During the early 1980s, market uncertainties were a significant factor in the deferment and abandonment of a number of energy facilities, including the Susitna hydroelectric project in Alaska, oil shale and synthetic fuels facilities in Wyoming and Colorado, and electric generating facilities in Washington.

3.2.3.3 High Investment and Long Time to Payback

Investment decisions involve trade-offs between selecting projects with lower projected life-cycle costs but relatively long payback periods, or selecting projects with higher projected life-cycle costs but relatively quick paybacks. Life-cycle analysis can indicate which option is the lowest overall cost over time. However, if industry, government, consumers, or investment bankers demand quick paybacks, the option with the lowest initial cost may be selected, even though it is not the optimum selection on a life-cycle basis. Energy facilities typically have very high capital investment requirements coupled with long payback times. Many believe that in the U.S., short-term profits are widely favored over long-term performance. As a result, energy facilities are often not the investment of choice.

For such facilities, any factor that lengthens the time between investment and payback (already too long for some investors), or that increases the upfront costs of a facility, can act as a powerful disincentive. It could even lead to a decision to abandon the attempt to site a facility altogether. A current example of a facility undergoing this type of financial stress is Chevron's Gaviota gas and oil processing facility in California. This facility, which represents a major investment, has been unable to initiate full production because Chevron has been unable to reach agreement with State and local officials over transportation issues. On the other hand, the outcome of such financial stress in some instances could be the selection of alternatives that require lower capital investments or that are more likely to be successfully sites.

3.2.3.4 Budgetary Limitations and Financial Constraints

Budgetary limitations and financial constraints affect public and private sector facility proponents in different ways. The national deficit and the resulting competition regarding priorities have caused some public agencies to cut back their plans for new facility construction, even with lower interest rates. Agencies contemplating multiple, large-scale facilities face particular difficulty finding adequate funds to meet out-year expenditure requirements.

The private sector is more directly affected than the public sector by changes in market and price conditions. For private companies, the current business climate influences not only the availability of internal funds, but also the cost and availability of investment capital or loans. There is significant competition for funds available from companies or from other prospective backers (domestic or foreign). Such budgetary and financial constraints affect facility siting principally by reducing or delaying the number of proposed facilities.

3.2.3.5 Coordination of Investment

Factors that affect investment can lead to decisions being made that are inconsistent with the goal of protecting the public interest. For instance, if the undesirable environmental effects associated with the continued operation of a given conventional facility were accurately calculated, it might be found that in the long run it would be less expensive to build a larger plant that would use a new, more efficient, cleaner technology. However, a climate that discourages new siting projects also discourages this kind of choice.

Additionally, major public investments are often undertaken without considering how they will affect each other. States and localities typically make decisions about projects such as road improvements, zoning, schools, and hospitals without considering their relationship to projected facility siting requirements. Such poorly coordinated investments increase both the time and cost of siting facilities. In some areas, private investment may be essential to upgrade and expand the energy-related infrastructure. Whether such projects are publicly or privately sponsored, however, more ways need to be found to encourage a long-term outlook by investors and to minimize unnecessary problems caused by lack of public and private coordination in planning.

3.2.4 Organizational and Institutional Factors

Constraints on successful and timely siting are not all external to the organization proposing the facility. The organization's own inability to function efficiently and cooperatively can contribute to systems uncertainty, constituting a significant constraint on siting of facilities. Internal organizational difficulties can reduce the ability of an organization to field siting initiatives in a

timely manner or to manage the siting process effectively. Proponent organizations that have a poor operating record, that have been secretive or dishonest, or that frequently violate safety or environmental regulations, are likely to evoke public opposition that is difficult to overcome. Complex internal policies and procedures can delay and frustrate initiatives, hindering an organization from implementing effective siting methods. Large, complex organizations can find it difficult to establish the degree of internal consistency and intensity needed to move complex and controversial project proposals through their own internal bureaucracies. Managers involved in the siting process may not be familiar with their organization's internal policies and procedures, or may be resistant to them.

The inability of essential players in the siting process to fulfill their responsibilities in a timely manner can also delay or prevent facility siting. Regulatory agencies that place a low priority on preparing regulatory requirements or reviewing siting proposals in a timely manner, or that are engaged in power struggles with other regulatory agencies, can significantly impede the siting process. Power struggles or conflicting missions within an organization can also occur, resulting in differing interpretations of laws and regulations that can delay siting.

In some cases, the siting process becomes the arena for interorganizational competition and power struggles. Particularly when the siting process involves multiple public agencies, interorganizational competition can become a significant obstacle to the siting process. States' rights issues associated with the high-level waste repository fall within this category as well as recent court rulings on low-level radioactive waste compacts. In cases involving multiple agencies, the proponent can be caught in a frustrating and time-consuming debate that can deter progress toward facility approval. For example, political skirmishes within Congress, or between Congress and the Executive branch, can result in substantial delays in resolving critical issues that affect siting.

3.3 UNIQUE SITING CONSTRAINTS FOR PARTICULAR TYPES OF FACILITIES

Very few siting decisions are likely to encounter a high level of technical and regulatory certainty and a high level of agreement among stakeholders. Almost every facility is affected by legal and

regulatory constraints and by public opposition. For some types of facilities, such as some of the renewables and uranium mines, accurately assessing current constraints is difficult because recent siting experience is limited. Moreover, the importance—and even existence—of constraints can change quickly. New legislation, such as the Clean Air Act Amendments or the Energy Policy Act, can dramatically alter the nature and importance of constraints to the siting of specific facilities.

3.3.1 Extraction

Facilities for energy extraction include coal, oil shale, and uranium mines and their related processing facilities, as well as natural gas and petroleum drilling sites and their related support facilities. In general, technical and regulatory uncertainties for these types of facilities are low: many of the applicable technologies are mature, and the environmental regulations governing mining, on-shore drilling, and processing facilities are well established, so that both proponents and regulators have experience with their implementation. However, exploration for off-shore oil and gas in deep water (e.g., the Gulf of Mexico and Alaska), where the use of cutting-edge technology is being proposed, is more likely to encounter technical and regulatory uncertainties and conflict over the environmental costs involved.

3.3.1.1 Mining and Processing (Coal, Oil Shale, and Uranium)

Currently, the principal barrier to the siting of new mines and processing facilities for oil shale and uranium is the lack of a market for these products. This is a particular problem for oil shale, which is not cost-competitive, and uranium, where excess capacity has limited the development of new facilities. Coal is facing increased competition from natural gas as a fuel for generating facilities because natural gas is more environmentally acceptable to the public (Schleede, 1991, p.13).

Although strict regulatory standards govern the siting, operation, and reclamation of coal mining projects, industry representatives indicate that these regulations are generally manageable and allow the industry to produce reliable and competitively-priced coal supplies. In part this is because many coal producers have been working for a number of years in the areas where new

mines are being located. Consequently, State and Federal agencies, as well as the producers, have experience with the facility and applicable regulatory procedures. However, there is a need to resolve the increased concern about methane emissions from underground coal mines contributing to greenhouse gases.

Previous administration policy analysts identified a need to reduce uncertainty about how potential new environmental constraints under the Surface Mining Control and Reclamation Act would affect coal production. They were concerned that uncertainty would hinder the flow of investment capital to the industry. In general, these analysts recommended several changes to this Act. For instance, the requirement that mined areas be reclaimed could hinder the development of extensive coal extraction and export from Alaska, since reclamation has not yet been demonstrated in Arctic areas. In addition, current regulations were viewed as hindering the use of new mining techniques that would further enhance both safety and economic efficiency.

Industry representatives support the policy of promulgating performance-based standards for mine health and safety (where appropriate). New standards focusing on outcomes would replace the old standards, which often require specific technologies and operating procedures. Performance-based standards would allow operators to meet or exceed health and safety standards more efficiently and at lower cost.

The feasibility of siting oil shale extraction and processing facilities and synthetic fuel facilities depends upon the price of oil. Now and in the near term, oil prices are expected to be too low to support the development of these alternative fuels. Oil shale facilities that were far along in the siting process in Colorado were canceled in response to lowered forecasts of energy prices. A similar situation exists for facilities to produce synthetic fuel from coal. A large synfuels project (the WyCoal Gas facility) had nearly completed the siting process in Wyoming when it was canceled for economic reasons. Although the previous siting work conducted for these facilities should be an asset, the very large capital investment required for these facilities is likely to make investors hesitate to initiate new projects unless higher oil prices are assured.

3.3.1.2 Drilling and Extraction Facilities (Natural Gas and Petroleum)

Most of the new petroleum and natural gas drilling occurring on-shore in the U.S. is located in areas within or adjacent to existing wells and facilities. As a consequence, new wells and facilities are relatively easy to site, although depressed oil prices have limited the number of new wells that have been proposed. Recent modifications of the tax code provide tax incentives to encourage domestic oil exploration and production; these changes may increase the number of new facilities proposed. The objective of the tax and pricing structure is to encourage a moderate increase in domestic oil and gas production, not to follow a “drain America first” policy that escalates domestic production too dramatically.

A number of regulations aimed at protecting air quality may constrain the drilling and extraction of natural gas and petroleum. Oil and gas facility siting must be undertaken in compliance with State and Federal laws that have been designed to meet the societal goal of protecting air quality. Siting in or adjacent to national ambient air quality non-attainment areas, for example, may be difficult. At the State level, the California Clean Air Act of 1988 established a mandate to achieve State air quality objectives by the earliest possible date. New regulations and local air pollution control district plans are reducing allowable emissions from oil and gas operations. New emissions from oil field equipment idling even temporarily must be offset. Critics claim that such requirements will result in no net growth in California oil and gas production and may cause a net decrease. The California Department of Conservation plans to initiate a comprehensive study of air, endangered species, and other environmental regulations that may constrain the future production of onshore oil and gas operations in California.

Wetlands regulations are also a source of restraints on oil and gas production. A substantial proportion of domestic oil and natural gas production is affected by restrictions on development in areas designated as wetlands. Access to wetland areas is becoming increasingly limited as concern for wetlands loss motivates more stringent environmental regulations or permitting requirements. Much of the current oil and gas production in the Gulf Coast wetlands is still primary production. Increased recovery from oil and gas reserves using stepouts (the practice of drilling additional wells around a primary well to increase recovery), water-flooding, infill drilling, or by tertiary

recovery will require the drilling of additional wells and the installation of new surface equipment, e.g., tanks, pumps, and piping. This will result in additional surface impacts that will require permits and mitigation.

Buffer zones placed around oil and gas drilling facilities result in constraints on oil and gas production. Prompted by grassroots environmental organizations, States are now considering such regulations. Oklahoma, for example, has recently proposed regulations that would preclude the siting of oil and gas drilling and production operations within three to five miles of urban areas. Buffer zones established without consideration of actual risks may present unnecessary constraints on oil and gas facility siting.

Regulatory barriers also exist to the siting of wells that must employ horizontal drilling technology in order to be economically viable. Some States prohibit the use of this new technology.

A significant barrier to new drilling is restrictions on oil and gas exploration in the Alaskan National Wildlife Refuge and the Outer Continental Shelf. The Bush administration deferred leases along the coasts of Washington, Oregon, parts of California, the North Atlantic area, and a portion of the eastern Gulf of Mexico. As a result, no new drilling occurred in those areas.

Through the appropriations process, Congress has extended the moratoria on leases for new offshore drilling to other geographical areas. Achieving consistency with the Coastal Zone Management Act now hinders oil and gas development in the outer continental shelf areas outside the Gulf of Mexico. In addition, the EPA is promulgating regulations to limit offshore disposal of produced waters, muds, and cuttings that could affect the economics of specific oil or gas projects. However, natural gas is generally seen as environmentally preferable to coal as a fuel choice for electrical generation, which may help with the siting of new natural gas wells and transmission facilities.

Resource and infrastructure limitations affect other energy development activities such as oil and gas exploration and development, especially in remote locations. Problems include transportation difficulties to and from more established areas; insufficient berthing space for workboats, airport

capacity, or docking capacity for delivery of supplies and equipment; and inadequate office space, housing, and other facilities for support personnel and their families. Regulatory barriers currently block most development of additional pipeline capacity in heavy oil production areas; however, clearance has been obtained to construct pipelines needed to facilitate the export of some California heavy crude.

The most important siting constraint affecting natural gas is the difficulty of obtaining permits to construct new interstate transmission pipelines and associated facilities that could deliver natural gas where it is needed to meet expanding power generation loads (both in utility and non-utility markets). The use of natural gas in power generation is expected to increase dramatically over the next 10 years. Much of this increase in natural gas consumption will be in areas where natural gas has not traditionally been a major power generation fuel—the Midwest, the Mid-Atlantic States, and the Northeast, for example. Adequate gas transmission capacity to meet these increased requirements does not exist and will have to be constructed. Moreover, the planned gas-fired power generation capacity is based almost exclusively on combustion turbine technology, which requires high rapid fuel fluctuations. Partly as a result of this requirement, severe operating requirements are imposed on the supplying pipeline, creating a need for additional associated gas storage and compressor facilities.

It is very difficult and time consuming to obtain all the necessary permits required to build a new gas transmission pipeline. Several new pipelines have been proposed in recent years, and each has faced long delays and costly modification requirements. In passing Order 436 in 1985, the Federal Energy Regulatory Commission intended to streamline the pipeline certification process. Under the "Optional Expedited Certificates" process, project shareholders assume financial risks, optimally reducing the Federal Energy Regulatory Commission's involvement in the certification process. However, the process has remained time consuming and costly. The environmental review process has proven especially difficult, in part because of the frequent involvement of multiple jurisdictions. The difficulties experienced by the Iroquois Gas Transmission System's effort to construct a pipeline from Canada to Long Island, New York, are a case in point. Opposition to this pipeline was voiced by local groups, nationally-known celebrities, and fuel dealers. Proposed

pipeline projects in each region will probably experience similar opposition to planned routes, substantially delaying the project and raising siting costs.

3.3.2 Conversion

Among conversion facilities, the siting of fossil fuel facilities (coal and natural gas) and liquid fuel facilities are especially likely to encounter regulatory and/or technical uncertainty and to generate heated conflict over potential environmental effects. Such difficulties have also characterized nuclear facility siting. To date, renewable energy facilities, with the exception of hydropower, have been less subject to controversy; however, this situation could change as awareness of potential environmental impacts increases.

3.3.2.1 Coal-, Oil-, and Natural Gas-Fired Power Plants

After a hiatus during the 1980s when many utilities had sufficient generating capacity and few new power plants were proposed, interest in the siting of coal- and natural gas-fueled power plants is increasing. New facilities are currently moving through the siting process in many parts of the U.S. Considerable concern exists about emerging barriers to the siting of coal-fired power plants. This concern stems in part from regulatory requirements established in the Clean Air Act Amendments of 1990, particularly the extremely stringent interpretation by some Federal and State agencies of the visibility requirements (Section 169-A). An example of the severity and potential impact of the visibility issue has already been presented. Significantly, the stringent interpretation of this regulation does not appear to result from public concern but rather from a Federal agency's policy interpretation. This may be a situation in which existing statutes and regulations are individually desirable but collectively undesirable because they reduce the ability of regulators to balance national energy and non-energy policy requirements. Reforms may be required to provide additional flexibility in this area.

Increasingly, States are recognizing the negative consequences of coal-fueled plant emissions and trying to ensure that alternative fuels are selected. The use of coal for new electric generating capacity may, in effect, be prohibited in some areas. In California, coal-use proponents are con-

cerned about new regulations that favor alternative fuels by adjusting the price of electricity generated by coal plants so that it is higher than electricity generated by alternative fuels. The effect will be to discourage utilities even from purchasing electricity produced by coal-fired plants located outside the State.

Uncertainty about the specifics of this regulatory approach and its potential geographic application and impacts is reported to be affecting utilities' choice of fuel for new facilities. The increased uncertainty, combined with expected administrative difficulties associated with such new requirements, could lead to utilities deciding to lower their risks by constructing new facilities of their own rather than purchasing electricity from independent power producers. In addition, the requirements are seen as having a potentially significant impact on the price consumers pay for electricity.

Considerable uncertainty about the continued use of fossil fuels arises from the concern that the combustion of such fuels may contribute significantly to global warming. Questions are being raised in the media and in international environmental symposia on this issue. While the answers to many of these questions are the subject of ongoing research, if sufficient media attention is given to the problem, significant public opposition to fossil fuel plants could develop. Eventually, this might lead to the enactment of legislation that would severely limit the use of fossil fuels.

Concern about the negative impact of global warming on global environmental quality may significantly increase conflict over the costs and benefits of coal-fueled power plants. Industry representatives already report higher opposition for coal-fueled plants than for similar facilities fueled by natural gas, which is seen as cleaner and more environmentally benign. A potential additional constraint for coal-fired power plants is the possibility that the Resource Conservation and Recovery Act will be amended to require that fly ash and sludge from the scrubbers be treated as a hazardous material. This would substantially increase the regulatory burden and cost of operating coal-fired plants.

3.3.2.2 Nuclear Power Plants

The rapid growth of nuclear power as a source of electricity in the U.S. began in the 1960s. Between 1972 and 1983, however, plans for over 100 reactors were canceled. About a third of these reactors had construction permits and were already sited. No new plants have been ordered since 1978. In 1990, however, three new nuclear power plants in the U.S. came on line: Comanche Peak-1, Limerick-2, and Seabrook (Nuclear News, 1991).

Today the U.S. contains almost one-quarter of the world's operating nuclear power plants. Among countries with nuclear power plants, the U.S. has the greatest number of licensed reactors (110), the largest megawatt capacity in operations (almost 100,000 megawatt), and the most reactor years of experience (over 1,000). In the last decade, the contribution of nuclear energy in the U.S. grew from 11 percent of total electricity produced to over one-fifth of all electric energy production in 1992.

Current plans for increasing the use of nuclear power reflect lessons learned in bringing the current inventory of nuclear power plants on line and are dependent on the success of efforts to site a permanent repository for high-level nuclear waste or find another acceptable solution for storage and disposal. The future of nuclear power as a feasible technology depends on the satisfactory resolution of the following issues:

- safe permanent nuclear waste disposal
- public acceptance
- economic viability
- predictable economic regulation
- design certification
- commercial standardization
- license renewal

- development of advanced reactors with passive safety features, and
- availability of financing.

These requirements are being addressed through programs that are funded or otherwise supported by DOE, the utility industry, the Electric Power Research Institute, and reactor vendors. As mentioned earlier in this report, these requirements are interrelated. Successful resolution of technical and institutional issues would reduce the financial risk and improve the economics of nuclear power, which in turn would improve the prospects for favorable treatment for nuclear generation by economic regulators using integrated resource planning.

Two of the most critical constraints on siting new nuclear power plants are waste disposal and public acceptance. Programs to site facilities for the temporary storage and ultimate disposal of waste are currently afforded a high priority by DOE and by the Federal Nuclear Waste Negotiator. Although nuclear power is continuing its established excellent record for safety and performance in the U.S., and over 30 sites have previously been approved for reactor construction, current trends point to the need for an open, collaborative dialogue with the public to facilitate the siting of the next new reactor.

The nuclear industry's Nuclear Power Oversight Committee has published its "Strategic Plan for Building New Nuclear Power Plants," which recognizes enhanced public acceptance as a required element. The lead organization in this area, the U.S. Council for Energy Awareness, recognizes the social challenges facing nuclear power plant siting (Warren, 1991). Included among the nuclear issues that should be addressed is the need for emergency preparedness plans that meet local, State, and Federal regulatory requirements and also win public acceptance.

The Energy Policy Act now provides for one-step licensing, a process designed to reduce the delays and uncertainties that have occurred in the siting process. In the past, issues that should have been resolved prior to construction were introduced after the plant was under construction. In one-step licensing, the public will have an opportunity to participate in safety and emergency planning for a proposed plant before a combined construction and operating license is issued,

rather than when the plant is close to operation, and delays are much more costly. One-step licensing will focus on resolving issues before the plant is licensed. Builders will then be responsible for ensuring that the plant is constructed in accordance with the design specifications of the construction license.

In 1989, the Nuclear Regulatory Commission added a new part to its regulations that provides for the issuance of early site permits for future operation and construction of advanced light water reactors. These permits are expected to make possible the early resolution of site-related issues prior to combined construction permit/operating license application proceedings. In 1991, DOE and the nuclear industry cost-shared the Early Site Permit Demonstration Program that is designed to demonstrate the practical implementation of the early site permit regulations. The program is now in its final Phase that calls for site specific activities, licensing, and permit approval of an actual site. The program will address environmental, institutional, and public acceptance concerns for nuclear power plant siting. However, an extremely complex regulatory environment and vehement public opposition have created a hostile environment for nuclear power plants that has raised costs, increased siting and construction time, and produced uncertainty.

Competition between Federal and State agencies for control of the nuclear power plant licensing processes has resulted in some States establishing their own siting requirements—including report preparation, review, and hearings. Such State-level requirements have increased the complexity of the licensing process. In addition, States have won a Supreme Court test of their right to block new nuclear power plant construction until a permanent method of waste disposal is established. Some maintain that no new commercial nuclear power plants will be constructed until the new inherently safe plant designs are developed.

Nuclear energy development will undoubtedly slow in the 1990s; only two more plants are currently scheduled for commercial starts in the 1990s. A demonstration of the process of re-licensing existing facilities was delayed when Yankee Rowe, the first U.S. nuclear power plant expected to apply for a renewal license, was retired instead. In addition, Northern States Power

Company recently announced that it will delay submitting a license renewal application for its Monticello Plant.

3.3.2.3 Renewable Energy Facilities

Renewable energy electricity sources include hydropower, biomass, municipal solid waste, solar energy conversion, wind turbine farms, geothermal, and water pumped storage facilities. Hydropower is already in widespread use. Other renewable energy technologies are being considered for large-scale commercial application, and several of these technologies are already in commercial operation (White, Andrews, and Stauffer, 1992). The 1978 passage of the Public Utility Regulatory Policies Act modified regulations in order to allow Independent Power Producers that meet certain criteria to develop and sell electricity to utilities. This removed a significant barrier to the development of small-scale renewable energy facilities such as biomass, wind, solar, and geothermal.

The Energy Policy Act amends the Public Utility Regulatory Policies Act to further broaden competition among suppliers, easing regulations of Independent Power Producers and allowing the Federal Energy Regulatory Commission to require utilities to grant Independent Power Producers access to transmission services. These measures are likely to serve as an incentive for the development of renewable energy-powered electricity generating facilities. Cost competitiveness continues to be a barrier to the development of some renewable energy resources, notably photovoltaics, and to a lesser extent, wind, solar thermal, biomass, and geothermal facilities. The greatest single constraint to renewable energy technologies is that many are in relatively early stages of development and have not yet been commercially proven.

Many Federal and State resource agencies, the general public, and environmental groups tend to view renewable energy-powered facilities more favorably than fossil or nuclear-fueled facilities. However, conflicts over costs and benefits may arise as more and larger renewable energy facilities are proposed and as their environmental and socioeconomic impacts are more closely scrutinized. The location of any facility in an environmentally sensitive area is likely to cause siting difficulties. Two geothermal facilities in Oregon, for example, may face opposition from environ-

mental organizations because of their proposed location in environmentally sensitive areas. One potential site is in a national park (Elford Desert) and may involve endangered species; the other is in a popular recreational area (Newberry Crater).

3.3.2.4 Hydropower

While hydropower is a mature technology, conflicting and overlapping regulatory and environmental regulations have been identified as significant constraints to hydropower's competing effectively as an electricity source. Despite hydropower's lack of harmful emissions, there has been strong public opposition to the development of additional hydropower facilities, and stringent regulatory controls have been imposed.

Hydropower has frequently involved resource use conflicts and concern about hydropower's environmental impacts on fisheries, water quality, aesthetics, whitewater boating, and endangered species. Conflicting requirements at the Federal and State levels that focus only on environmental resource (excluding air quality), combined with the imposition of mandatory conditions in Federal Energy Regulatory Commission licenses, have increased the time needed to complete the hydropower licensing process. As a result, some potential projects have been rendered unfeasible.

The Energy Policy Act grants the Department of the Interior and the U.S. Department of Agriculture permitting authority for new hydropower facilities on some Federal lands. While it restricts the licensing of new dams in national parks, the Energy Policy Act facilitates hydropower licensing by allowing third party preparation of environmental impact statements and preparation of environmental assessments by project proponents. The Energy Policy Act also requires DOE to study opportunities to increase hydropower generation at existing Federal facilities.

In at least some parts of the country, public opposition to the development of additional hydropower facilities is increasing. This stance results from concern about environmental impacts (e.g., habitat destruction and endangered salmon runs in the Pacific Northwest) and competing resource uses (e.g., commercial fishing, recreation, downstream water quality and quantity). Public opposi-

tion is now sufficiently intense to significantly hinder additional hydropower development. Pumped storage hydropower facilities generally face similar constraints.

3.3.2.5 Biomass

The general public's opinion of renewable energy facilities will be influenced by environmental organizations, which have to date generally favored renewable facilities (except large-scale hydropower) as alternatives to the fossil fuel and nuclear power plants they oppose. However, as facilities using renewables such as biomass, municipal solid waste, and solar energy become more prevalent, these organizations may begin to take issue with their impacts on land use and air quality, as well as their transmission requirements. The very large land areas required to support biomass generation of electricity, for example, have not yet become well recognized. As additional facilities are constructed, resource use conflicts and concerns over the environmental impacts of cultivation and harvesting are likely to increase.

Biomass production may cause erosion and depletion of soil nutrients, affect other agriculture, limit water resources, and degrade water quality (Placet and Humphreys, 1991). Several biomass facilities faced heavy opposition in Michigan, as communities objected to the harvesting of trees to feed the facility. Concern over the emissions of biomass facilities and disposal of their ash is growing (Frankena, 1989).

3.3.2.6 Municipal Solid Waste-to-Energy Plants (MSW)

Municipal solid waste electricity plants involve both waste and incineration, neither of which is popular with the public. Proponents of recycling have objected to incineration of municipal solid waste in biomass facilities. For these and other reasons, not everyone views municipal solid waste as a renewable energy source.

Municipal solid waste plants use mass-burn technology to convert heat to electricity. However, the primary purpose of most existing facilities has been to reduce landfill needs; electricity generation has been a secondary benefit. Municipal solid waste significantly reduces the solid waste

volume that would otherwise require disposal in landfills. However, the process may also create air pollution (Placet and Humphreys, 1991). An additional drawback is that municipal solid waste ash may have to be handled as a hazardous material. Experience with regional waste facilities has shown that importing municipal solid waste from outside the immediate vicinity results in strong public opposition. Despite the fact that municipal solid waste emissions are highly regulated and municipal solid wastes have a good performance record overall, proposals for facilities involving incinerators, emissions, and hazardous waste create public opposition and siting difficulty.

3.3.2.7 Solar

For most parts of the country, solar electricity generation is currently neither economically competitive nor cost effective. However, advancements in technology are improving solar efficiency rates, while mass production is lowering costs. Solar thermal collectors are feeding electricity into the Southern California Edison utility network. The solar collectors are cylindrically parabolic mirrors with a north-south axis. The mirrors focus on a steel tub carrying heat-transfer fluid, which is then pumped through heat exchangers to boil water and produce electricity by using a conventional steam turbine.

Solar technology is environmentally benign in terms of direct greenhouse gas emissions or smog creation (Smith, 1991). However, as larger scale solar facilities are developed, concerns over land use, life cycle environmental costs, and transmission lines are likely to increase. At the same time, additional experience and streamlined production of solar technology components is likely to reduce the institutional obstacles involved in incorporating solar-generated electricity into the power grid.

3.3.2.8 Wind

Wind farms, some of which supply electricity in California and other western states, have become more financially attractive as procedures for feeding wind-generated electricity into the power grid have become institutionalized (Smith, 1991; Weinberg and Williams, 1990). One of the key obstacles to wind generation of electricity has been a technical one: the difficulty of developing a

design that can withstand variable wind speeds and vandalism while retaining sufficient generating efficiency. In some areas, public opposition to the noise and visual impact of the facilities has been an additional barrier. Another concern is the potential disruption of avian pathways.

3.3.2.9 Liquid Fuels Production and Processing

The siting of petroleum refineries has been a problem since the 1970s (Randle, 1981; Duerksen, 1979; Chemical Engineering, 1977). When refinery sitings were proposed in coastal zone areas to handle imports, opponents objected on the basis of refineries' environmental and visual impact, as well as economic concerns uniquely associated with coastal zone development (Gillespie and Clark, 1979; Marcus and Smith, 1979). These objections have been raised primarily for east coast petroleum refineries. However, protection of vista, or viewshed, has also hindered oil and gas facility siting on the west coast, especially offshore exploration and production platforms.

Issues historically associated with the siting of refinery projects include crude oil pricing policies, air quality issues, and other environmental concerns. The need to develop technologies to reduce emissions of hydrocarbons has significantly constrained siting of additional refineries. If additional refineries are introduced in areas already experiencing air quality degradation, an incremental burden is placed on the environment and resource base. Other constraints on siting include:

- A complex, cumbersome regulatory process that requires extensive documentation and paperwork to meet Federal, state, and local permitting requirements. For example, 65 permits were required to construct a petrochemical complex (5 Federal, 40 state, 20 county) in California. The company spent \$2 million in 2 years to obtain a total of 4 permits. Chevron's Gaviota gas and oil processing facility, referred to above, provides another example of the same difficulty. The project is currently delayed because agreement cannot be reached on a transportation issue.
- State taxes and regulations. As with the siting of other facilities, refinery siting decisions are affected by the State business climate, including State corporate income tax, worker's compensation, and the state's attitude toward industrial development.
- Resource and infrastructure limitations such as the lack of an adequate water supply, infrastructure, and energy supplies. This is a particular problem in places like Alaska.

The environmental concerns identified in a case study of the Portsmouth oil refinery by Choi (1984) appear to still hold, and are likely to affect siting of new refineries:

- Citizen and environmental groups were opposed to “foul smells” generated by a neighboring refinery. This experience influenced their decision on the proposed siting.
- Environmental concerns included woodland and cropland destruction, loss of water habitat because of dredging, and wastewater pollution.
- The EPA, U.S. Fish and Wildlife Service, and the National Marine Fisheries Service opposed the Portsmouth oil refinery permit under consideration by the U.S. Army Corps of Engineers because of concerns that the refinery would: (1) place an unacceptable burden on the region’s ground-water supply, (2) degrade the already jeopardized water quality of the area, (3) add to the area’s severe air pollution problem, and (4) speed the filling of a local landfill with dredge spoil.

Institutional constraints may also affect proposed sitings for production and processing facilities. A complex regulatory structure that included the U.S. Army Corps of Engineers, the Environmental Protection Agency, the Department of Interior, the Department of Commerce, and the State Air Pollution Control Board created a lengthy approval process for production facilities that is difficult to negotiate. Conflicting goals and resulting differences in interpretation of procedures and regulations among the agencies aggravated the problem. The interpretation of the Clean Air Act’s Section 169–A that some found overly stringent was one of the barriers that affected the siting of the Portsmouth Oil Refinery.

To a lesser extent, the siting of synfuel plants has faced impediments similar to those hindering oil refinery siting efforts. However, synfuel plants are commonly sited inland and away from major urban areas where public opposition is more likely. Access to water for the production of synthetic fuel from coal, new Clean Air Act pollution control requirements, and capital-investment costs are major factors affecting the siting of these facilities. The issues associated with interpretation of the Clean Air Act also apply to these facilities.

Production of alcohol for use as an energy source has not yet encountered the siting constraints associated with fossil fuels. Similar to the production of electricity from biomass, production of

alcohol from biomass requires either the conversion of acreage currently used for food production or the development of additional large tracts of land dedicated to energy crops. In addition, the siting of conversion or production facilities, though currently not a major problem, could face constraints similar to those associated with other industrial or energy facilities.

3.3.3 Transmission, Storage, and Distribution

Siting of transmission, storage, and distribution facilities is also likely to encounter technical and regulatory uncertainties as well as conflict over costs and benefits.

3.3.3.1 Electricity

Expanding residential and industrial development is increasingly limiting the number and location of available corridors for transmission and distribution. When possible sites are identified, utilities must often address several major issues. These include technical and associated uncertainties about the potential dangers of electromagnetic fields, regulatory uncertainties, and opposition based on aesthetic and environmental values. Utilities have responded in several ways to concerns about the aesthetic appearance of new lines, the perceived adverse effects on real-estate values, and potential impacts on farmland. They have conducted additional research on electromagnetic field effects, sponsored education and awareness campaigns, tried to make the structures and surrounding landscape associated with transmission and delivery lines more aesthetically pleasing, modified design and operation lines to reduce field strengths, sited new transmission and distribution lines in alternative locations where possible, and even sited some new lines underground.

Other controversial environmental issues that have been raised as new transmission and distribution lines are sited include the use of herbicides around line sites, protection of designated historical sites, and impacts on the habitats of endangered species (Transmission & Distribution, 1992). The need to meet frequently untested wetlands protection and mitigation requirements, which are complex and sometimes not clearly delineated, have also made siting efforts more complex and difficult.

As with other corridor projects, e.g., highways and pipelines, the difficulties of overlapping jurisdictions, slow review, and conflicting or unclear regulations constrain siting efforts. Burdensome internal procedures and requirements have often hindered expeditious siting. There have been difficulties, for example, setting up agreements among collaborating utilities in cases where other utilities want to join with a Federal power authority in constructing a transmission or distribution line. A potential constraint in some areas is that access may not be permitted to sites except by foot or helicopter.

3.3.3.2 Fossil and Liquid Fuels

Transmission, storage, and distribution facilities for fossil and liquid fuels include pipelines, storage facilities such as underground tanks or liquefied natural gas terminals, port facilities, and transportation infrastructure. Developing these facilities in coastal zones presents constraints similar to those encountered by other energy facilities, namely, public opposition to coastal zone development and burdensome and conflicting permitting requirements. For instance, the development of the Point Conception, California liquefied natural gas facility in the late 1970s faced concerns over the location of a safety-sensitive facility near an earthquake fault, tribal objections to the proposed land use, various environmental concerns associated with the facility (habitat destruction, visual impacts, infrastructure requirements), competing land use interests, and ratepayer opposition to costs associated with the facility.

The Coastal Zone Management Act has provided an additional mechanism for States and local governments to establish compatibility requirements and use restrictions that have thwarted facility siting efforts in a number of states, including Florida, California, and Oregon. These issues are relevant to current coastal zone development efforts. Obstacles facing the siting of natural gas pipelines have been described previously in the discussion of oil and gas extraction.

3.3.4 Waste Treatment and Disposal and Environmental Cleanup

Waste treatment and disposal facilities have experienced increasing difficulty at each step of the siting process. Public opposition to waste handling facilities of all types has increased dramatically

over the past decade, extending even to the siting of municipal solid waste facilities. Proposals to site hazardous and radioactive waste facilities have generally met with well organized, vehement public opposition. Resistance has been particularly strong and effective against radioactive waste facilities, to the point that elected officials are generally unwilling to publicly support activities that may be viewed as facilitating the siting effort. The choice of location for many proposed hazardous waste facilities also raises questions about the equity and fairness of the process—a major source of contention for many sites.

These facilities are required to meet complex and sometimes contradictory regulatory requirements that are subject to frequent change. As a result, the permitting process is complex, ill-defined, and unstable. This creates many difficulties for facility proponents and regulators alike. The obstacles posed by the regulatory complexity facing proponents of hazardous waste facilities can hardly be overstated. Conflicting requirements, vague regulations, and “first-time through” learning curves all slow up the process and greatly increase the cost, particularly when a concerned public is demanding justification of every decision made. The stringent public scrutiny applied to hazardous waste facilities and environmental cleanup activities is also a factor in the slow pace of regulatory review and approval.

3.3.5 Non-Energy Science and Engineering

The slow pace of siting extends to non-energy science and engineering facilities, even those not opposed by the host community. In part this reflects cumbersome, inefficient, or inflexible internal procedures. Another major factor is the cumbersome regulatory processes and multiple permit requirements that apply to nearly all siting efforts in the 1990s. There are some indications that non-energy facility proponents do not capitalize on the advantage of having an accepting host community and regulatory environment. Sponsors sometimes mistakenly adopt rigorous, defensive-oriented procedures for projects faced with entrenched opposition. They also fail to adopt more quick-moving procedures that would enable them to move ahead expeditiously in the absence of major obstacles.

3.4 QUALITATIVE ASSESSMENT OF POTENTIAL SITING DIFFICULTIES

Siting decisions are always strongly influenced by local conditions and concerns, and it is always risky to generalize about how easy or difficult it will be to site a given facility in a particular location. However, with strong caveats in mind, it is possible to identify particular facility types and assess the nature and strengths of the siting constraints they are most likely to face.

The extremes are easiest to identify. Facilities where controversy and uncertainty are both low—where technologies are mature, regulations well established, associated advantages and disadvantages familiar, and the facility generally acceptable to the various stakeholders—are usually easiest to site. Examples include extraction facilities for coal and facilities for on-shore oil and gas exploration that are located in or near existing facilities and wells. Facilities with the opposite profile, i.e., high disagreement among stakeholders and high technical or systems uncertainty, are often quite difficult to site. Nuclear waste storage and disposal facilities, hazardous waste incineration, and, increasingly, coal-fired power plants fall into this general area.

The majority of energy facilities fall somewhere between these two extremes. Increased importance of environmental values combined with uncertainty over cumulative and long-term impacts and regulatory uncertainty are likely to result in siting difficulties for almost all proposed facilities.

Siting of many types of facilities will be a priority activity in the 1990s. This is true both because of their relevance to Administration goals and as a result of the research and development investment required and encouraged by the Energy Policy Act of 1992. Priority for siting energy facilities is likely to be given to renewables and natural gas. While these are currently viewed with favor both by the Administration and by many segments of the public, it may be premature to assume that such facilities will necessarily be easiest to site. For example, the technologies involved in production and distribution of natural gas are mature, and gas is viewed as “clean” and environmentally acceptable. But providing gas to the consumer actually involves the siting of several types of facilities, many of which are likely to be unpopular: extraction facilities, interstate transmission pipelines, storage facilities such as underground tanks or liquefied natural gas termi-

nals, and, possibly gas-fired power plants for electricity generation. As a result, siting may be more complex than might initially be expected.

Even if high levels of agreement and technical and regulatory certainty exist at the extraction stage (e.g., near existing wells), other needed facilities may encounter constraints. For example, construction of the Canada-Long Island transmission pipeline has encountered strong stakeholder disagreement and delays due to the need for regulatory permits involving multiple jurisdictions. Similarly, liquefied natural gas terminals and port facilities are likely to encounter a high level of disagreement and uncertainty over coastal zone development issues and permitting requirements. Meeting Administration goals for natural gas will require resolving a variety of siting and infrastructure constraints.

Finally, siting of renewable energy sources such as solar, geothermal, biomass, and wind farms also may be more complex than initially envisaged. As more renewable energy facilities are proposed and as awareness of their environmental impacts increases, achieving stakeholder agreement on siting may become increasingly difficult. These facilities, which typically require large land areas,⁸ may encounter natural resource conflicts. Biomass facilities may also engender stakeholder disagreement over erosion, depletion of soil, and harvesting of trees; wind farms may be opposed because of the noise, visual impacts, and disruption of avian pathways. In addition, distribution of these forms of energy to the consumer will require construction of electricity transmission lines, which are associated with a number of obstacles, not the least of which is the high level of uncertainty concerning the possible health effects of the electromagnetic fields associated with line sites.

In sum, it seems evident that siting is becoming more difficult for all types of facilities, with little relief in site.

⁸ Non-renewable energy technologies may also require considerable land use requirements for extraction, transport, conversion, and waste operations.

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3.6 PERSONAL COMMUNICATIONS

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4.0 SITING CONSTRAINTS: CONSEQUENCES FOR ADMINISTRATION GOALS

The exact nature of the siting problem is difficult to characterize. Market forces alone will not solve the many complex problems involved. But the U.S. Department of Energy can play a constructive role in developing policy initiatives pertaining to the siting of energy facilities. Its role was most recently highlighted in the Energy Policy Act of 1992 directives that seek to ameliorate siting constraints.

Additional possible initiatives have been developed by a DOE Working Group on Energy Facility Siting in initial consultations with stakeholders.

4.1 U.S. DEPARTMENT OF ENERGY CAN PLAY A CONSTRUCTIVE ROLE IN ENERGY FACILITY SITING POLICY

Given the extent of siting needs and the scope of siting constraints, what is the exact nature of the siting problem? Was it one that the Federal government could help ameliorate, or could market forces “solve” the problem on their own? After all, facilities have been sited in the past and continue to be sited at present, even in the face of a variety of difficult constraints.

There does not seem to be any easy way to ascertain the exact nature of the problem on a national basis. Each facility has its own unique set of characteristics and faces its own unique set of constraints. Siting inefficiencies cause, at a minimum, serious delays that result in adverse economic, environmental, and energy impacts. In certain cases, the siting process does not proceed at all and disrupts development of needed national infrastructure. It is also clear that market forces alone, without additional direction or new incentives, cannot be relied upon to “solve” these problems.

Concrete solutions to remove siting constraints require consensus among levels and branches of government as well as between public and private stakeholders. At the Federal level, DOE has a constructive role to play in identifying and implementing siting policy alternatives.

The Department’s role was most recently highlighted in the Energy Policy Act directives that seek to ameliorate siting constraints. The Energy Policy Act provides market incentives and supports research, development, demonstration, and commercialization for renewables. It provides incentives for utilities that operate facilities producing electricity from solar, wind, geothermal, or

biomass energy. It also establishes a new demonstration and commercialization program for renewable energy technologies, similar to the Clean Coal Technology program.

The Act requires DOE and the U.S. Department of Commerce to work together to promote the export of renewables; the Department of Commerce is required to develop a database on renewable energy opportunities in developing countries. Finally, the Act provides funding for Federally-sponsored training of energy managers from less developed countries.

Other Energy Policy Act siting-related initiatives concern licensing. The Energy Policy Act partially streamlines the licensing of hydroelectric plants by allowing third-party contractors to prepare some environmental documents and conduct review; it also gives the Nuclear Regulatory Commission statutory authority to issue, before plant construction, a one-step license combining the construction permit and the operating license.

The Energy Policy Act provisions address the siting of a permanent nuclear waste repository at Yucca Mountain, Nevada. It requires that the Environmental Protection Agency health and safety standards for the protection of the public from releases of radioactive materials stored at Yucca Mountain be based on recommendations of the National Academy of Sciences. The Act will also speed the Environmental Protection Agency promulgation of regulations relating to repository safety; ensure that the regulations are based on reasonable scientific assumptions; and enable dose-based standards to be ascertainable with a greater degree of certainty than previously envisioned standards.

4.2 FAILURE TO ADDRESS SITING CONSTRAINTS WILL IMPEDE PROGRESS TOWARD ADMINISTRATION ENERGY, ECONOMIC, ENVIRONMENTAL GOALS

Another reason why siting policies cannot be left to the vagaries of the "marketplace" is that failure to act decisively to ameliorate siting constraints will seriously impact our ability to achieve key Administration energy, economic, and environmental goals.

As Secretary O'Leary said in her opening statement at her confirmation hearing this January:

For too long, energy policy has been made in a vacuum. The health and the quality of our environment and economic performance are linked to our energy policy decisions. That is why we will develop a strategy to integrate all three—energy policy, environmental policy, and economic policy. The outcome of this effort should be to maximize energy options available to the nation while protecting the environment and ensuring economic growth....

We need to increase the use of natural gas because it's cleaner than other fossil fuels, creates jobs, and is an abundant domestic resource. We need to increase our reliance on renewable energy, especially in the face of global climate change. We also need to develop technologies which will allow us to increase efficiency and reliance on renewable energy resources.

Since her confirmation, Secretary O'Leary has often referred to the "three E's" regarding overall energy policy directives, but consideration of energy, environment, and economy is no less important when discussing specific issues governing energy facility siting. In terms of energy, failure to expand the distribution network for natural gas will impede the rapid expansion of natural gas use envisioned by Secretary O'Leary. Siting new facilities for distribution and consumption of compressed and liquid natural gas will be required to meet Administration targets for consumer acceptance of natural gas vehicles. Neglecting the siting constraints unique to renewable energy—land use, road construction, disruption of avian pathways, and aesthetics—could seriously impede the competitive advantage of the renewable technology manufacturers while delaying our nation's ability to reduce dependence on foreign oil.

With regard to the environment, it is desirable to replace aging energy facilities with plants that utilize newer, more environmentally benign, technologies. Current inefficiencies in the siting process—that an effective national policy could rectify—delay our ability to bring new technologies on line expeditiously. In addition, if the nation is unsuccessful in its attempt to consolidate the storage of high- and low-level nuclear waste as well as hazardous wastes in one or more central-

ized facilities, these radioactive and hazardous materials will remain spread dangerously in hundreds of sites throughout the country.

On the economic side, our continued use of older, less efficient energy facilities drives up the cost of U.S. energy, and hence, the cost of U.S. products, negatively impacting national competitiveness. Neglecting siting constraints on new, more efficient energy facilities contributes to this problem.

4.3 POTENTIAL POLICY INITIATIVES

What sort of actions will be needed to ameliorate siting problems and therefore avoid the negative consequences posited above? What approach is most suited to meeting Secretary O'Leary's strategy of integrating the "three E's"?

Siting decisions may be made routinely, within established administrative processes in situations characterized by a low level of technical uncertainty and a relatively high level of agreement among stakeholders. Such traditional, relatively closed approaches may be appropriate, for example, in siting new on-shore petroleum and natural gas drilling in areas within or adjacent to existing wells. As discussed in the preceding chapter, however, many siting decisions are likely to occur in contexts marked by great technical uncertainty and high levels of disagreement among stakeholders. Traditional approaches in these circumstances must therefore be modified if siting is to occur.

If technical uncertainties increase, while agreement among stakeholders remains fairly high, relatively small adjustments may be required in the decision process. For example, independent consultants may be called upon to provide additional information and expert judgment or, given the absence of conflict over costs and benefits, stakeholders may be willing for siting to proceed while needed information is gathered. As the level of disagreement among stakeholders increases, however, more fundamental changes in approach will be required. Most facility sitings fall into this category. A need for a different approach is especially apparent, given the recent proliferation of

siting failures and delays over controversial facilities and the associated recognition that the "Decide, Announce, Defend" approach has proven unworkable.

Where important values are at stake, an approach to siting that emphasizes open and transparent decision making, early participation, power sharing, and negotiation among stakeholders is more appropriate. Moreover, such methods are consistent with the Administration's commitment to participatory decisionmaking. In extreme cases, where the level of disagreement and the level of technical uncertainty are very high, as in the case of siting disposal facilities for nuclear waste, resolution may extend beyond the siting agency. Such siting issues may involve system-wide political debate and extensive time before resolution is achieved.

Thus, the kinds of actions needed to ameliorate siting problems must be linked to the sort of problems affecting siting. Several alternatives were identified during a special policy initiatives development workshop held by DOE's Working Group on Energy Facility Siting. Much of the discussion at the workshop was based on preliminary interactions with stakeholders who either spoke at working group meetings or were contacted during several field trips. The workshop produced an extensive list of possible ideas that can be grouped into two broad categories. In terms of stakeholder agreement, ideas address institutional consensus and processes for stakeholder involvement and equity. In terms of technical and systems uncertainty, ideas cover legal and regulatory processes and technology transfer and research, development, and demonstration. A final set of ideas concerns siting-related research and data needs.

The workshop was designed as a brainstorming session to create a wide universe of potential ideas, as opposed to a decisionmaking forum in which specific initiatives would be selected for DOE to pursue. The ideas represent the contributions from various individuals, not a consensus of the participants at the meeting. Not all working group members agree with every initiative. A complete list of ideas from the workshop is found in the Appendix.

4.3.1 Working Group Identified Ideas Related to Stakeholder Agreement

4.3.1.1 Institutional Consensus

When it comes to facility siting, there are legitimate, competing interests among stakeholders—Federal agencies, states, localities, and private interest groups. Organizations and agencies have different missions, and even within a given organization, programs may have opposing goals and priorities. Institutions differ on such matters as the levels of energy services that should be provided, the kinds of facilities that should provide those services, and how various priorities should be established among conflicting choices. Without the support of a qualified consensus, siting of many energy facilities will continue to be delayed and perhaps halted altogether.

Consensus is neither capitulation nor unanimous consent. Rather, institutional consensus implies cooperation and the shared willingness to allow a project to proceed. Institutional consensus takes as given that institutions hold different values and represent different constituencies, and seeks to build from there to achieve a particular objective.

The Working Group identified many initiatives that might contribute to institutional consensus at the Federal level: establishing an Administration task force for regulatory reform, with representatives from industry, the environmental community, and government; convening a national annual conference on facility siting, with participation by representatives of all siting stakeholders; establishing an interagency working group on regulatory matters to streamline permitting procedures; establishing an interagency siting committee; instituting staff exchanges; promoting coordination among Federal agencies with Federal lands to facilitate the siting process for linear facilities such as pipelines; and promoting government procurement policies and programs consistent with national energy policy siting needs.

Incentives for cooperation and innovative land use among regional, state, and local stakeholders also promote institutional consensus. Ideas surfaced by the Working Group as incentives for cooperation include: encouraging regional and State risk and burden sharing; establishing national development zones, focusing on using Federal lands to site power generating facilities; evaluating

military bases located in areas of utility need for co-generation opportunities; establishing mitigation banks whereby a developer receives a credit when he pays into a fund that rebuilds wetlands at a place separate from the site of the new facility; establishing a Federal block grant program to apply to regional transmission and service needs; ensuring that new public works investments are compatible with private sector investments, and that initiatives are consistent with Administration energy policy priorities.

Siting support and information-sharing among the States is yet another means of promoting institutional consensus. Suggested measures to meet support and information-sharing needs include: providing Federal underwriting or technical assistance to help States site their own facilities; providing Federal assistance to help replicate the North Carolina permitting streamlining process; developing a handbook for State and local governments, articulating principles for effective siting and clarifying Federal roles and responsibilities in the siting arena; convening an annual conference for State siting officials; providing Federal assistance to facilitate states' risk-sharing cooperation; and establishing a working group by either Executive Order or legislation that would involve the States in streamlining regulatory procedures.

4.3.1.2 Stakeholder Involvement and Equity/Environmental Justice

As mentioned in Chapter 3, for the siting process to work, stakeholders must be involved. They must have trust in many aspects of the decision making process. They must also believe that the process was fair; that the right factors were considered in reaching the decision; and that those individuals and institutions who should have participated in the decisions did so or at least had the opportunity to do so.

Processes unique to the U.S. Department of Energy, again suggested by the Working Group, include establishing an Office of the Negotiator for Siting Facilities to oversee the process for non-routine siting decisions that have policy implications and require extensive stakeholder involvement; establishing a policy for DOE volunteer sites; selecting a DOE facility to test a model siting process; implementing the recommendations of a DOE Task Force on Radioactive Waste Management dealing with public confidence; providing funds for different constituent

groups to perform scientific analyses and risk assessments during the siting process; funding credible third parties to assess the risks of DOE projects; publicly embracing the National Environmental Policy Act and indicating that the National Environmental Policy Act process will demonstrate the need for the project as well as dealing with the impacts of “no action alternatives”; assessing the Alternative Dispute Resolution Act as a potential resource for DOE siting policy initiatives; and establishing a DOE site selection administrative order to rationalize DOE siting decisions, with the goal of consolidating current procedures, clarifying internal roles and responsibilities in the siting decisionmaking process, and promoting uniformity and consistency throughout the Department.

Potential ideas applicable to all Federal agencies include: legislation guaranteeing equity in the distribution of costs and benefits as a result of siting a facility; and proposing legislation to set up a fund that could be used for facility siting to indemnify risk to property values or other economic disbenefits.

The Working Group also proposed establishing a Federal model strategy for equitable and effective siting procedures. The model would be developed in an inter-agency context. It would include an open communication system; shared decisionmaking authority with the public; public and stakeholder involvement in the decision process throughout the planning and implementation stages of a project; systematic assessment of environmental, socioeconomic, health, safety, and cost/benefit impacts; a requirement that reasonable mitigation actions be taken to reduce community concerns; and the monitoring and evaluation of project impacts and the sharing of monitoring results with the community.

4.3.2 Working Group Identified Ideas Related to Technical and Systems Uncertainty

4.3.2.1 Legal and Regulatory Impacts and Procedures

Some laws and regulations reflect society’s values, and legal and regulatory problems often arise from disagreement among stakeholders. Once enacted, however, laws and regulations frequently

result in complexity and uncertainty in proponents' ability to site new facilities, and thus they are discussed in the context of systems uncertainty.

States and facility developers face at least two kinds of burdens from legal and regulatory impacts and procedures. One is the cumulative effect of environmental and other statutes; the second, overlapping and inconsistent regulatory requirements. The Working Group proposed several policy initiatives to relieve the regulatory burden by making regulatory goals and procedures consistent across Federal and State agencies; minimizing or eliminating areas of jurisdictional overlap and clarifying roles and responsibilities; improving procedural efficiencies within Federal agencies including DOE; and identifying and transferring models of effective and efficient siting procedures across State and Federal agencies.

Specific recommendations related to regulatory impacts include: establishing risk-based procedures so that the focus and scope of siting and licensing administrative activities will apply more directly to the individual facilities in question; periodically reconsidering regulations to ensure they remain justified; evaluating the technical competence and fiduciary trust record of those recommending regulatory streamlining or revision; revisiting the Clean Air Act Amendments to eliminate overlapping administrative requirements and make compliance schedules more attainable; enacting legislative initiatives to promote non-regulatory, market-oriented approaches to environmental externalities and to deal with cumulative regulatory effects; and amending parts of the Clean Water Act, Endangered Species Act, and Clean Air Act Amendments to require the regulator to conduct a good-faith, cost/benefit analysis.

Concerning DOE organization and procedures, Working Group proposals included: creating a position within DOE to function as a process resource or ombudsman, particularly for smaller procedures; developing and carrying out training sessions for senior DOE and private sector managers to enhance their ability to listen as well as to hear each other; promoting delegation of authority from the staff offices to line management to speed internal approvals on siting issues; and making internal administrative procedures more efficient and tailoring them to the nature and scope of the proposed facility.

Regarding organizational arrangements and procedures of other Federal agencies, Working Group suggestions included: eliminating duplication of effort among agencies and encouraging the shared use of results of permitting processes; focusing licensing and administration procedures appropriately for specific facilities; requiring agencies to establish a single siting focus such as an ombudsman or an office of siting; and promulgating an Executive Order directing the Environmental Protection Agency to set standards where they do not currently exist, that under the Clean Air Act would require the Park Service to acquiesce on the issue of visibility standards.

4.3.2.2 Technology Transfer and Research and Development

Much of the nation's need for technical knowledge is met by independent private sector investment, by companies who see their future viability dependent on their ability to make significant technological breakthroughs. However, corporate concerns for acceptable levels of return in a relatively short-term time frame limit the extent of industrial research and development investment. Therefore, Federal and State governments act as catalysts for private efforts and for fostering the dissemination of research, development, and demonstration results, especially for the development of innovative technologies and methods that are viewed as serving the common interest. Examples of such support include providing grants for technologies close to commercialization; establishing research and development centers of excellence; developing business incubators; and establishing consortia of academic, industrial, and governmental partners.

The anticipated need for new energy facilities has many technological implications. For example, the development and refinement of energy efficient and environmentally benign technologies can help justify the replacement of older energy facilities; the satisfactory demonstration of the safety and effectiveness of new technologies will help gain public acceptance; and the efficient deployment of new technologies will help meet Administration technology transfer goals while encouraging cooperation among Federal and State agencies and the private sector.

The Working Group offered the following ideas to promote technology transfer and research, development, and demonstration: examining the role of technology transfer in encouraging infrastructure investment; encouraging utilities and other private sector parties, through tax-credits and cost-sharing, to undertake high-priority, high-risk research, development, and

demonstration; removing environmental and technical barriers to effective technology transfer and developing more “transferable” technologies through early industry participation in the research, development, and demonstration process; allowing a degree of industry proprietary use of information for negotiable time periods, depending on early and mutual collaboration; and using already licensed sites as test beds for research, development, and demonstration.

4.3.3 Working Group Offered Ideas to Identify and Meet Siting-Related Research and Data Needs

DOE and other Federal agencies have had most success in basing siting decisions on economic data, as the costs and benefits in economic terms are more easily measured. Success is less easily achieved when trying to incorporate social and organizational dimensions and processes. Well-designed facilities for energy production and waste disposal have often been rejected for political reasons; many conservation and renewable energy technologies have failed to penetrate to many of the users that would benefit economically; and energy forecasting has suffered from an inadequate understanding of the rates of technology diffusion. The most sophisticated technological and scientific work will be in vain if its results are not used. DOE's and the Administration's mission can be enhanced by paying attention to the institutional and socioeconomic aspects of energy choices.

Sociologists and political scientists have conducted a substantial amount of research on many issues that appear to have a bearing on facility siting. However, little work has been done on reviewing research findings, especially in terms of their applicability to energy or siting policy issues, or on pilot-testing the findings on specific siting projects. A strategic perspective needs to be developed for socioeconomic and political science research on siting issues.

In addition, the nation is extremely diverse in many factors critical to facility siting decision making. More needs to be known about State and regional characteristics to construct regional solutions to facility siting constraints and encourage cooperation among Federal and State players.

To increase knowledge in these areas, the Working Group offered several alternatives that include: developing and publishing regional and local energy status profiles encompassing fore-

casts of energy service needs; regional socioeconomic characteristics; a siting resource assessment tool; and an analysis of the regional regulatory environment. Establishing an independent Bureau of Environmental Statistics was also suggested.

Additional data needs identified by the Working Group led to the following suggestions: compile and disseminate “lessons learned” from non-U.S. experiences in facility siting; examining the constraints of various Federally-owned lands to determine their potential for various uses; assess the impacts of specific regulations focusing on where it is not credible to carry out the regulation; review and assess current and proposed energy research, development, and demonstration initiatives for the purpose of realigning these to be consistent with national siting policies; assess the value of DOE developing an aggressive, proactive posture vis-à-vis the energy industry to promote favorable dispute resolution; assess and optimize the use of existing sites by retrofitting and life-cycle extension; review private sector models of internal cooperation; and study how things get done without consensus and the impact of the actions/decisions made under those circumstances.

5.0 WORKING GROUP TENTATIVE LIST OF IDEAS

The Working Group has identified a tentative list of ideas as a point of departure for further discussion with stakeholders. These ideas address a wide range of issues and involve States, Indian Tribes, stakeholders, other Federal agencies, and the Department of Energy.

This chapter presents nineteen ideas for siting initiatives that show promise for improving energy facility siting processes. The initiatives pertain to State, Tribal, and regional focus and stakeholder interaction, Federal and interagency processes and operations, and DOE's internal programs and organization. As a heuristic device, the list is divided into five categories (although many of the ideas affect more than one category)—Stakeholder Interaction, Equity/Environmental Justice, Strategic Planning, Reinventing Government, and Research. The ideas are drawn from the list of options presented in Chapter 4, and taken as a set, represent a balanced portfolio of policies and actions with near-, mid-, and long-term impacts. Virtually all siting stakeholders are affected by the initiatives, with consensus-building and interagency coordination being strong themes. In choosing from the list of alternatives in the previous chapter, three criteria were employed:

- **Appropriate Federal role:** The Federal government—and its component agencies—are among a diverse and influential set of stakeholders, virtually all of whom have an important role in resolving facility siting issues. The solution to siting and energy deployment problems does not primarily rest with the Federal government (as most key siting actions are taken by State and local governments), but some policy and programmatic actions may be appropriate at the Federal level.
- **Significant impact on siting problem or obstacle:** Ideas were selected based on either their ability to minimize a siting obstacle(s) or to increase understanding of siting dynamics and issues. Many of the ideas impact more than one issue or obstacle.
- **Feasibility of implementation:** The options are relatively straightforward to implement administratively, within reasonable cost constraints, and may be acceptable to a wide range of stakeholders.

Table 5.1 organizes the ideas into the five major categories mentioned above. The table also displays the ideas by the category of policy options discussed in Chapter 4. Each idea is discussed in detail following Table 5.1.

Table 5.1 Tentative List of Ideas by Category and Policy Option

	Institutional Consensus	Stakeholder Involvement and Equity	Legal/ Regulatory Impacts and Procedures	Technology Transfer and RD&D	Siting Related Research and Data Needs
Stakeholder Interaction					
1. Establish a State/Tribal Siting Forum	X	X		X	X
2. Convene National Conference on Energy Facility Siting	X	X			
3. Convene National Workshop of State and Tribal Siting Officials	X		X	X	
4. Develop a State/Tribal Handbook		X	X	X	
Equity/Environmental Justice					
5. Develop Strategic Planning Process for Regional Burden-Sharing	X	X			
6. Explore Feasibility of Mitigation Banks	X	X			
7. Evaluate Compensation Strategies to Distribute Siting-Related Costs and Benefits		X			
Strategic Planning					
8. Explore Coordination of Public and Private Sector Investment Planning	X				
9. Develop Regional Siting Profiles	X				X
10. Explore Feasibility of National Development Zones	X	X	X		X
Reinventing Government					
11. Establish an Interagency Siting Regulatory Action Panel	X		X		
12. Develop a Model Strategy for the Siting of Federal Facilities	X	X	X		
13. Pilot-Test the Model Siting Policy in a Region		X			X
14. Evaluate Federal Organizational Arrangements for Coordinating Facility Siting	X		X		
15. Evaluate Alternative Siting Uses for Surplus Defense Facilities	X			X	
16. Establish DOE Site Selection Administrative Order on Facility Siting to Streamline Internal DOE Procedures	X	X	X		
17. Assess Siting Implications of Recommendations of Task Force on Radioactive Waste Management	X	X	X	X	
18. Establish DOE Office of Facility Siting Policy	X	X	X		
Research					
19. Develop a Siting Research Agenda					X

STAKEHOLDER INTERACTION

IDEA 1: *Establish a State/Tribal Siting Forum*

FOCUS: *State/Tribal Siting Officials, Stakeholder Groups (Industry, Environmentalists) and Other Interested Parties*

DESCRIPTION: The initiative would establish, in coordination with the National Governors Association, the National Council of State Legislatures, the Council of Energy Resource Tribes, and the National Council of American Indians, a State/Tribal Siting Forum. Other organizations could also act as co-sponsors. Membership would include State siting officials (including those dealing with coastal zone management), industry representatives, and representatives of environmental and other interest groups. The primary purpose of the Forum would be to provide a context for building consensus by establishing a framework for the identification and discussion of common siting-related issues. The Forum would also facilitate information and technology transfer, by providing a method for disseminating information on siting-related issues, e.g., successful siting-related strategies, emerging energy technologies, and efficient permitting processes. In addition, the Forum could sponsor or undertake a number of related initiatives such as strategic planning for regional burden sharing (Idea 5) and convening a national conference for energy facility siting (Idea 2).

DISCUSSION: Facility siting issues and related environmental and energy service concerns vary widely in nature and extent among States and regions. State siting officials have expressed the need for a mechanism to exchange information, share ideas, and identify common siting-related issues. Several States have developed promising approaches to streamlining the permitting process. While many of these processes can be successfully replicated elsewhere, currently no structured, institutionalized means of disseminating information about them has been established. Moreover, opportunities may exist for interstate and regional cooperation in developing innovative strategies for addressing facility siting issues. A State/Tribal Siting Forum could facilitate the emergence of these kinds of opportunities.

PROS:

- Serves as a vehicle for institutional consensus-building.
- Provides opportunity for States to share lessons learned.
- Allows for the airing of innovative ideas on siting in a multi-state arena.
- Brings peers together to discuss common issues.
- Provides an opportunity to identify needs for training on topics of general interest, e.g., dispute resolution.
- Reduces barriers to interstate projects and fosters regional approaches to siting.

CONS:

- Resources would be needed for administrative support for the Forum.
- Determining the make-up of the Forum would be problematic: providing representation for everyone who wants a seat at the table would be difficult; limitations on participation could undermine the Forum's effectiveness.
- Individual agencies might resist some Forum recommendations.

ACTIONS REQUIRED: The Secretary to establish a State Siting Forum, in coordination with cognizant organizations.

IDEA 2: *Convene National Conference On Energy Facility Siting*

FOCUS: *Broad Range of Public and Private Sector Stakeholders*

DESCRIPTION: This initiative is to organize and conduct a national conference or workshop on energy facility siting, possibly on an annual basis. The conference would be organized and conducted in coordination, and possible co-sponsorship, with cognizant organizations representing key public and private sector siting stakeholders. The Secretary of Energy would be the keynote speaker.

DISCUSSION: Stakeholders involved in facility siting often have professional associations and membership organizations, many of which hold annual meetings. These meetings provide opportunities for peer interaction, and typically have broad-based agendas, covering a wide variety of topics likely to be of interest to the memberships. However, currently there is no conference that is either devoted exclusively to addressing energy facility siting issues, or that provides opportunities for interaction across stakeholder lines. Such an opportunity is needed to help build the institutional consensus that is a prerequisite to facilitating siting progress.

PROS:

- Brings siting stakeholders together to share perspectives.
- Provides opportunity for Federal agencies to obtain feedback on policies and programs that are under consideration.
- Provides occasion for direct communication among stakeholders who might not otherwise have an opportunity for personal interaction.

CONS:

- Time and space limitations of conference may limit the agenda; omission of some topics may prove frustrating to some participants.
- Organizational travel budgets may be tight, that may, in turn, limit participation.
- Siting issues often emerge unexpectedly; however, lead-time requirements for conference planning mean agenda and speakers will have to be determined months in advance.

ACTION REQUIRED: DOE to organize conference, in cooperation with cognizant stakeholder organization(s). If a DOE Office of Energy Facility Siting Policy is established, that Office would have responsibility for implementing this initiative.

IDEA 3: *Convene National Workshop Of State And Tribal Siting Officials*

FOCUS: *State/Tribal Siting Officials with Professional Interest in the Field*

DESCRIPTION: This initiative would provide a workshop for State and Tribal siting officials, to be co-sponsored by DOE and cognizant State organizations such as the National Governors Association, the National Council of State Legislatures, the Council of Energy Resource Tribes, and the National Council of American Indians.

DISCUSSION: State and Tribal siting officials have expressed a strong interest in meeting with their counterparts from other States to discuss a wide range of siting issues. Like other professionals, they feel a need to exchange ideas with peers, develop innovative solutions to common problems, and share lessons learned. Presently, national workshops or conferences that promote and support an integrated focus on facility siting issues do not exist. This initiative was proposed by the staff of the California State Energy Commission.

PROS:

- Facilitates timely exchange of information on lessons learned in siting activities.
- Provides a forum for DOE and others to announce and discuss siting policies.
- Provides opportunity for interaction among State siting officials, to identify common siting needs.

CONS:

- Each State is organized differently, complicating the identification of the "siting officials" to participate in conferences; this may be clearer at the Tribal level.
- State and Tribal travel budgets may be tight; DOE may need to subsidize participants' costs.

ACTION REQUIRED: Planning for a first workshop is underway by DOE's Office of Policy, Planning and Program Evaluation.

IDEA 4: *Develop a State/Tribal Siting Handbook*

FOCUS: *Information regarding Federal, State, and Tribal siting process for use by States and Tribal Officials*

DESCRIPTION: This initiative would produce a Siting Handbook, primarily for use by States and Indian Tribes, that articulates principles for effective siting and clarifies the Federal role in the siting. To help ensure its relevance to State/Tribal siting needs, the Handbook would be produced with extensive State/Tribal involvement, in cooperation with State associations such as the National Governors Association, the National Council of State Legislatures, the Council of Energy Resource Tribes, and the National Council of American Indians. The Handbook could be a product of the State/Tribal Siting Forum (Idea 1), or it could be developed and published independently, as a joint project of DOE and the National Governors Association/National Council of State Legislatures/Council of Energy Resource Tribes, using the conference and workshop (Ideas 2 and 3) as mechanisms for its input and development.

DISCUSSION: The facility siting process could be enhanced by disseminating information among States and Indian Tribes on siting-related topics, as well as by improving and establishing channels for communication among States and Indian Tribes on siting issues. Several States have made significant advances in simplifying the siting process within their boundaries, embracing principles and employing internal procedures that are worthwhile and practical. State siting officials indicate a strong need to share information among States and Indian Tribes, yet no systematic way to do so exists. This initiative would provide one such vehicle, a user-friendly handbook containing information most likely to be useful to State and Tribal siting authorities. To be useful, the document would have to be updated and reissued periodically (every several years).

PROS:

- Provides a tangible mechanism for disseminating important information, principles, and strategies among States and Indian Tribes.
- Consolidates useful information in retrievable form.
- Provides an opportunity for the exchange of siting information among State officials.

CONS:

- Federal and State policies change frequently; there is a potential for some information to quickly become obsolete.
- It might be difficult to obtain information from some States and Indian Tribes.
- Reissuance will be expensive.

ACTION REQUIRED: Planning for this work is currently underway in DOE's Office of Policy, Planning and Program Evaluation, and would be a topic in the workshop for State and Tribal siting officials (Idea 3).

EQUITY/ENVIRONMENTAL JUSTICE

IDEA 5: *Develop Strategic Planning Process For Regional Burden-Sharing*

FOCUS: *Federal Government Assistance to States and Indian Tribes in Developing Regional Burden-Sharing Process*

DESCRIPTION: This initiative would develop a strategic planning process for the establishment of regional compacts as a means of allowing States/Indian Tribes and regions to share energy infrastructure, thus collectively minimizing siting difficulties. The process would form the basis of regional conferences on infrastructure “burden-sharing” held with the cooperation of State and Tribal organizations. Among the questions that would be addressed:

- How historical experience with regional compacts can contribute to plans for burden-sharing: where and under what circumstances regional compacts have been used, and what the outcome has been;
- To what types of facilities might regional compact siting be most suitable;
- What barriers impede the establishment of regional compacts;
- What other ways exist to achieve burden sharing, and what benefits and costs these alternatives entail;
- What regional commonalties and differences exist in regulatory structures?

DISCUSSION: Significant differences in energy infrastructure needs, rates of economic growth, and resource availability and constraints exist among regions nationwide. For example, some regions have abundant supplies of water, while others face chronic water shortages. Some parts of the country are sparsely populated; others have experienced rapid population growth and have an increased need for electric power. One example of burden sharing would be an agreement among several States under which one State permits the siting of a liquid natural gas facility to provide fuel to adjacent States in return for a neighboring State’s building a power plant to meet the region’s growing demand for electricity.

The nation as a whole has a vested interest in a common set of concerns: energy service needs, economic development, and environmental issues. It may be possible to develop and implement strategies that take advantage of regional variations, to the mutual benefit of a region's inhabitants and the nation as a whole.

A related concept is that of national development zones (see Idea 10), whereby certain kinds of facilities are concentrated in particular areas, to make use of land that a given State considers underutilized.

PROS:

- Helps States and regions meet energy infrastructure needs.
- Allows regions to trade environmental and socioeconomic risks relating to energy facilities.
- Possibly mitigates public opposition based on perceptions that facility-related impacts are not distributed equitably.
- Facilitates land use planning across regional boundaries, thus simplifying identification of linear corridors for pipelines and transmission lines.
- May speed up identification and public acceptance of suitable sites, thereby possibly lowering investment risk.

CONS:

- State rivalries might interfere with development of regional goals.
- Federal and State regulations might limit use of candidate lands or make siting economically infeasible.
- Numerous State and local regulations would need to be identified and compared—a complicated and expensive process.
- It is an open question of whether some States might view this sort of initiative as intrusive.

ACTIONS REQUIRED: Secretary to recommend to the White House and the Office and Management and Budget consideration of an initiative to implement strategic planning for regional burden-sharing.

IDEA 6: *Explore Feasibility Of Mitigation Banks*

FOCUS: *DOE, in Consultation with Stakeholders, Evaluates Concept of Mitigation Banks*

DESCRIPTION: The purpose of this initiative is to identify ways to provide incentives for investment in energy infrastructure, concentrating on impact mitigation. Such a study would develop mechanisms to enable developers of energy facilities to offset negative impacts from the siting of an energy facility. One such mechanism would allow developers of energy facilities to establish an account in a fund established specifically for this purpose and to receive credit for impact mitigation contributions. The developer could draw down on the account in several ways:

- By mitigating negative impacts in the location of the proposed facility, e.g., upgrade local roads in the vicinity of the site;
- By improving an adjacent, unaffected area, e.g., expand a nearby State or national park; and
- By borrowing or purchasing credits with another developer, in order to build a facility.

This study would examine the feasibility of the mitigation bank concept. It would identify and analyze ways the mechanism could be structured and administered, the costs and benefits, and the role of States and localities in deciding how and where the mitigation funds should be applied.

DISCUSSION: The siting process is often delayed over disputes about siting-related impacts, the locus of responsibility for mitigating impacts, and the boundaries of eligibility for receiving compensation. These matters, that can be slow to resolve and costly to address, often serve as deterrents to investment in energy facilities. This option would provide a means to address some of these issues.

PROS:

- Expedites the mitigation of adverse impacts from the siting of energy facilities.
- Brings comfort level to those who might be negatively impacted.

- Similar mechanisms to offset air pollution show promise for success.

CONS:

- Negatively impacted communities might still oppose the proposed facility.
- Administering the fund and deciding on appropriate uses might be difficult.

ACTIONS REQUIRED: DOE to study the concept in cooperation with a variety of stakeholder organizations including the Electric Power Research Institute, the American Petroleum Institute, environmental organizations, etc., and if it seems promising recommend it to the White House for implementation.

IDEA 7: *Evaluate Compensation Strategies to Distribute Siting-Related Costs and Benefits*

FOCUS: *DOE, in Consultation with Stakeholders, Evaluates Concepts of Compensation Strategies*

DESCRIPTION: This initiative would identify and evaluate mechanisms to reduce perceived economic risk and to compensate those who might be adversely affected by the siting of a facility. A number of approaches have been proposed for addressing the concerns of affected parties that a proposed facility will cause negative socioeconomic impacts. Examples of the kinds of approaches that could be assessed include establishing funds to guarantee property values, providing affected parties with energy at a discounted price, and providing investment equity in the developer's enterprise. The study would identify and assess alternatives for energy developers and other siting authorities to develop compensation programs for affected parties, as well as potential Federal and/or State/Tribal roles in implementing those programs. Among the aspects of the strategies that would be analyzed are costs, legal constraints, pros and cons in terms of siting specific kinds of facilities, and likely public perceptions.

DISCUSSION: Many siting delays arise when public opposition develops over fear of negative impacts and perceptions that the siting of a facility will inequitably distribute rewards and burdens. This is particularly true for minority communities. There are indications, both in research literature and in the experience of utilities and others who have sited facilities, that some of this opposition can be ameliorated if the siting process embraces certain principles:

- Distribution of costs and benefits should be fair and equitable, or derived from a decision process agreed upon by those affected as fair and equitable;
- There should be appropriate compensation for those actually negatively impacted, and those benefiting from the project should be the source of compensation; and
- Monitoring should be conducted to detect problems as they arise.

PROS:

- Guaranteeing property values for potentially impacted property owners has been an effective siting tool.
- Greater public acceptance expedites siting and improves return on investment.

CONS:

- Determining property values is relatively straightforward; other socio-environmental losses are more difficult to quantify and compensate for.
- There would be a need to guarantee the guarantee, possibly by setting up an escrow account. Guarantee needs to be more than words on paper.
- Some stakeholders view compensation as bribes for accepting undesirable facilities; they are often more interested in empowerment.
- May increase cost of siting by lowering threshold for claims for compensation.

ACTIONS REQUIRED: DOE to conduct a study to identify and analyze alternative strategies to compensate stakeholders who may be negatively impacted by the siting of a facility.

STRATEGIC PLANNING

IDEA 8: *Explore Coordination of Public and Private Sector Investment Planning*

FOCUS: *State and Private Sector Planning Efforts, Coordination with Federal Agencies*

DESCRIPTION: This initiative would establish a joint interagency effort to integrate public and private sector investment planning relating to the siting of energy facilities. This effort would be aimed at ensuring the compatibility between, and overall cost-effectiveness of, public and private infrastructure investments at future energy facility sites, e.g., highways, airports, ports, waste treatment plants, and subsidized housing. The integrated planning would ideally draw on locally credible regional siting profile data developed by university consortia. The Office of Management and Budget is needed to require participation from pertinent Federal agencies, including DOE, the Environmental Protection Agency, the Department of Interior, the Department of Transportation, the Department of Housing and Urban Development, and the General Services Administration. In addition, the Office of Management and Budget would ensure the proper execution of the benefit/cost analysis guidelines through its interpretation and execution of Executive Orders 12291 and 12564, taking into account the shared costs and benefits of jointly planned and executed public and private investments.

DISCUSSION: All energy facilities are sited with both public and associated private investments. Unfortunately, the strategic planning and selection processes for public investments are typically performed separately from the planning for geographically and functionally related private investments. Incompatible investments are frequently the result. For example, transportation infrastructure may not meet the needs of an energy facility site, an area-wide public sector environmental control and treatment system may be designed without a capacity for adding an appropriate energy facility, or public education systems are not designed to accommodate regional population increases projected in an energy facility siting plan. Benefits are lost and costs incurred through this lack of coordination.

The recent Executive Order on the Privatization of State and Local Government Assets is aimed at removing potential impediments to full and/or partial privatization of public assets, and could be useful to integrate planning. Executive Orders 12291 and 12564 provide guidelines for benefit-cost measurement, choice of appropriate discount rate, treatment of uncertainty, cost-effectiveness analysis, lease-purchase analysis, asset sale analysis, and information technology that could be used to more effectively facilitate public-private planning. Federal, state, and local planners of public works investment would benefit from this planning integration. Data developed by university consortia on regional siting profiles would also facilitate consistent planning.

PROS:

- Cost-effective.
- Avoids additional public and private investment to rectify incompatibilities.
- Mitigates public opposition through functionally and culturally compatible investment planning.
- Integrates public and private approaches to regulatory issues.
- Uses credible data—National Laboratory/university-provided regional profiles.
- Identifies alternative solutions through profiles data.

CONS:

- Creates a bureaucracy and, hence, transaction costs.
- Potential interference with private investment objectives.

ACTIONS REQUIRED: Secretary to recommend to the Office of Management and Budget that it establish an interagency joint coordination effort. DOE, the Environmental Protection Agency, the Department of Interior, the Department of Transportation, the Department of Housing and Urban Development, the General Services Administration, and the Department of Commerce to participate in developing integrated planning framework.

IDEA 9: *Develop Regional Siting Profiles*

FOCUS: *Regional Data on Energy Demand, Supply, and Infrastructure Provided by DOE for Use by States, Indian Tribes, and Other Stakeholders*

DESCRIPTION: This initiative would provide standardized data on a regional basis dealing with projected energy supply and demand, siting needs, and other relevant information. Its purpose is to help educate the public about energy supply and demand and facility resources and how these factors help frame choices in planning for future energy service needs. Regional siting profiles would not be produced to promote the siting of any facility or type of facilities or to influence decisions about how to meet—or reduce—the demand for energy service.

The profiles would be prepared by the National Laboratories or a consortium of universities around the country, who, in addition to using national data, would work with utilities, electric reliability planning councils, public utility commissions, cognizant State agencies, and other State and local sources to gather the information to prepare profiles for their own region. To ensure uniformity in format and standardization of data across regions, the Energy Information Administration would manage the project, possibly working with a national coordinating group that could provide outside expertise and advice. Were the State/Tribal Siting Forum (Idea 1) to be established, that group might serve in this advisory capacity.

DISCUSSION: Siting issues vary by region. Much of the public is largely unaware of siting needs and is not normally involved in decisions concerning future facility choices. What is clear to planners now, but less so to the public, is that current facilities are aging while the population and economy, and hence demands for energy services, are growing. Decisions regarding future energy services cannot be postponed indefinitely. Presenting information on a regional basis may have more meaning for people, encouraging more local interest in regional siting issues and helping the public to understand better the issues and trade-offs they are likely to face.

PROS:

- Illustrates nation's energy diversity, thereby helping to identify priorities, trade-offs, and alternative solutions.

- Organizes and presents data in such a way that people can understand the potential effects of new energy facilities on their communities.
- Encourages interaction with Public Utility Commissions and other regional data sources.
- Use of National Laboratories or universities fosters credibility of the data, increases regional visibility of the project, and places databases within organizations with the capability to provide future analyses.

CONS:

- Regional data profiles might be more expensive and time consuming than producing the product directly through the Energy Information Administration.
- Data will not lead everyone to the same conclusions about need for facilities.
- This option may duplicate work conducted by the electric power industry.
- Clear guidelines will be required to ensure consistency among profiles.
- Role of labs and universities vis-à-vis State and regional agencies needs further analysis.

ACTIONS REQUIRED: DOE to approve funding of a consortium of National Labs and/or universities to conduct the work. The Energy Information Administration would manage the project, with advice and cooperation from DOE's Office of Policy, Planning and Program Evaluation in developing the framework for data collection effort.

IDEA 10: *Explore Feasibility of National Development Zones*

FOCUS: *DOE, in Consultation with Stakeholders, Evaluates Concepts of National Development Zones*

DESCRIPTION: This initiative would provide a study of the feasibility of designating national development zones, for all energy-related uses (e.g., refining, oil and gas storage, generation of electricity, possibly in combination with industrial uses such as cogeneration facilities). Areas considered by the study would include surplus Federal lands, such as decommissioned army bases, and industrial sites with retired manufacturing facilities. The study would examine several aspects of the concept, including:

- Economic and other conditions required for the viability of a development zone;
- Organizational and institutional mechanisms needed to implement the concept;
- Criteria and parameters for determining candidate sites;
- Selection criteria for energy facilities;
- Determination of the match between energy service needs and candidate sites;
- Potential for additionally locating research, development, and demonstration projects on these sites; and
- Economic development for depressed areas.

DISCUSSION: One way to mitigate opposition to energy facility siting may be to concentrate generation capacity in relatively few places. Many communities around the country are experiencing severe economic pressures, as both public and private sector enterprises contract. There is reason to believe that, given appropriate environmental safeguards, such communities may be receptive to hosting new energy facilities or serving as a focal point for centralized energy development efforts.

PROS:

- Fosters economic development in communities likely to be suffering economic stress.
- Takes advantage of sunk-cost investment in existing secondary support infrastructure, e.g., roads.
- Recycles sites developed for purposes that are now obsolete.
- Elevates consideration of energy service needs to the regional and national level.
- Consolidates energy production, and associated impacts, in designated areas.

CONS:

- Concentrated development might cause excessive environmental impacts in too concentrated an area.
- Secondary negative impacts of intense development may not be apparent in the short term.
- Requires regional cooperation to locate sites in areas that yield optimum benefit.
- Large concentration of electricity generation would likely require high-voltage transmission lines, that are increasingly difficult to site.
- Must be careful not to exploit communities that are economically or politically weak.

ACTIONS REQUIRED: DOE to study the concept and, if it seems promising, recommend it to the White House for implementation. The concept could also be an agenda item for one of the interagency or State and Tribal interaction mechanisms discussed in previous initiatives.

REINVENTING GOVERNMENT

IDEA 11: *Establish an Interagency Siting Regulatory Action Panel*

FOCUS: *Federal Regulatory Requirements*

DESCRIPTION: This initiative would establish by Executive Order a Federal interagency working group focused on streamlining the siting process by coordinating siting-related regulations and statutorily-driven regulatory requirements. The Panel could be chaired by the Office of Management and Budget because it has responsibility for regulatory coordination, with membership from various agencies involved in facility siting.

The mission of the group would be to review legislation and regulatory requirements in terms of siting processes, with the aim of streamlining and eliminating areas of overlap and/or reconciling conflict. Functions of the Panel could include:

- Review of laws and regulations with an eye toward making recommendations for regulatory reform, identifying outdated provisions in current statutes, and targeting critical regulations and facility types;
- Identification of opportunities to make changes via administrative action;
- Establishment of a Memorandum of Agreement process, through which agencies would coordinate and streamline the permitting requirements of their different statutory regimes;
- Creation of an arbitration procedure, such as a process of appeal to the Office of Management and Budget, for cases in which Panel members cannot reach agreement.

DISCUSSION: The current processes for siting energy facilities are often unnecessarily complex and cumbersome. Facility siting is governed by a wide range of laws and regulations that, while individually meritorious, often have overlapping or even conflicting provisions. The need to resolve siting problems quickly is likely to grow, as economic development needs and associated energy supply requirements collide with global climate and other environmental concerns. The

current “jobs versus spotted owl” controversy in the timber industry is a harbinger of the kinds of economic and environmental issues the nation can increasingly expect to face.

Executive Order 12291 requires that an impact analysis be conducted when a regulation is promulgated. Currently, however, no institutionalized process looks comprehensively at siting-related regulations from the standpoint of their cumulative impact or inter-regulatory consistency. While the Office of Management and Budget coordinates the regulations of different agencies, currently it does not review or assess them specifically in terms of their impact—either individually or collectively—on facility siting.

PROS:

- Panel actions would expedite permitting.
- The initiative has potential to identify and minimize conflicts among regulations, as well as time/resource-consuming litigation.
- Multi-agency participation would help to preserve regulatory intent.
- The arbitration procedure would provide incentives for cooperation and would prevent gridlock.
- The initiative can reduce costs of regulation, by eliminating duplication.

CONS:

- Committees are often inefficient; tangible results might come slowly.
- Mission differences among agencies would create potential for conflict.
- Non-Federal stakeholders would lack the direct access to decision makers they enjoy in the legislative process.
- Legislative commitments are not easily changed.
- Meetings alone would not do the job. Resources would be required to establish research and analysis capability.
- Legal analysis would be required to define the Panel’s mandate and ensure that it would function within the constraints of law and administrative procedures.

- The Office of Management and Budget fulfills some of these functions now.
- The initiative would need to be examined in terms of its compatibility with National Environmental Policy Act procedures for resolving disagreement among agencies.

ACTIONS REQUIRED: Secretary to recommend to the White House the establishment, by Executive Order, of an Interagency Siting Regulatory Action Panel.

IDEA 12: *Develop a Model Strategy for the Siting of Federal Facilities*

FOCUS: *Model Strategy to Help Site Federal Facilities*

DESCRIPTION: This initiative calls for a model facility siting strategy, to be adopted at the Federal level. The Federal model could employ the results of the DOE internal pilot-tested model (Idea 15) in providing principles for Federal agencies to use in siting its own facilities and in working with industry and the public in the siting of non-governmental facilities. The initiative would integrate a number of ideas resulting from findings of the analytical work described in other initiatives, e.g., State/regional burden sharing, establishment of national development zones, and stakeholder compensation alternatives. An important component of the Federal strategy would be a set of operating principles for working with stakeholders and building and maintaining consensus.

DISCUSSION: Policies among the many Federal agencies siting facilities are often inconsistent regarding how to do business with potentially affected stakeholders. Policy and operational differences exist even among programs in a single agency. States and others who deal with the Federal government run into both procedural and policy inconsistencies.

In many Federal siting efforts, public opposition is a key obstacle to progress. Often that opposition centers around two concerns: perceived inequities for the community that hosts the facility, and lack of input into the decision making process by potentially affected stakeholders. Federal agencies that deal with hazardous and nuclear materials are particularly susceptible to public resistance. Communities that are targeted to accept these facilities often feel they are being asked to bear the burden for problems that are not of their own creation, e.g., hosting a facility for waste generated elsewhere. Much is known about public processes that foster agreement and prevent unnecessary siting delays. The Federal government, which deals with these kinds of issues continually, should have a consistent siting policy.

PROS:

- The Office of the Nuclear Waste Negotiator may serve as a precedent for many of these principles, in its approach to seeking a volunteer site for a high-level waste repository and Monitored Retrievable Storage facility.
- Diminished public opposition will speed the siting of facilities, and reduce the economic and other costs associated with delays and lengthy siting processes.

CONS:

- May be difficult to reach agreement in a multi-agency arena.
- National Environmental Policy Act already provides an outline of a process for siting facilities.

ACTIONS REQUIRED: Secretary to recommend to White House that it initiate a proposal for development and maintenance of a Federal model siting strategy, drawing on the experience of Monitored Retrievable Storage facility, the Superconducting Super Collider, and other relevant siting experiences.

IDEA 13: *Pilot-Test the Model Siting Policy in a Region*

FOCUS: *Test Effectiveness of Policy for Siting a DOE Facility*

DESCRIPTION: This initiative is to develop and verify a Departmental siting policy utilizing a menu of ideas potentially effective in improving the facility siting process. DOE would develop and test the effectiveness of the policy on a siting project administered directly by DOE (or, alternatively, of interest to a DOE program, e.g., a power plant). The model siting policy would focus on identifying and employing innovative processes for building consensus among parties and would aim to bring an actual project through at least the permit approval stage. One or more independent studies would be conducted to verify how well the process works, and analyze and clarify the weakness of various aspects of the model siting policy and its components.

Included among the aspects of the model siting policy that would be tested are:

- Emphasis on demonstrating the need for the project in the National Environmental Policy Act process so as to better foster the understanding of the impacts of the “no-action” alternatives;
- A siting decision process that includes open multi-way communication paths with information flows from and between the public and stakeholder groups;
- The involvement of stakeholders and the public in the decisionmaking process from the planning through implementation stages;
- Assessment of environmental, socioeconomic, health, safety, and cost/benefit impacts including efforts to identify “winners” and “losers”;
- Ongoing monitoring for impacts and employment of reasonable mitigation actions to reduce community concerns; and
- Providing funds and technical assistance to credible third parties and constituent groups to perform scientific analysis and risk assessment.

The facilities that DOE sites range from small energy research laboratories to large, controversial radioactive waste management projects. The model siting policy would contain a menu of options and provide the flexibility to address different circumstances.

DISCUSSION: Public opposition can seriously delay or even prevent the siting of facilities. However, there is increasing evidence that involving the public and other stakeholders in an open, participatory decision making and communication process will both facilitate public acceptance and lead to better quality decisions. There are many ideas about how to promote better harmony and cooperation among organizations with different mission interests and constituencies, but few have been tested in a focused way. Instead of trying to formulate a DOE policy or order *a priori*, this initiative would attempt to demonstrate these ideas, in a DOE setting on an actual siting project.

PROS:

- The initiative will result in a strategy that is both tailored to DOE's needs and reality-tested.
- Selecting a DOE facility as a test case provides a relatively controlled environment to address methods of promoting cooperation among agencies and stakeholders.
- Demonstrating the effectiveness of the strategy will help establish its credibility and visibility, and make it more likely to be adopted as policy.
- Policy and programmatic precedent already exists within DOE for many of these principles, e.g., the Office of Environmental Restoration and Waste Management's public participation policy and the Bonneville Power Administration's public participation program.
- The initiative will help promote department-wide consistency in the way DOE does business.

CONS:

- May be difficult to achieve agreement from all DOE programs on the content of the model siting policy.
- Will need Program Secretarial Officer cooperation to identify one or more test cases.
- Model siting policy may have to be flexible to address national security issues.

- Single policy may not be able to reach across all DOE siting projects.
- The National Environmental Policy Act and other regulations already provide for substantial public participation.

ACTIONS REQUIRED: DOE's Office of Policy, Planning and Program Evaluation, in coordination with the Office of Organization, Resources, and Facilities Management, other DOE staff offices, and program offices, will develop and test a model siting policy on at least one real siting project.

IDEA 14: *Evaluate Federal Organizational Arrangements for Coordinating Facility Siting*

FOCUS: *Federal Agency Organizations Responsible for Facility Siting*

DESCRIPTION: This initiative would provide an evaluation of how Federal agencies with substantial siting-related functions are organized to carry out those responsibilities. The study would produce a Federal directory or “road map” describing the roles and responsibilities of key agencies. The study would address:

- What organizational patterns are effective for specific siting-related functions?
- How are siting issues coordinated within various agencies?
- Whether certain Federal agencies that deal with siting issues should have a single point-of-contact for siting issues or a central siting office, and what should those functions include?

If the study indicated strong benefits for a particular organizational structure, such as a central siting office, it might result in a recommendation that an Executive Order be promulgated requiring all Federal agencies to establish such organizations.

Within the Federal government, the study report would be distributed to agency offices. Outside the Federal government, the information could be shared with stakeholders who regularly deal with Federal siting officials.

DISCUSSION: Siting is a complex “umbrella” subject, with a variety of programs and policy issues falling within its domain. Some of these issues are legal and regulatory; others are related to the mission interests of an agency, and the discretionary policies and programs that the agency administers. Even within the Federal government, those concerned with siting issues often find it difficult to identify their counterparts in other agencies. Agencies such as the Environmental Protection Agency, the Department of Defense, the Department of Interior, and Housing and Urban Development deal frequently with siting issues, and each has its own unique organizational structure. Many Federal agencies are involved with the siting of facilities, and their processes and

organizational arrangements are not always clear to those outside their agencies. Individuals and organizations who need to interact with agencies on siting issues often find obtaining information or even locating the appropriate office difficult and confusing. A specifically identified agency siting contact could assist those who deal with these agencies on siting-related matters. Some agencies may find it helpful, internally, to designate a focal point to address and coordinate agency strategies on key issues facing siting.

PROS:

- This option could potentially result in the simplification of communications on siting-related issues for individuals within and outside an agency.
- Evaluation would help agencies develop consistent agency- and government- wide policies.
- Costs of analyses would be matched by expected efficiencies of operation.

CONS:

- Single point-of-contact may not make sense for agencies with strong field offices.
- Responsibilities of designated siting offices likely to vary among agencies.
- Mission requirements and other agency-specific factors may limit alternatives for reorganization.

ACTIONS REQUIRED: DOE study of Federal organizational arrangements for siting in selected agencies, e.g., DOE, Department of Defense, Department of Interior, the Department of Housing and Urban Development, and Environmental Protection Agency.

IDEA 15: *Evaluate Alternative Siting Uses for Surplus Defense Facilities*

FOCUS: *Defense (or Other Federal) Sites for Either Private or Public (State, Federal) Energy Facility Use*

DESCRIPTION: In conjunction with the Office of Environmental Restoration and Waste Management, this initiative would identify alternative uses for surplus DOE, Department of Defense, and other sites no longer required to maintain our national defense infrastructure. The evaluation would build on the DOE Weapons Complex Reconfiguration Program and include consideration of both Federal and non-Federal uses for these sites. As part of this evaluation, the study would catalog DOE and Department of Defense sites that might become available for alternative uses, and provide relevant characteristics of each site, including the remedial actions needed before the site can be dedicated to other uses. Potential uses for DOE and Department of Defense sites would include the siting of energy facilities and the advancement of technology transfer through prototype demonstrations of emerging technologies. These demonstrations would serve as "test beds" for prototypes involving all aspects of the fuel cycle, including waste minimization and waste treatment.

DISCUSSION: The Department of Defense is presently closing bases around the country with grave economic consequences for the communities that have lost them. At the same time, the Department's Office of Defense Programs is undertaking a comprehensive Reconfiguration Program of DOE defense facilities to select the most appropriate configuration for the nation's future nuclear defense program. Facilities determined to be surplus will be transferred to the DOE Office of Environmental Restoration and Waste Management for cleanup and determination of possible future land uses, including evaluation of remedial actions needed before the sites could be made available for unrestricted use. Other studies have also characterized surplus non-defense DOE sites, although on a smaller scale than the Reconfiguration Program. Additional analysis needs to be done to clarify the potential uses of all these surplus sites. For example, an assessment is needed regarding the extent of waste cleanup required as a prerequisite for initiating potential alternative uses. An evaluation of the relationship between each site's proximity to population centers and specific alternative uses is also essential.

Communities that have lived with nuclear and defense work for years may be more comfortable with energy technologies than residents in other places who might view such technologies as risky. As Department of Defense facilities are shut down and DOE defense programs consolidate and scale down, many communities are faced with a loss of employment and income and may be interested in exploring options that will revitalize their local economies.

PROS:

- There may be less public opposition to locating facilities at existing Defense and DOE sites than in “greenfield” settings.
- Defense and DOE sites are likely to have support facilities and infrastructure, such as roadways and power lines, already in place.
- Approved environmental impact statements may already be in place at many Defense and DOE sites.

CONS:

- Even if these sites are suitable for energy facilities, communities may prefer uses for them other than those DOE or others may advocate.
- In the case of DOE facilities, it is difficult to know when most sites might be clean enough for new energy facilities; assessments may be inconclusive.
- May require legislation.
- DOE and other agencies involved will face burden of implementation costs.

ACTIONS REQUIRED: DOE’s Office of Policy, Planning and Program Evaluation initiate a study, with participation by the Office of Environmental Restoration and Waste Management and Office of Organization, Resources, and Facilities Management, based on data and information collected in other siting studies and investigations.

IDEA 16: *Establish DOE Site Selection Administrative Order on Facility Siting to Streamline Internal DOE Procedures*

FOCUS: *Internal DOE Effort to Rationalize Procedures for Siting DOE Facilities*

DESCRIPTION: This initiative calls for developing a DOE administrative order to consolidate and streamline guidance on procedures governing the siting of DOE facilities. Many elements and procedures concerning routine siting decisions are already in place. The administrative order would streamline current guidance, and if necessary consolidate existing guidance and orders to clarify the roles and responsibilities of the Office of Organization, Resources, and Facilities Management, the Office of Policy, Planning and Program Evaluation, and other program and staff offices in siting decisions involving DOE facilities. The administrative order will reflect policy decisions made by the Secretary on stakeholder involvement and other siting-related issues. Thus, this initiative is to be distinguished from Idea 15, and other policy-related initiatives.

The administrative order will be developed by a working group that will include participation by the Office of Organization, Resources, and Facilities Management, the Office of Policy, Planning and Program Evaluation, Program Secretarial Offices, field offices, and others who have experience and interest in the siting process. For example, the U.S. Environmental Health and Safety may be consulted by the working group or participate directly based on experience with the public participation requirements of the National Environmental Policy Act.

DISCUSSION: DOE makes many siting decisions each year for a wide variety of facilities and programs. Several different orders and guidance affect these activities. What is needed is thoughtful development of an integrated process to site DOE facilities that is flexible enough to accommodate the wide variety of activities of the Department, improving those processes where necessary, adhering to procedures proven effective in implementing siting decisions that are non-controversial, and providing appropriate guidance for siting activities that are controversial or require special attention.

PROS:

- A consolidated process will improve internal visibility and understanding of Departmental objectives in siting facilities and will improve probability of successful siting decisions.
- A siting order will clarify internal roles and responsibilities in the siting decisionmaking process.
- The order will promote uniformity and consistency throughout the Department, and improve efficiency.

CONS:

- A consolidated process may eliminate flexibility for some siting decisions.
- The policy must be general to address the varied decisions made in the department.

ACTIONS REQUIRED:

The Office of Organization, Resources, and Facilities Management and the Office of Policy, Planning and Program Evaluation co-chair working group. The Office of Organization, Resources, and Facilities Management will be responsible for carrying out the administrative order once it is approved.

IDEA 17: *Assess Siting Implications of Recommendations of Task Force on Radioactive Waste Management*

FOCUS: *Internal DOE Efforts to Enhance Public Confidence and Trust in Its Efforts to Site DOE Facilities*

DESCRIPTION: This initiative would assess the recommendations contained in the June 1993 *Earning Public Trust and Confidence: Requisites for Managing Radioactive Waste, Final Report of the Secretary of Energy Advisory Board Task Force on Radioactive Waste Management.*

DISCUSSION: In April 1991, a DOE Task Force on Radioactive Waste Management was established and charged to “recommend measures the Department might take to strengthen public trust and confidence in the civilian radioactive waste management program” (see Task Force *Draft Final Report*). The mandate of the Task Force was formally expanded in September 1991 to include the environmental restoration and defense waste management program. The Task Force did not conduct a management audit, but rather concentrated on the specific issue of public trust and confidence. Its recommendations cover both interactions with external parties and DOE internal operations.

PROS:

- Task Force findings have relevance to many Departmental and Federal siting activities, beyond those in the radioactive waste and environmental restoration programs.
- Problems with public confidence and trust are fundamental siting issues; progress in those arenas is required to forge the institutional consensus needed for siting progress.

CONS:

- Task Force recommendations may conflict with other program and Departmental priorities.
- Implementing the recommendations may require additional resources.

ACTION REQUIRED: DOE's Office of Policy, Planning and Program Evaluation to assess the Task Force report and develop implementation plans, in cooperation with DOE program directors who have responsibility for the areas concerned.

IDEA 18: *Establish DOE Office of Facility Siting Policy*

FOCUS: *Internal DOE Organizational Initiative*

DESCRIPTION: This initiative would establish an Office of Facility Siting Policy in DOE.⁹ The Office would provide a broad range of expertise in the siting and policy analysis arenas and act as a focal point and clearinghouse for the analysis and formulation of energy facility siting policy. A key responsibility would be to provide leadership for the Department in the area of facility siting environmental justice. In close coordination with the Office of Minority Economic Impact, the Office of Facility Siting Policy would work with the White House, public and private sector siting stakeholders, and other Federal agencies in interpreting Administration and/or legislative directives (Executive Orders, legislation, etc.) and provide policy direction and guidance to DOE program offices in planning, conducting, and evaluating their programs from the standpoint of environmental justice considerations when siting facilities.

The Office would also be responsible for conducting research and providing analysis and support on other energy facility siting matters, with special emphasis on those policies and programs related to the achievement of overall energy, economic, and environmental goals. Illustrative functions include:

- Developing guidelines for socioeconomic impact assessments related to facility siting,
- Coordinating the development of Departmental positions related to energy facility siting;
- Integrating regulatory, risk perception, socioeconomic, and public acceptance considerations in developing Departmental policy;
- Analyzing the impact of programs, policies, and regulations of non-DOE agencies on energy facility siting;

⁹ The Office would be responsible for facility siting policy affecting both DOE facilities and other facilities that are within the Department's mission interest. The Office of Facility Siting Policy would not have jurisdiction over day-to-day Department facility and property management and acquisition or administrative procedures that are within the purview of the Office of Organization, Resources, and Facilities Management. (See Idea 16).

- Working with States/Indian Tribes and other stakeholders on addressing emerging siting issues;
- Developing and recommending improved approaches for dealing with energy facility siting issues, including administrative actions, regulations and legislation; and
- Assisting foreign governments, especially developing nations, with siting issues related to the development of energy facilities.

DISCUSSION: While almost every State in the country has an office dedicated to the siting of energy or hazardous waste facilities, the Department of Energy, that has national leadership for these areas, has no office that focuses on siting policy issues. DOE is in the siting business, both directly as an agency that sites its own facilities, and indirectly in terms of its constituent programs' mission interests. Siting is often a complex issue, calling for an integrated policy focus, collaboration among a number of disciplines, and the cooperation of a variety of organizations and constituencies. Those dealing with the Department on siting issues often find it difficult and confusing to obtain information or locate the appropriate office. Moreover, energy facility siting is increasingly linked to environmental issues, including the ability to assess socioeconomic impacts and to ensure against disproportionate impacts on low income and minority populations, when a facility is sited. Finally, energy facility siting policy is increasingly an international issue, with ramifications for global climate change, sustainable development, and national competitiveness. It is becoming increasingly important to assess siting programs and approaches in other agencies, states, localities, and other countries for "lessons learned," including those related to non-energy facilities, to determine worthwhile features of those programs with potential applicability to siting.

PROS:

- Supporting reinventing government theme of new Administration.
- Facilitates implementation of Administration policy related to energy facility siting.
- Provides integrating link for energy and environmental policy issues.
- Provides central focus and integrated capability for policy oversight and analysis.
- Gives high visibility to an important, cross-cutting function.

- Sends signal to States/Indian Tribes and localities about the importance the Department places on siting and siting policies.

CONS:

- Requires additional resources to establish and operate.

ACTIONS REQUIRED: Secretary to establish an Office of Facility Siting Policy in the Office of Policy, Planning and Program Evaluation, the Office of Environmental Health and Safety, the Office of Organization, Resources, and Facilities Management, or similar office with cross-cutting policy responsibilities for siting.

RESEARCH

IDEA 19: *Develop a Siting Research Agenda*

FOCUS: *Internal DOE initiative focusing on long-term research efforts related to siting*

DESCRIPTION: This initiative would develop a research agenda on siting-related issues, ideally in conjunction with the State/Tribal Siting Forum (see Idea 1) and other opportunities for stakeholder interaction. The DOE Office of Facility Siting Policy (see Idea 18) would have the lead for this work.

DISCUSSION: Decision makers who deal with facility siting require knowledge and expertise in a wide variety of disciplines. In addition to understanding the technological aspects and physical impacts of a facility, siting managers and policy makers who want to maximize their effectiveness need to be well grounded in political and social processes, resource economics, and management and organizational theory. A substantial amount of research has been conducted on many of these topics, but few studies have been conducted strictly from the standpoint of facility siting. In partnership with siting stakeholders, work needs to be done to survey and assess the existing body of work, and determine an agenda for priorities for further research. For example, areas ripe for detailed study include: effective methods for changing risk perception, the economic consequences of siting delays, and how to develop a continuing consensus for decisions.

PROS:

- Establishing a research agenda will help direct scarce resources towards subjects of highest priority.
- Working with stakeholders and decision makers to develop the research agenda has high potential pay-offs; they are good judges of the kinds of information they need.

CONS:

- Establishing a research agenda may raise stakeholder expectations beyond that which can be accomplished within resource constraints; many worthwhile research projects may not be able to be pursued.

ACTIONS REQUIRED: In lieu of the work being directed by an Office of Facility Siting Policy, DOE's Office of Policy, Planning and Program Evaluation to produce a plan for developing a siting research agenda.

APPENDIX

**SUGGESTIONS DEVELOPED BY
THE DOE WORKING GROUP ON ENERGY FACILITY SITING**

INSTITUTIONAL CONSENSUS

National-Level Actions

- Establish an Administration task force for regulatory reform, with representatives from industry, the environmental community, and government. The role of the task force would be to review regulations, to make recommendations for regulatory reform, and to propose sunset provisions. The task force could be constituted by Executive Order as a continuing body and located and chaired within an Administration branch as a permanent body. Periodically it would publish a report offering recommendations to the White House.
- Convene a national annual conference on facility siting, with participation by representatives of all siting stakeholders: e.g., Federal, State, local officials, and representatives from environmental groups, industry, the research community, and the public.

Federal Interagency Cooperation

- Publish an Executive Order/set of Federal administrative orders, as needed, to require the Park Service, the Department of Interior, DOE, etc., to work out procedures on siting energy facilities, and to require interagency agreements.
- Establish an interagency working group on regulatory matters, organized by Executive Order and codified by legislation, if need be, whose purpose would be to streamline permitting procedures. A Memorandum of Agreement/Memorandum of Understanding process should be included. The Executive Order for legislation should have a default provision that if there is no agreement an appeal to the Office of Management and Budget process will ensue.
- Prepare a draft Presidential Executive Order on Energy Facility Siting establishing an interagency process to be convened, administered, and directed by the Department of Energy to facilitate and expedite in every way needed national energy facility siting objectives. All matters of public acceptance, regulatory reform, environmental health and safety, and public-private sector relations as they bear on the achievement of the government-wide energy facility siting objectives will be subject to this Executive Order.

The draft Executive Order on risk assessment could serve as a model. Principles for equitable distribution of costs and benefits could be included.

- Establish a Federal interagency cooperation-building process, directed towards the siting of energy facilities. The process of having to learn about each other, their different missions in life, etc., could bring Federal agencies closer together.
- Establish an interagency siting committee, whose underlying mission would be the siting of energy facilities, and which would require consensus to achieve that mission. Applicants for facility siting licenses would deal with one source, rather than different sources. Technical assistance to States and local governments would be provided help them participate in the siting process.
- Institute staff exchanges among Federal agencies.
- Promote coordination among Federal agencies with Federal lands, to facilitate the siting process for linear facilities, e.g., pipelines.
- Reduce hostility between the public and private sectors through training, orientation, and sensitivity sessions.
- Assess and remove existing government-wide infrastructure privatization roadblocks.
- Promote government procurement/purchasing policies and programs consistent with national energy policy siting needs, e.g., guarantee purchase of base-load, extend the Public Utilities Regulatory Policies Act to Federal power purchasing agencies, etc.

Incentives for Regional/State/Local Cooperation and Innovative Land Use

- Encourage regional/state risk and burden sharing. Work with two or three States to share risks; e.g., one State could accept the risk of one type of facility and provide its benefits to neighboring States in exchange for gaining benefits from other facilities sited in other states.
- Establish national development zones, focusing on using Federal lands to site power generating facilities (e.g., Rocky Flats, decommissioned army bases, possibly sites not necessarily owned or operated by the Federal government). A database could be developed to inventory and evaluate potential Federal lands available for siting facilities. These would offer regulatory relief and fast-track permitting through pre-approved "generic"

environmental impact statements. These zones also could be used for promoting co-generation facilities (energy and industrial development zones).

- Conduct a national inventory of Federal lands and evaluate their potential for various uses. As a model, process certain land holdings through a portion of regulatory review, e.g., the National Environmental Policy Act process.
- Evaluate military bases located in areas of utility need for co-generation opportunities. DOE could work with the Department of Energy for this purpose.
- Establish mitigation banks, whereby a developer pays into a fund that rebuilds wetlands at a different place, and the developer gets a credit. Amend the Clean Water Act to allow States to establish the funds.
- Establish Federal block grant program to apply to regional transmission and service needs, where there is not much incentive for neighboring utilities to work together, or on issues that would otherwise fall between the cracks.
- Through DOE, or other coordination, ensure that new public works investments are compatible with private sector investments, and that initiatives are consistent with Administration energy policy priorities.

Siting Support and Information-Sharing for States

- Provide Federal underwriting or technical assistance to help States site their own facilities.
- Provide Federal assistance to help replicate the North Carolina permitting streamlining process.
- Develop a handbook for State and local governments, articulating principles for effective siting, and clarifying Federal roles and responsibilities in the siting arena.
- Convene an annual conference for State siting officials.
- Provide Federal assistance to facilitate States' risk-sharing cooperation.
- Establish a working group, by Executive Order or by legislation, that would include States, that would focus on streamlining regulatory procedures and that would produce Memorandum of Understandings.

PROCESSES FOR STAKEHOLDER INVOLVEMENT AND EQUITY

Department of Energy

The Department of Energy is involved in numerous siting decisions each year, most of which are neither controversial nor complex. A process currently exists within DOE to manage routine siting decisions. The recommendations below are more pertinent to major siting decisions that have policy implications and which therefore require extensive stakeholder involvement.

- Set up an Office of the Negotiator for Siting Facilities.
- Issue a policy statement that indicates that DOE wants volunteer sites.
- Issue a policy statement that indicates that DOE will work cooperatively with localities, to demonstrate that facilities will not be forced on a community unconditionally.
- Select a DOE facility to test a model siting process, emphasizing innovative processes for building consensus among parties at interest to a site decision. Apply processes for conflict resolution and cooperation to involve regulatory agencies, proponents, NGO's and affected citizens in a voluntary, open process to choose one or more candidate sites and bring at least one through the permit approval stage.
- Implement the recommendations of the DOE Task Force on Radioactive Waste Management, dealing with public confidence.
- Provide funds for different constituent groups to perform scientific analyses and risk assessment during the siting process.
- Fund credible third parties to assess the risks of DOE projects.
- Publicly embrace the National Environmental Policy Act and indicate that the National Environmental Policy Act process will demonstrate the need for the project as well as dealing with the impacts of "no-action" alternatives.
- Assess the Alternative Dispute Resolution Act as a potential resource for DOE siting policy initiatives.

- Rationalize DOE siting decisions through the development and implementation of a DOE siting selection administrative order. The purpose of the administrative order would be to consolidate current procedures, clarify internal roles and responsibilities in the siting decisionmaking process, and promote uniformity and consistency throughout the Department.

General Federal Actions

- Recommend to Congress legislation guaranteeing equity in the distribution of costs and benefits as a result of siting a facility; e.g., establishing a mechanism to be set in place ahead of time to use to compensate losers should economic damage occur (such as property values declining). This might help reduce the perceived economic risk of the project.
- Set up a fund that could be used for facility siting to indemnify risk to property values or other economic disbenefits. Legislation would be needed for this.
- Establish a Federal model strategy for equitable and effective siting procedures, in an inter-agency context.
- Include in the model siting strategy a decision process that includes an open communication system in which information flows from and between the public and stakeholder groups, as well as to them.
- Include in the model siting strategy a decision process that includes sharing of decision making authority with the public, and public and stakeholder involvement in the decision process throughout the planning and implementation stages of a project.
- Include in the model siting strategy a process that provides that systematic assessment of environmental, socioeconomic, health, safety, and cost/benefit impacts be performed, including efforts to identify “winners” and “losers” and to ferret out community concerns.
- Include in the model siting strategy the requirement that reasonable mitigation actions be taken to reduce community concerns.
- Include in the model siting strategy requirements for monitoring and evaluation of project impacts (according to locally satisfactory standards) and the sharing of monitoring results with the community.

LEGAL/REGULATORY IMPACTS AND PROCEDURES

Regulatory Impacts

- Establish risk-based procedures so that the focus and scope of siting and licensing administrative activities will apply more specifically to the individual facilities in question.
- Periodically reconsider regulations; i.e., zero-base budgeting/sunset law for new regulations. Every 10 years or so the agency that promulgates a regulation would have to justify the regulation.
- Evaluate the technical competence and fiduciary trust record of those recommending regulatory streamlining or revision.
- Revisit the Clean Air Act Amendments. It has too many complicated, overlapping administrative requirements that agencies cannot accomplish, and contains schedules that cannot be met.
- Enact legislative initiatives that would promote non-regulatory market-oriented approaches to environmental externalities, to deal with cumulative regulatory effects.
- Amend parts of the Clean Water Act, Endangered Species Act, and Clean Air Act Amendments to require the regulator to conduct a good-faith cost/benefit analysis.

DOE Organization and Procedures

- Create a position within DOE to function as a process resource or ombudsman, particularly for smaller producers (Office of Siting Issues).
- Develop and carry out training sessions for senior DOE and private sector managers to enhance their ability to *listen* as well as to hear each other.
- Promote delegations of authority from the staff offices to line management for internal approvals on siting issues and move from the old culture to audit and validation procedures (important to use minimal staff in this activity). This is reference to the siting of DOE's own facilities.
- Make internal administrative procedures more efficient, as well as tailor them, as appropriate, to the nature and scope of the proposed facility.

Other Federal/Interagency Organizational Arrangements and Procedures

- Eliminate duplication of effort among agencies, and encourage them to use the results of other agencies permitting processes.
- Focus licensing and administration procedures appropriately for specific facilities.
- Ensure that the product of an interagency committee is a working agency agreement on how they will do business procedurally.
- Require agencies to establish a single siting focus: e.g., an ombudsman to help industries steer their way through the siting and permitting process; an office of siting. Smaller developers would be the main customer.
- Establish an Executive Order directing the Environmental Protection Agency to set standards where they do not currently exist, which under the Clean Air Act would require the Park Service to acquiesce. Legislative initiative preferred, but Executive Order by default.

TECHNOLOGY TRANSFER AND RESEARCH, DEVELOPMENT, AND DEMONSTRATION

- Examine the role of technology transfer in encouraging infrastructure investment.
- Encourage utilities and other private sector parties, through tax-credits and cost-sharing, to undertake high-priority, high-risk research, development, and demonstration. Could be a condition of the license; could be administered through a Cooperative Research and Development Agreement-like process.
- Examine and promote the lesser scale “small is beautiful” concept as appropriate for each technology, both to facilitate siting and for greater system flexibility.
- Remove environmental and/or technical barriers to effective technology transfer; develop more “transferable” technologies through early industry participation in the research, development, and demonstration process.
- Allow degree of industry proprietary use of information for negotiable time periods, depending on early and mutual collaboration.

- Use already licensed sites as test-beds for research, development, and demonstration. Would require regulation revision in some cases.

SITING-RELATED RESEARCH AND DATA NEEDS

- Develop and publish regional and local energy status profiles. Include information across technologies on subjects such as demand-side management, IPPs, and co-generation facilities. Cover the entire fuel cycle from extraction through disposal in describing the energy infrastructure, including pipelines, storage facilities, transmission lines, etc.
- Develop forecasts of energy service needs as a companion data set.
- Also, as a companion data set, describe regional socioeconomic characteristics, such as population and demographics; historical trends; socio-economic projections; industry growth and investment; building types and characteristics; transportation infrastructure; and possibly environmental sensitivities, such as non-attainment status.
- Also, as a companion data set, develop a siting resource assessment tool in the form of a Geographical Information System, to include land use plans, zoning, maps of potential sites for facilities of all types (e.g., municipal solid waste, waste-to-energy, power plants, sewage treatment, etc.).
- Also, as a companion data set, characterize the regulatory environment.
- Establish an independent Bureau of Environmental Statistics.
- Evaluate whether integrated resource planning and new incentive programs to utilities for demand-side management investments in California and New England increase public acceptance of facility siting downstream. Will the public believe that appropriate steps are being taken?
- Compile lessons learned from non-U.S. experiences in facility siting.
- Evaluate the New Jersey Experience: Have the Rutgers' recommendations assisted public acceptance of siting?
- Examine the constraints of various Federally-owned lands to determine their potential for various uses.

- Assess the impacts of specific regulations, focusing on where it is not credible to carry out the regulation. Don't specify cost-benefit or any other model.
- Review and assess current and proposed energy research, development, and demonstration initiatives (e.g., tax incentives) for the purpose of realigning these to be consistent with national siting priorities.
- Continue to assess the regulations flowing from the Clean Air Act Amendments of 1990 and implementation and enforcement from the standpoint of the energy technology industry.
- Assess the value of DOE developing an aggressive, proactive posture with and for the energy industry to promote favorable dispute resolution, e.g., increasingly assume regulatory intervenor roles. [Be an advocate]
- Assess and optimize the use of existing sites by retrofitting and life-cycle extension (varying number of years). Perform required research, development, and demonstration, technical area. [Identify all constraints, e.g., public opposition.]
- Review private sector models of internal cooperation.
- Study how things get done without consensus and the impact of the actions/decisions made under those circumstances.

END

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3/10/94