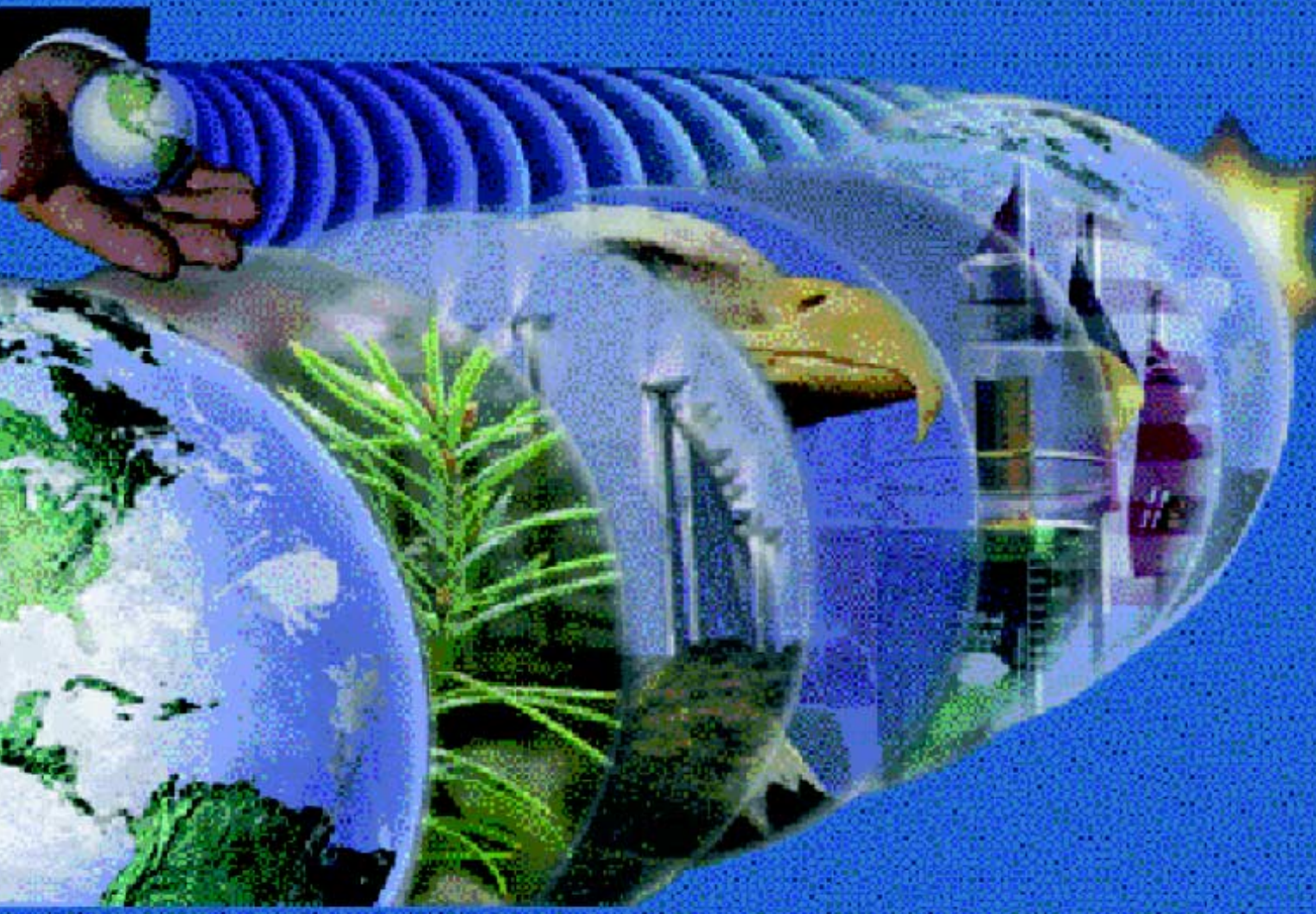
U.S. DEPARTMENT OF ENERGY

STRATEGIC PLAN



STRENGTH THROUGH SCIENCE

POWERING THE 21st CENTURY

Secretary's Message:

I am pleased to present our new Strategic Plan for the Department of Energy. This Plan sets forth the mission and vision of the Department. It also establishes goals, objectives, performance measures, and strategies for each of our business lines.

The development of this Plan involved representatives from our entire complex. A draft of the Plan was made available to the general public in February 2000, and we have had the benefit of hundreds of comments from a wide range of sources.

This Plan represents our best effort to provide measurable outcomes and accountability for the funds entrusted to us by Congress and the President on behalf of the American people. Through this Plan we are making a clear statement to both Congress and the public what we plan to accomplish over the next six years. We will annually commit to measures of our performance through the budget process so that Congress can determine whether we stay on track.

I hope that this plan will be useful to our Congressional oversight committees. I am confident that it will be useful to those of us in the Department as we strive to achieve our goals.

Bill Richardson
Secretary of Energy

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U.S. DEPARTMENT OF ENERGY STRATEGIC PLAN

Introduction

The Department of Energy conducts programs relating to energy resources, national nuclear security, environmental quality, and science. In each of these areas, the United States is facing significant challenges. Our economic well-being depends on the continuing availability of reliable and affordable supplies of clean energy. Our Nation's security is threatened by the proliferation of weapons of mass destruction. Our environment is under threat from the demands a more populated planet and the legacies of 20th-century activities. Science and the technology derived from it offer the promise to improve the Nation's health and well-being and broadly expand human knowledge.

In conducting its programs, the Department of Energy (DOE) employs unique scientific and technical assets, including 30,000 scientists, engineers, and other technical staff, in a complex of outstanding national laboratories that have a capital value of over $45 billion. Through its multidisciplinary research and development activities and its formidable assemblage of scientific and engineering talent, DOE focuses its efforts on four programmatic business lines:

- Energy Resources—promoting the development and deployment of systems and practices that provide energy that is clean, efficient, reasonably priced, and reliable.

- National Nuclear Security—enhancing national security through military application of nuclear technology and by reducing global danger from the potential spread of weapons of mass destruction.

- Environmental Quality—cleaning up the legacy of nuclear weapons and nuclear research activities, safely managing nuclear materials, and disposing of radioactive wastes.

- Science—advancing science and scientific tools to provide the foundation for DOE's applied missions and to provide remarkable insights into our physical and biological world.

In support of the above four business lines, DOE provides management services to ensure that the technical programs can run efficiently. Our Corporate Management area deals with organizational and management challenges that we must address to better serve our customers, and ultimately, U.S. taxpayers, in an effective and efficient manner. Within Corporate Management, we strive for excellence in the Department's environment, safety, and health practices, together with effective management systems and efficient business practices.

This Strategic Plan describes the goals, objectives, performance measures, and strategies for each of these business lines. This Plan covers our planned activities for the next six years beginning with fiscal year 2001.

DOE Mission

The Department of Energy's mission is:

To foster a secure and reliable energy system that is environmentally and economically sustainable; to be a responsible steward of the Nation's nuclear weapons; to clean up the Department's facilities; to lead in the physical sciences and advance the biological, environmental, and computational sciences; and to provide premier scientific instruments for the Nation's research enterprise.

DOE Vision

The Department of Energy, through its leadership in science and technology, will continue to meet the Nation's needs in energy, environmental quality, and national security by being:

- A partner with Congress, other agencies, and stakeholders to develop and implement policies, legislation, and regulations that promote national security and address our energy and environmental needs in a balanced manner.
- A key contributor to ensure that the United States has a flexible, clean, efficient, and accessible system of energy supply with minimal vulnerability to disruption.
- A vital contributor to reducing the global nuclear danger through our national nuclear security, nuclear safety, and nonproliferation activities.
- A responsible steward of nuclear weapons and materials, cleaning up DOE sites, decommissioning our facilities, stabilizing nuclear materials, managing and disposing of waste, and preventing pollution.
- A major partner in world-class science and technology through our national laboratories, research centers, university research, and our educational and information dissemination programs.
- An employer noted for providing a safe and secure workplace, recognized for management excellence, and acknowledged for delivering results.

Members of the Workplace Improvement Network (WIN), chartered in November 1999 to identify, evaluate, and recommend the implementation of employee ideas to improve the workplace at Department of Energy.

DOE Core Values

The Department will succeed only through the efforts of its employees. Our beliefs and values motivate our behavior and set standards for our individual and collective performance. The core values of the Department of Energy guide our activities as we strive to fulfill our mission.

1. We are public servants and are customer-oriented.

2. We value public safety and respect the environment.

3. We believe people are our most important resource and that they should be treated with fairness, respect, and dignity.

4. We value creativity and innovation.

5. We are committed to excellence.

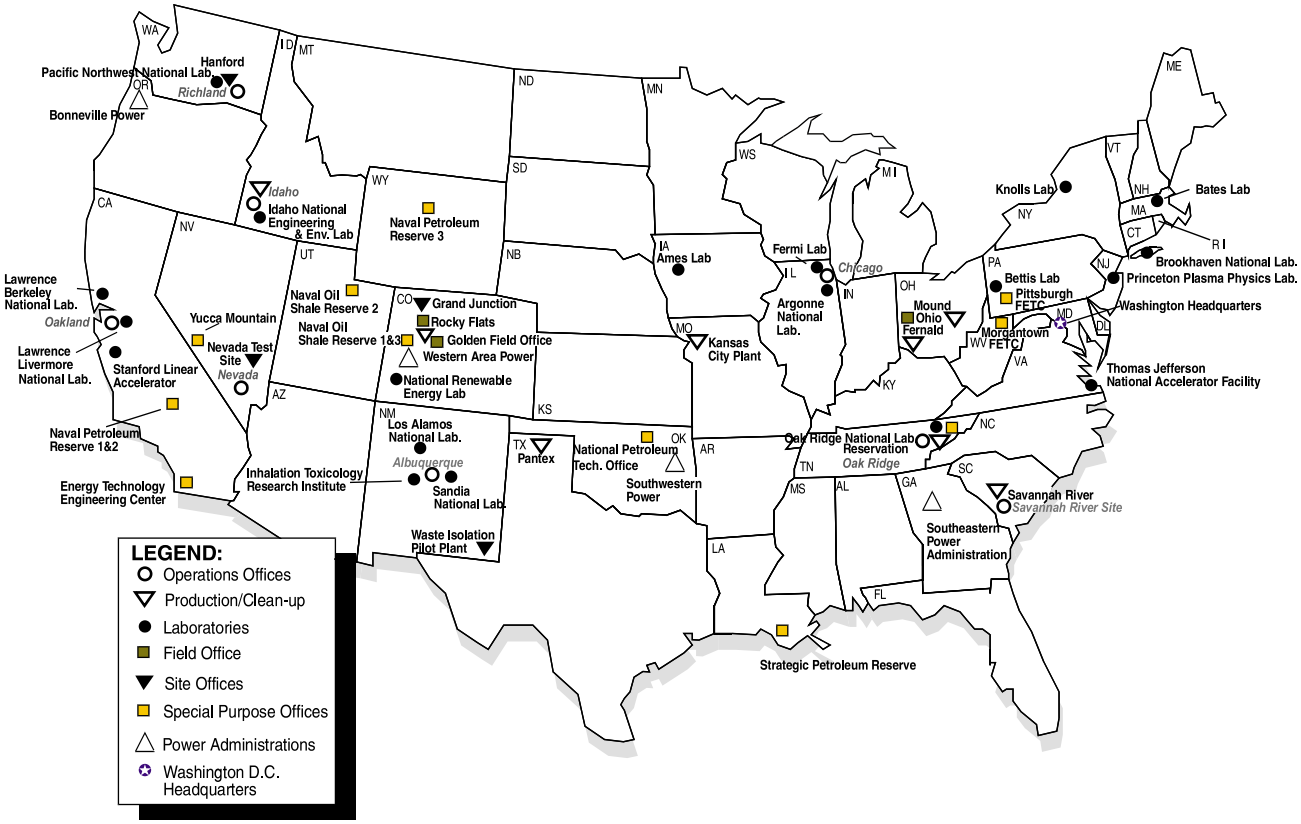
6. We work as a team and advocate teamwork.

7. We recognize that leadership, empowerment, and accountability are essential.

8. We pursue the highest standards of ethical behavior.

A more extensive statement of these core values appears inside the back cover.

Major DOE Field Facilities



The Department's Background

DOE's History. The Department of Energy's has its roots in the Manhattan Project of the U.S. Army Corps of Engineers, which was established in 1942 to manage development of the atomic bomb. After World War II, Congress created the Atomic Energy Commission in 1946 to direct the design, development, and production of nuclear weapons. The Atomic Energy Commission was also responsible for developing nuclear reactors and, beginning in 1954, for regulating the commercial nuclear power industry.

In 1974, Congress replaced the Atomic Energy Commission with two new agencies: the Nuclear Regulatory Commission and the Energy Research and Development Administration. The latter was created to manage the nuclear weapons, naval reactors, and energy development programs, and to research the environmental, biomedical, and safety aspects of energy technologies.

In 1977, Congress created the Department of Energy, which brought together functions and responsibilities of the Energy Research and Development Administration, the Federal Energy Administration, the Federal Power Commission, and the Power Marketing Administrations under one cabinet-level department.

DOE's Present Scope. The Department of Energy develops and implements energy policy and manages a vast array of technical programs. The Department's nationwide complex consists of headquarters and field organizations, national laboratories, nuclear weapons production plants, power marketing administrations, and special-purpose offices. DOE has almost 16,000 Federal employees and over 100,000 contractor employees working at over 50 major installations in 35 states.

The DOE complex includes unique capabilities in science and engineering that we apply to meet the Department's goals in Energy Resources, Nuclear National Security, Environmental Quality, and Science. Powerful accelerators, light sources, neutron beam facilities, plasma and fusion science facilities, genome centers, hydrodynamic testing facilities, special nuclear materials research facilities, and advanced computational centers are just some of the major instruments of science that distinguish DOE's capabilities and enhance the Nation's science base.

Development of this Plan and Its Business Lines

This Plan builds on the 1997 DOE Strategic Plan and incorporates the results of subsequent efforts to evaluate, update, and improve our strategies. Strategic planning activities throughout DOE, major program evaluations, and Departmental annual self-assessments of management challenges have all contributed to this Plan. In addition to our internal efforts, we consulted with Congress, stakeholders, and the public as part of the planning process. The many comments we received on earlier drafts of this Plan have improved the final product. Our planning process and the challenges the Department faces are described in more detail in the third section, entitled "DOE's Strategic Planning."

Our planning efforts are structured into four programmatic business lines: Energy Resources, National Nuclear Security, Environmental Quality, and Science. These programmatic business lines are supported by a corporate management function, presented as a fifth "business line." These business lines are essentially the same as the ones described in the 1997 Strategic Plan. In that document, the Science Business Line was entitled "Science and Technology." The change reflects the fact that "Technology" is distributed throughout DOE's business lines—almost all DOE programs are about technology. Also, in recognition of the

establishment of the National Nuclear Security Administration, the National Security Business Line of 1997 is now named the National Nuclear Security Business Line. That change reflects the singular responsibility of the Department for the "military application of nuclear technology."

A description of the business lines follows, together with a table that lists the general goal for each and its associated objectives.

Energy Resources. Programs in the Energy Resources Business Line respond to the challenge of providing current and future generations with energy that is clean, efficient, reasonably-priced, and reliable. Our development activities cover all aspects of domestic energy from supply through end use, and we also develop energy standards as well as energy-related information, policies, legislation, and regulations. In addition, the Department maintains the Nation's Strategic Petroleum Reserve and actively supports efforts to increase international cooperation on energy issues. Our strategic planning for the Energy Resources Business Line draws heavily on the *Comprehensive National Energy Strategy* (April 1998) and further thinking reflected in the new report *Powering the New Economy: Accomplishments, Investments, Challenges* (September 2000).

National Nuclear Security. Programs in the National Nuclear Security Business Line enhance national security through the military application of nuclear technology and by reducing global danger from weapons of mass destruction. DOE pursues a broad range of activities to maintain the safety, security, and reliability of the Nation's nuclear weapons stockpile in the absence of underground nuclear testing. Strategic planning in this area draws on the Stockpile Stewardship Plan, which DOE updates on an annual basis. Military application of nuclear technology also includes DOE's Naval Reactors Program. In addition, the Department provides expertise and develops capabilities to detect and help prevent the proliferation of materials, technology, and expertise related to nuclear, chemical, and biological weapons.

Environmental Quality. DOE is committed to honoring the Government's obligation to clean up its sites across the country that supported the Nation's production and testing of nuclear weapons; to dispose of spent nuclear fuel from civilian nuclear power plants and radioactive wastes from DOE programs; and to protect human health and the environment. Our plans to address these challenges comprise the Environmental Quality Business Line. They draw on information in the *Status Report on Paths to Closure* (March 2000), as well as the planning and evaluation processes we are following pursuant to the Nuclear Waste Policy Act.

Science. The Department is responding to the challenges of providing basic research to advance science and support DOE's other business lines, and providing instruments of science for the Nation's research enterprise. Programs in the Science Business Line are the foundations for DOE's applied missions, a basis for U.S. technological innovation, and a source of remarkable insights into our physical and biological world and the nature of matter and energy. Our plans for the Science Business Line draw on information in the *Strategic Plan of the Office of Science* (June 1999), as well as the work of many advisory committees that support the Office of Science.

Corporate Management. The Department strives to achieve excellence in its environment, safety, and health practices and provide effective, efficient management systems in support of our technical programs. Corporate Management is an area in which DOE faces multiple performance and management challenges. These challenges have been primarily identified through DOE's own internal reviews and Inspector General reports, but they have also

been reported by others. The Corporate Management Business Line describes our plans to protect the health and safety of DOE workers and that of the general public, improve the delivery of products and services, ensure the public's confidence in DOE, increase the Department's efficiency and effectiveness, and ensure appropriate internal oversight.

DOE General Goals and Objectives

General Goals	Objectives
Energy Resources General Goal: Promote the development and deployment of energy systems and practices that will provide current and future generations with energy that is clean, efficient, reasonably-priced, and reliable.	ER1: Promote reliable, affordable, clean, and diverse domestic fuel supplies.
	ER2: Promote reliable, affordable, and clean transformation of fuel supplies into electricity and related products.
	ER3: Increase the efficiency and productivity of energy use, while limiting environmental impacts.
	ER4: Inform public policy makers, energy industries, and the general public by providing reliable energy information and analysis.
	ER5: Cooperate globally on international energy issues.
National Nuclear Security General Goal: Enhance national security through the military application of nuclear technology and reduce the global danger from weapons of mass destruction.	NS1: Maintain and refurbish nuclear weapons in accordance with directed schedules to sustain confidence in their safety, security, and reliability, indefinitely, under the nuclear testing moratorium and arms reduction treaties.
	NS2: Achieve the robust and vital scientific, engineering, and manufacturing capability that is needed for current and future certification of the nuclear weapons stockpile and the manufacture of nuclear weapon components under the nuclear testing moratorium.
	NS3: Ensure the vitality and readiness of DOE's national nuclear security enterprise.
	NS4: Reduce the global danger from the proliferation of weapons of mass destruction (WMD).
	NS5: Provide the U.S. Navy with safe, militarily effective nuclear propulsion plants, and ensure their continued safe and reliable operation.
	NS6: Ensure that the Department's nuclear weapons, materials, facilities, and information assets are secure through effective safeguards and security policy, implementation, and oversight.

DOE General Goals and Objectives

General Goals	Objectives
Environmental Quality General Goal: Aggressively clean up the environmental legacy of nuclear weapons and civilian nuclear research and development programs at the Department's remaining sites, safely manage nuclear materials and spent nuclear fuel, and permanently dispose of the Nation's radioactive wastes.	EQ1: Safely and expeditiously clean up sites across the country where DOE conducted nuclear weapons research, production, and testing, or where DOE conducted nuclear energy and basic science research. After completion of cleanup, continue stewardship activities to ensure that human health and the environment are protected.
	EQ2: Complete the characterization of the Yucca Mountain site and, assuming it is determined suitable as a repository and the President and Congress approve, obtain requisite licenses, construct and, in FY 2010, begin acceptance of spent nuclear fuel and high-level radioactive wastes at the repository.
	EQ3: Manage the material and facility legacies associated with the Department's uranium enrichment and civilian nuclear power development activities.
Science General Goal: Advance the basic research and instruments of science that are the foundations for DOE's applied missions, a base for U.S. technology innovation, and a source of remarkable insights into our physical and biological world and the nature of matter and energy.	SC1: Provide the leadership, foundations, and breakthroughs in the physical sciences that will sustain advancements in our Nation's quest for clean, affordable, and abundant energy.
	SC2: Develop the scientific foundations to understand and protect our living planet from the adverse impacts of energy supply and use, support long-term environmental cleanup and management at DOE sites, and contribute core competencies to interagency research and national challenges in the biological and environmental sciences.
	SC3: Explore matter and energy as elementary building blocks from atoms to life, expanding our knowledge of the most fundamental laws of nature spanning scales from the infinitesimally small to the infinitely large.
	SC4: Provide the extraordinary tools, scientific workforce, and multidisciplinary research infrastructure that ensures success of DOE's science mission and supports our Nation's leadership in the physical, biological, environmental, and computational sciences.
Corporate Management General Goal: Demonstrate excellence in the Department's environment, safety, and health practices and management systems that support our world-class programs.	CM1: Ensure the safety and health of the DOE workforce and members of the public, and the protection of the environment in all Departmental activities.
	CM2: Manage human resources and diversity initiatives and implement practices to improve the delivery of products and services.
	CM3: Manage financial resources and physical assets to ensure public confidence.
	CM4: Manage information technology systems and infrastructure to improve the Department's efficiency and effectiveness.
	CM5: Use appropriate oversight systems to promote the efficient, effective, and economical operation of the Department of Energy.

Resource Requirements

The Department will achieve its goals and objectives only if it has adequate resources: financial, human, facilities, and infrastructure.

Financial Resources. In developing this plan, the Department assumed budget appropriations consistent with the Administration's outyear budgets except where specifically noted.

Human Resources. Since 1995, the Department has reduced Federal staff from 13,640 to 10,027 through reductions in force, buyouts, and attrition during a hiring moratorium to meet lowered budget levels. As a consequence, the average age of employees in the Department has increased from 44 to 48 over the last 5 years—almost two years older than the government-wide average. The fraction of the staff eligible for retirement has increased from 6 percent to 11 percent in the last 5 years and will increase to 34 percent in the next 5 years. These are all signs of a declining workforce with separations exceeding hires by almost 3 to 1.

The Department must ensure that it has the necessary skills available to carry out its critical missions, and it must begin the process of rebuilding a pipeline of skills for the future as the Department enters a period where the retirement rate is expected to increase. In November 1998, the Secretary of Energy announced a workforce initiative to identify critical hiring needs and strengthen our technical and management capabilities. Funding for this initiative was not available in FY 2000, leaving the Department almost 700 employees short of its projected needs.

More recently, the Under Secretary has established an R&D Technical Capability Panel to provide a "path forward" for rebuilding R&D technical capability at DOE headquarters. The Panel has determined that a comprehensive program is needed for DOE to improve its technical research management capabilities. In April 2000, the Panel recommended a series of specific steps to be taken. The Department is addressing the recommendations as well as pursuing additional initiatives to address our problems in the area of technical management.

Facilities and Infrastructure. DOE is the landlord of 2.4 million acres of land and over 20,000 facilities throughout the United States. DOE developed and used these properties for nuclear weapons research, production, and testing, as well as basic and applied research in nuclear energy and other fields.

Currently, a significant number of facilities continue to be used for research activities and continue to serve national interests. These facilities need to be upgraded, modernized, and maintained scrupulously. At some sites, many of the support facilities and buildings continue to be essential to our missions. They are aging and are in disrepair. It is essential that we apply resources to maintain this infrastructure. Resources will also be needed in the future to construct high-priority, major new facilities and, more generally, to provide technology upgrades to keep pace with advances in science. High-priority items include both new user facilities for the Office of Science and major new capabilities needed for the Stockpile Stewardship Program. Upgrades to modernize capabilities will require substantial modification to existing instrumentation and in many cases, completely new facilities that will be difficult to accommodate within a largely level funding base.

Other sites are being reduced in size and shut down as a result of downsizing. Often, maintenance at these sites has been deferred, creating a growing liability. Many of these properties can serve other valuable functions. For example, buildings can be decontaminated and converted for reuse to spur economic

redevelopment of surrounding communities. In fact, entire parcels of land can be released for economic development or for other uses (e.g., ecological research, conservation, and recreational, agricultural, or rangeland), as appropriate. We are seeking to reduce the Department's real estate to eliminate low-value assets which will free resources to provide greater protection of vital, remaining assets.

Key External Factors

DOE conducts its programs within a complex environment of laws, regulations, and shared responsibilities and in areas of intense public interest and concern. Many of its programs require external coordination and consultation, and the Department does not exclusively control their direction. In order to be successful, the Department maintains close, continuing working relationships with a number of Federal agencies, State and local governments, Tribal Nations, private industry, and other stakeholders, as well as with Congress. Many other Federal agencies play a complementary and extremely important role in ensuring that success of our programs. Appendix A provides a list of interagency crosscutting activities that entail significant DOE participation.

In addition to external coordination and consultation, there are other factors that are outside of DOE's full control and can influence desired outcomes for programs. Examples include:

- Actions by parties opposed to the national security interests of the United States.
- International developments that affect domestic energy security and prices.
- Future developments in national climate policies that result in major changes in the requirements for reduced greenhouse gas emissions from the energy sector.
- Revolutionary technology improvements and discoveries that significantly alter our strategies.
- Significant changes in the public's perception of DOE's performance that affect Congressional and Administration support for DOE programs.

Monitoring Progress and Data Capacity

In FY 1995, the Secretary of Energy first developed and signed an Annual Performance Agreement with the President. Annual Performance Agreements have been prepared each year since, and they have required DOE to track and report performance at the Departmental level. The system we presently use provides a consistent method of presenting data and assessing performance. However, it is not linked with budget execution, and therefore, does not provide the comprehensive perspective needed to plan effectively.

DOE is developing new standardized technology—the Business Management Information System (BMIS)—that integrates budget data and performance assessments. It uses performance measures that are based on goals defined in the Strategic Plan, Annual Performance Plan, and Performance Agreement. BMIS will be used Department-wide to consolidate the business, organizational, and operational information. BMIS will provide a structured approach to financial management and budget formulation, and it will enhance the ability of DOE to monitor and report on its commitments.

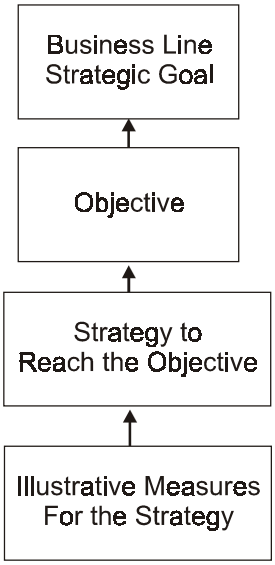
Design of this Plan

The design of this DOE Strategic Plan differs from our previous plan of 1997. Our terminology is now more consistent with the definitions provided in the Government Performance and Results Act (Public Law 103-62). Our business lines have general goals that are long term and outcome oriented. They are stated in a manner that allows an assessment of progress in the future. Each general goal is supported by three to six objectives. Each objective defines major accomplishments that contribute to achieving the general goal. Objectives are measurable, achievable, and reasonable targets with deadlines.

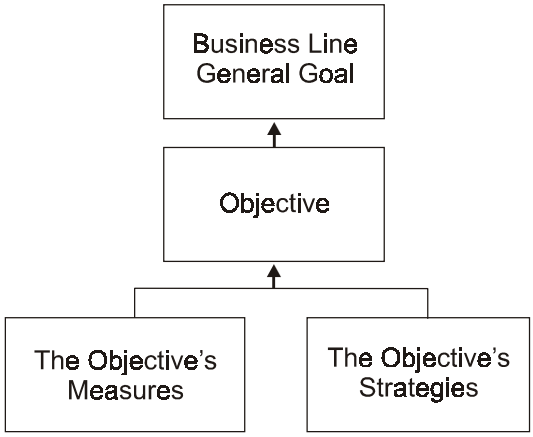
In this Plan, each objective has a definitive set of performance measures and a set of strategies. The objective's measures expand on the objective. They specify the basis by which DOE will ascertain that it is making progress toward achieving the objective. The strategies are the activities that support an objective. In most cases, they are the activities executed using the funds appropriated by Congress.

The second section of this Strategic Plan covers the four programmatic business lines and Corporate Management. Each business line subsection contains: a situation analysis; key external factors; interagency crosscutting coordination; Congressional and stakeholder consultations; program evaluations and analyses; resource requirements; and the business line's general goal, objectives, measures, and strategies.

The third section of this Strategic Plan describes DOE's planning process, the role of program evaluation in planning, management challenges for the Department, and our consultations with stakeholders during the planning process.



1997 Strategic Plan Design



2000 Strategic Plan Design

DOE'S BUSINESS LINES

ENERGY RESOURCES BUSINESS LINE

Energy is the vital force powering business, manufacturing, and movement of goods and services throughout the country. The United States spends over one-half trillion dollars annually for energy, and our economic well-being depends on reliable, affordable supplies of clean energy. Energy is also a global commodity. With growing worldwide populations, rising living standards, and economies in transition to market-based systems, the demand for energy is increasing in an ever more globalized energy market. These factors could contribute to several trends that would negatively impact our economy, environment, and energy security during the first half of the 21st century. To counteract these trends, it may be necessary to significantly change the way we supply and use energy.

In order to meet the Nation's energy needs in the 21st century, DOE is committed to the following policy principles:

- Reliance on competitive market as the "first principle" of energy policy;
- Support for energy science and technology development;
- Promotion of government/industry/ consumer partnerships;
- Use of targeted incentives and regulations; and
- Facilitation of international cooperation.

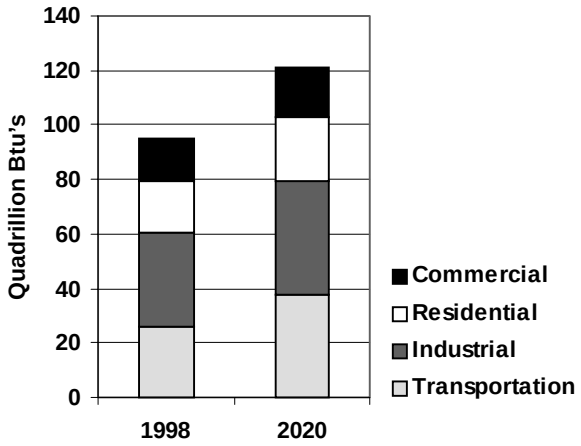
As an agent to affect both policy and technology development, DOE has unique roles and responsibilities.

The Department's goal in Energy Resources is to promote the development and deployment of energy systems and practices that will provide current and future generations with energy that is clean, efficient, reasonably-priced, and reliable. The Department pursues this goal through a variety of approaches, including market reforms that increase competition while assuring reliability, the development of improved energy technologies and standards, energy-related information, voluntary programs, and the maintenance of emergency oil reserves.

Situation Analysis

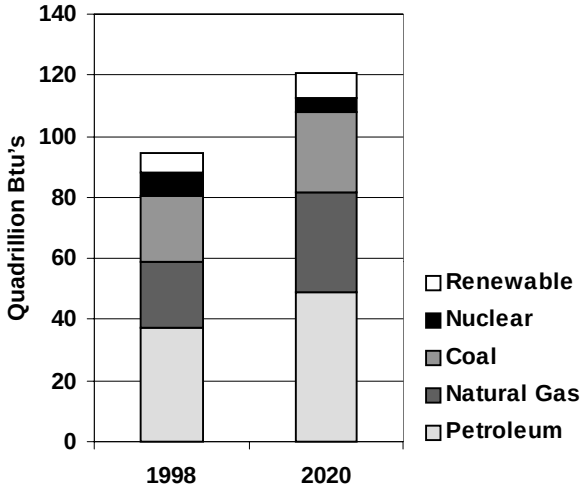
U.S. Energy Supply and Consumption. The two charts below show energy supply by type of fuel, and the amount of energy that is consumed in each sector of the economy.

Energy Consumption by Sectors



Source: *Annual Energy Outlook 2000*

Energy Supply by Fuel Type



Source: *Annual Energy Outlook 2000*

In 1998, the total U.S. energy consumption was about 95 quadrillion BTU's, which was about 25 percent of the world total, and that figure is projected to increase to about 120 quadrillion BTU's by 2020. As can be noted from the 1998 data, the energy supply is dominated by fossil fuels (coal, oil, and natural gas), which account for 85 percent of the total. America's energy resources are extensive and diverse. Coal, oil, natural gas, and uranium are abundant, and a variety of renewable resources are available in large untapped quantities. The United States produces almost twice as much energy as any other nation, nearly as much as Russia and China combined. Our Nation uses most of this energy domestically, although it exports considerable amounts of coal, refined petroleum products, and enriched uranium. It is significant that the United States relies on petroleum for about 40 percent of its energy supply, and over 50 percent of this petroleum is imported.

The second graph illustrates how energy is consumed among the four basic demand sectors of our economy: transportation, industrial, residential, and commercial. In the transportation sector, petroleum currently accounts for nearly 97 percent of fuels consumed. A wide variety of fuels are used in the industrial sector, while energy use in the residential and commercial sectors is dominated by natural gas and electricity. Over 35 percent of energy consumed in the United States is used to generate electricity. However, nearly 70 percent of that energy is lost, mainly as waste heat in the generation process.

Energy Trends and Challenges. The supply and demand projections for 2020 are based on expected energy trends, which, in turn, depend on future energy policies and the development and deployment of new energy-supply and energy-efficiency technologies. Technology advances resulting from both Federal and private sector R&D investments are having a positive impact. Nevertheless, the overall domestic demand for

energy is expected to grow, which is likely to increase U.S. reliance on oil imports.

Technology advances are reducing the cost of energy production and electricity, enhancing the ease and affordability of transportation, and improving the comfort and utility of residential and commercial buildings. Advances are also supporting a vibrant and competitive industry. Technology advances have been key drivers in the decrease in energy intensity that the United States has achieved post-1970s.

The U.S. economy is demanding less energy per unit of goods produced. The rate of economic growth, as measured by the Gross Domestic Product (GDP), has outpaced the rate of primary energy consumption and it is projected to continue to do so. Hence, energy intensity—the ratio of energy consumption to GDP—is forecasted to continue to decrease.

Advanced energy technologies are also helping to limit or reduce environmental damage. For example, technology has enabled, at modest cost, significant reductions in the emission of most conventional air pollutants produced from the combustion of fossil fuels.

Various government agencies are working together to remove unnecessary government regulation and to institute regulatory reforms to revitalize our competitive market forces. The result has been to increase the economic efficiency of the U.S. energy system, which has in turn helped reduce energy prices from the highs experienced in the early 1980s.

In spite of the improvements brought about by better technology and regulatory reforms, total energy use has continued to increase in the 1990s. Important contributing factors include the growing U.S. population, increased production and use of light trucks (minivans and sport utility vehicles), and greater use of electrical equipment in our homes and businesses (for example, air conditioners, computers, and motors). Assuming energy and electricity prices remain near the year 2000 levels, energy consumption is likely to continue to increase.

Increasing energy demand by the transportation sector is likely to expand U.S. reliance on oil and oil imports. Improved technology has enabled the United States to boost energy production in many areas; however, these advances have been insufficient to counter the gradual decline of U.S. oil reserves and production. Based on this trend, EIA has projected oil imports to increase from 51 percent in 1999 to 64 percent in 2020.

In addition to greater reliance on oil imports, the Nation will be challenged by a rapidly increasing demand for electricity that could strain the ability of the U.S. electric system to provide reliable and affordable service, especially during periods of peak demand. Furthermore, the anticipated increased demand for fossil fuels is likely to increase emissions of greenhouse gases, which will make further reductions in the emissions of conventional air pollutants more difficult. Fossil fuels account for about 98 percent of man-made, carbon greenhouse gas emissions in the United States.

These trends and new challenges were captured in the final report of the Energy Research and Development Panel of the President's Committee of Advisors on Science and Technology (PCAST), November 1997, that stated:

> *"The United States faces major energy-related challenges as it enters the twenty-first century. Our economic well-being depends on reliable, affordable supplies of energy. Our environmental well-being— from improving urban air quality to abating the risk of global warming—requires a mix of energy sources that emits less*

carbon dioxide and other pollutants than today's mix does. Our national security requires secure supplies of oil or alternatives to it, as well as prevention of nuclear proliferation. And for reasons of economy, environment, security, and stature as a world power alike, the United States must maintain its leadership in the science and technology of energy supply and use."

Government Role. During the late 1970s, it became apparent that the decades-old regulation of energy prices was counterproductive and that the Nation should pursue market-oriented approaches to energy supply and use wherever possible. A consensus developed that competitive markets should be the cornerstone of a successful energy policy, but also that society cannot rely on markets alone to achieve all of society's economic, environmental, and security goals. A role remains for the government because market forces are generally not able to capture or reflect benefits that accrue to the society at large.

The role of government in energy is now focused on the important tasks of improving the operation of competitive markets and addressing the market's inherent limits. This approach allows markets to be the key determinants of supply and demand, while government supplements market forces through policies that bolster energy security and provide for a cleaner environment.

In this context, the Federal government focuses on augmenting energy security by maintaining the Strategic Petroleum Reserve and coordinating emergency responses with our allies in the International Energy Agency. To reduce dependence on oil imports, the government also promotes increased domestic oil and gas production and encourages reduced oil consumption through efficiency and the use of alternative fuels. Furthermore, the Federal government promotes measures to protect the domestic energy infrastructure and maintain military preparedness. The Federal government also seeks to encourage favorable conditions in energy-producing regions of the world to facilitate access of all oil and gas resources to global energy markets.

The government reduces negative environmental effects by developing cleaner and more efficient energy technologies, regulating pollution, and setting standards for energy use in consultation with the private sector. In addition, it ensures that any access to environmentally sensitive public lands is conducted with minimal impact. The government ensures the flow of new and cleaner energy technologies by funding energy research, development, and demonstration, in concert with the private sector. Ultimately, the continued development of new technologies improves the efficiency of end use and reduces the negative environmental effects of energy production and use and thus contributes to a high quality of life.

The Federal government's energy role is articulated through the goals, objectives, and strategies in the April, 1998, *Comprehensive National Energy Strategy* (CNES), developed by DOE and other Federal agencies with input from many stakeholders. The CNES identifies actions that help to increase energy supply diversity and fuel choices, bring renewable energy sources into the market, strengthen domestic production of oil and gas, support commercial nuclear energy research, and increase the efficiency of both power production and end-use technologies. DOE is the lead Federal agency in implementing CNES through our efforts to assure clean, affordable, and dependable supplies of energy for our Nation. More recently, the

accomplishments, investments, and current challenges of the Department were summarized in *Powering the New Economy* (available at www.policy.energy.gov).

The Department's Energy Resources mission is performed through the integrated efforts of a number of DOE organizations. Three of them—the Office of Energy Efficiency and Renewable Energy, the Office of Fossil Energy, and the Office of Nuclear Energy, Science and Technology—manage the research, development, and deployment of advanced energy technologies. This work is performed primarily through partnerships with industry, Federal and non-Federal laboratories, universities, and Federal, State, and local government agencies. Another DOE organization, the Energy Information Administration, publishes energy-related information necessary for informed consumer, market, and policy decisions. The Power Marketing Administrations sell and distribute more than $3 billion of electric power generated at Federal hydroelectric plants. DOE's Office of International Affairs and Office of Policy are the lead organizations for many of the policy-related thrusts supporting the Energy Resources goal.

Key External Factors

Factors external to DOE's direct control can influence desired energy resources outcomes. They include:

- The way that environmental regulations and policies will develop over time.
  - Reducing the levels of greenhouse gas emissions may prove to be one of the most important strategic drivers of energy policy, especially if international climate change agreements are reached that require significant reductions in projected U.S. emissions.
  - Changes in Federal or State regulations governing energy-related air emissions, motor fuel quality, and other liquid/solid waste streams, will affect both the types of energy and technologies used.
  - Competing Federal, State and local environmental and land management priorities could affect the ability of the private sector to produce and deliver energy to consumers.
- Changes in the pace or direction of energy market restructuring.
  - Without a national legislative framework for moving forward with electricity market restructuring, industry investment in new technology could be adversely affected with implications for consumer prices in the future.
- Unexpected developments in international energy markets.
  - Worldwide demand for oil and other energy resources may place upward pressure on international energy prices.
  - Uncertain rates of production by major oil-producing nations could increase price volatility, which tends to make domestic oil investments and investments in alternative energy technologies more risky.

- Unexpected scientific and technological developments.
  - The implications for energy use of the new digital economy and related technological advances are not yet well understood.
- Changes in market and economic trends.
  - The rate of economic growth will have an important effect on energy demand and the level of private investment.
  - Existing trends toward lower private sector investments in R&D could affect the rate of development of energy technologies.

DOE will continue to work with its stakeholders and Congress to promote legislation, regulations, and policies that may be needed to address these and related economic, demographic, social, or environmental issues.

In the face of these uncertain factors, DOE continues to press for the development of advanced technologies that can help the Department meet its energy security, environmental, and economic goals. In fostering new technologies, DOE offices will leverage Federal funding by developing partnerships with other DOE offices, other Federal agencies, Tribal Nations, State and local governments, foreign governments, national laboratories, universities, industry, and other stakeholders to plan, fund, and implement programs.

Interagency Crosscutting Coordination

DOE's goals and objectives reflect the unique roles and responsibilities of the Department. Nonetheless, success will depend upon closely coordinated planning and continued working relationships with a number of Federal agencies, State and local governments, Tribal Nations, private industry, and Congress.

It is especially important to recognize the complementary role other Federal agencies play in our energy programs. For example, DOE's activities to reduce the cost of producing domestic oil and gas resources must be coordinated with the Department of the Interior and Department of Agriculture because these agencies manage public lands that overlie large quantities of domestic energy resources.

The Department also participates in some crosscutting government functions and initiatives that are beyond the mission of any one agency. Responsibilities and programs relating to topics such as global climate change, basic research, and science education rely upon the expertise and capabilities of numerous agencies to meet common goals of the Administration. The Office of Management and Budget (OMB) and the White House Office of Science and Technology Policy play an important leadership role in coordinating these efforts. Each participating agency is challenged to define its role and develop programs that best use that agency's unique financial, human, and technical resources in an effort to optimize overall government performance. DOE's contribution to these crosscutting programs is founded upon the distinctive technical and scientific expertise and capabilities located within its laboratory system and facilities. The Department is committed to continue working closely with other Federal

agencies and with OMB and Congress to ensure that its programs provide critical and unique contributions to these crosscutting efforts.

Congressional & Stakeholder Consultations

DOE consults with Congress and stakeholders on a continuing basis. These consultations take place both as part of the energy resources mission and as part of normal strategic and multi-year planning and budgeting processes for individual DOE program offices. Consultations involve a large number of participants, including DOE staff, DOE laboratories, and DOE management and operations contractors; key customers in the Departments of Defense, State, Commerce, Transportation, Agriculture, and Interior, the Environmental Protection Agency, Nuclear Regulatory Commission, and National Aeronautics and Space Administration; and stakeholders including State and local government agencies, Tribal Nations, industry consortia, academic institutions, the White House Office of Science and Technology Policy, OMB, and Congressional committees. As an example of the process, DOE developed a *Comprehensive National Energy Strategy* in 1998, which included public hearings around the country and the solicitation of public comments on the draft.

Program Evaluation and Analyses

DOE continually modifies its Energy Resources programs through its own strategic planning process which includes portfolio planning and analysis, technology roadmapping, and budget planning activities. In addition, numerous other planning efforts and studies in recent years have provided important additional input to DOE's Energy Resources efforts and have influenced DOE program priorities and funding requests. Examples include:

Federal Energy Research and Development for the Challenges of the Twenty-First Century, published in November 1997, is a study conducted by an Energy R&D Panel appointed by the President's Committee of Advisors on Science and Technology. The report provides a thorough review of DOE's Energy Resources R&D Portfolio. It found that, in general, the R&D activities in the current DOE program were appropriate. While the study proposed particular changes within the programs, including some specific reductions, redirections, and increases, the most important recommendation was for a substantial increase in energy technology R&D.

Powerful Partnerships – The Federal Role in International Cooperation on Energy Innovation, published in June 1999, is a report from the President's Committee of Advisors on Science and Technology. It examined ways to improve the U.S. program of international cooperation on Energy R&D to best support U.S. priorities, and addresses the key global energy environmental challenges of the 21st century. The report recommends support for a variety of initiatives using mechanisms such as regulatory assistance, training, Federally-supported R&D, and tax credits.

The *Comprehensive National Energy Strategy*, published in April 1998, fulfills a statutory requirement of the Department of Energy Organizational Act and sets forth the Nation's national energy policy. Goals, objectives, and strategies in the report form a blueprint for the specific programs, projects, initiatives, investments, and other actions that will be developed and undertaken by the Federal government. The document places significant emphasis on the need for scientific and technological advancements to successfully implement the strategy.

Technology Opportunities to Reduce U.S. Greenhouse Gas Emissions, published in 1998, was conducted by 11 DOE National Laboratories. The study identified 47 technology pathways that offer significant potential to reduce greenhouse gas emissions. The laboratories grouped the technologies according to "Energy Efficiency," "Clean Energy," and "Carbon Sequestration" and reviewed them, with particular emphasis on the time period from the date of the study until 2030 when each technology would be most likely to make contributions toward reducing U.S. greenhouse gas emissions. The study concludes that the Energy Resources R&D Portfolio generally contains the range of advanced energy technologies that represent the best opportunities for reducing greenhouse gas emissions over time. It further recommends collaborative R&D efforts in a number of areas involving partnerships among the private sector, universities, and government.

The *Energy Resources Research and Development Portfolio*, the most recent version released in February 2000, is one of five volumes published by DOE to provide in one place a clear description of the Department's entire $7 billion research portfolio. The document is intended to help (1) describe DOE's current R&D activities and showcase recent accomplishments, (2) demonstrate that the energy portfolio is appropriately balanced to meet our long-term strategic mission goals, (3) align our technology investments with broader national policy goals, and (4) plan for future investments through technology roadmapping.

In addition to major planning studies such as those cited above, DOE continually seeks advice on issues of broad national energy importance from advisory committees and through partnerships with other groups. Examples include: (1) two studies requested by the Secretary from the National Petroleum Council titled: *Meeting the Challenges of the Nation's Growing Natural Gas Use* (December 1999) and *United States Refinery Viability and the Availability of Clean Fuels* (June 2000); (2) partnerships with the North American Electric Reliability Council and the National Petroleum Council to develop strategies for ensuring critical infrastructure protection within the energy sector (pursuant to 1999 directives); (3) reviews of DOE management practices, such as a recent review of performance by the National Academy of Public Administration; and (4) third-party reviews of program performance metrics, such as those periodically conducted by Arthur D. Little and Associates.

Finally, on September 28, 2000, the Department released its newest study, *Powering the New Economy: Accomplishments, Investments, Challenges*. The report summarizes DOE's accomplishments, R&D programs, and ongoing challenges.

Resource Requirements

The Department will only achieve its goals and objectives if it has adequate financial, human, infrastructure, and technical resources. In developing this plan, the Department assumed budget appropriations consistent with the Administration and Congress's agreed upon five-year budget deficit reduction targets through FY 2002. The Energy Resources Business Line is funded at about $2 billion per year.

Federal staffing levels are based upon the Department's internal staffing targets of about 7,600 full-time equivalent Federal employees (which includes the Power Marketing Administrations).

ENERGY RESOURCES GENERAL GOAL

Promote the development and deployment of energy systems and practices that will provide current and future generations with energy that is clean, efficient, reasonably-priced, and reliable.

The Energy Resources (ER) goal covers all aspects of domestic energy from fuel supply through end use. This goal is effectively advanced through a variety of approaches, including the development of improved energy technologies and standards, energy-related information, policies, legislation, regulation, international cooperation and the maintenance of emergency oil reserves. The Energy Resources general goal is supported by five objectives.

OBJECTIVE ER1

Promote reliable, affordable, clean, and diverse domestic fuel supplies.

Introduction

To promote reliable, affordable, clean, and diverse domestic fuel supplies, the Department pursues R&D to enhance domestic oil and gas supplies and provide fuels that reduce environmental concerns. In addition, DOE maintains the Nation's Strategic Petroleum Reserve.

R&D to enhance domestic oil and gas supplies aims to improve technologies for exploration and production. These efforts include work in areas such as diagnostics, seismic imaging, effective environmental protection, and reservoir life extension. Advances in technology are needed today and the need will increase in the future. The Nation's oil and gas resources are largely in mature, already producing areas, and remaining new sources are increasingly difficult to find and to affordably bring into production.

An increasingly important thrust for R&D is to provide fuels with greatly reduced environmental consequences. For example, through an "Ultra-Clean Transportation Fuels Initiative," DOE is pursuing fuels derived from petroleum and other hydrocarbon feedstocks (such as natural gas and coal) that can be used in advanced vehicles designed to meet anticipated emission standards (see Objective ER3: Energy Efficiency/Productivity). R&D on biofuels is stressing ethanol production as a gasoline additive and replacement fuel. Hydrogen fuels are the cleanest burning fuels that we can develop. DOE places particular emphasis in two areas: finding ways to economically produce hydrogen, and addressing the lack of an infrastructure to utilize hydrogen fuels. DOE also develops technologies aimed at the storage and distribution of gaseous hydrogen. One other relatively new area of R&D is to help ensure the integrity of the domestic natural gas delivery and storage infrastructure as domestic consumption increases a projected 40 percent by 2015.

The Strategic Petroleum Reserve (SPR) is the Nation's first line of defense against an interruption in petroleum supplies. At present, the inventory includes 570 million barrels crude oil in the Gulf Coast area, and the SPR's overall capacity is 700 million barrels. The current intent is to continue adding to the SPR inventory using royalty oil (i.e., oil provided by companies as payment for producing from Federal lands) from Federal offshore tracts. In a related action, the President, on July 10, 2000, directed DOE to offer to exchange crude oil from the SPR for heating oil and to seek out companies willing to provide up to 2 million barrels of emergency heating oil stocks and the necessary storage facilities in time for the 2000-2001 winter season. In August 2000, contracts for the storage sites were put into place.

Certain renewable sources (e.g., wind and solar) and nuclear are relevant to Objective ER1 but are not discussed here as fuels. Rather, they are covered comprehensively under Objective ER2 (Energy Transformation).

The Objective's Measures and Strategies

DOE has established the following performance measures. These measures provide the basis by which the Department will know that it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department. The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

Strategic Oil Reserves

Measure:

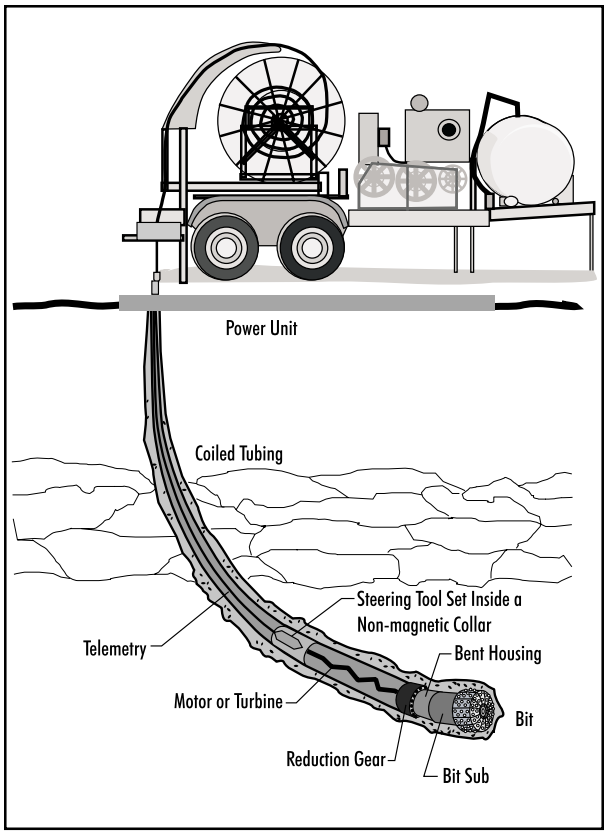
- Continue to assure the availability of the Strategic Petroleum Reserve at 95 percent or greater to enable draw down from the Reserve at a sustained rate of 4.1 million barrels per day for a sustained 90 day period within 15 days notice by the President.

- Achieve an operational Heating Oil Reserve by October 30, 2000.

Strategies:

- Maintain an effective Strategic Petroleum Reserve (SPR) to deter and respond to oil supply disruptions, and cooperate with member nations of the International Energy Agency.

- Implement the heating oil reserve through commercial exchange of SPR crude oil for two million barrels' equivalent amount of heating oil, and acquisition of interim storage tank capacity in the Northeast.



Microdrilling Technology: Drill bit attached to thin steel coil could be a major advancement in oil and gas exploration, reducing costs and environmental impacts.

Enhanced Domestic Oil and Gas Supplies

Measures:

- By 2005, increase domestic production by 600,000 barrels per day of oil and over 1.5 trillion cubic feet of natural gas per year relative to EIA's 1999 price and production forecast through development of advanced diagnostics and imaging systems, drilling technologies, more efficient recovery processes, and less expensive technology/ approaches for addressing environmental concerns.

- By 2007, provide the Nation with real-time tools and technologies that are capable of continually monitoring pipeline integrity for mechanical damage, seismic activity, and internal pipeline corrosion.

Strategies:

- Provide policy, legislative, regulatory, and technology options, as well as improved practices to enhance the availability of domestic oil and natural gas supplies, while minimizing the environmental impacts of production.

- Develop technologies and improved practices to enhance the reliability and adequacy of the domestic natural gas pipeline and storage system.

Clean Fuels

Measures:

- By 2002, achieve commercial ethanol production using non-corn biomass residues, and by 2010, incorporate into existing corn ethanol plants cellulosic ethanol production using dedicated biomass feedstocks.

- By 2005, demonstrate production of cost-competitive, ultra-clean, transportation fuels from natural gas and petroleum feedstocks with sulfur levels below the proposed EPA standard of 30 ppm average (current levels of gasoline and diesel are in the range of 300 to 500 ppm). By 2010, demonstrate the technology needed to produce fuels from these and additional carbon feedstocks (biomass, coke, coal, etc.) that can meet the much tighter Tier II Standards (cap of 15 ppm sulfur for both diesel and gasoline fuels) that are expected to be fully implemented by that time.

Biofuels: Harvesting short-rotation hybrid poplars for fiber and fuel.

- By 2004, develop and deploy hydrogen systems that are cost-effective to use with fuel cells in some applications for the production of electricity, and for transportation applications beginning in 2008.

- By 2005, increase the number of dedicated alternative fuel vehicles, the use of alternative fuel in dual-fuel capable vehicles, and the use of non-petroleum components in gasoline, displacing at least 130,000 barrels per day of petroleum-based fuels.

Strategies:

- Develop technologies to produce ultra-clean fuels from natural gas, oil, coal, biomass, and hydrogen from a variety of sources, which can be used with minimal negative environmental consequences.

- Promote the use of alternative fuel vehicles in selected niche markets (e.g., school buses, shuttles, fleets). Work with fuel providers and individual communities to help promote the development of refueling infrastructure and provide incentives for the use of alternative fuel. Promote the use of replacement fuels, such as ethanol, as blends in gasoline.

OBJECTIVE ER2

Promote reliable, affordable, and clean transformation of fuel supplies into electricity and related products.

Introduction

DOE conducts both policy and technology development activities directed toward achieving reliable, affordable, and clean methods for the transformation of fuel supplies into electricity and related products. Of interest are both centralized (i.e., large) and decentralized (i.e., distributed) systems to convert energy from its source form into one that is more useful to end users. This includes conversion of fuels to electricity and to additional co-products such as heat, mechanical energy, specialty fuels, and/or chemicals. DOE supports a variety of options to provide for competition among electricity generators and to assure open access to the transmission systems. Various technology options under development utilize fossil fuels, renewable energy resources, or nuclear power in high-efficiency, centralized energy systems and in distributed and hybrid energy systems to deliver affordable, reliable, and clean electric power. Hybrid means joining different energy technologies such as a fuel cell and gas turbine into a single system.

For centralized systems for energy conversion, DOE emphasizes several options. One area of emphasis is advanced coal and natural gas-fueled power technologies. The aim of this effort is to achieve high efficiency and low emissions, and eventually to integrate these technologies into "Vision 21" plants that will achieve even higher efficiency, provide feedstock and product flexibility, reduce emissions, and lower cost. There is also growing interest in multi-product facilities in which the otherwise wasted heat created by generating electricity is used for industrial applications. Other efforts are focusing on helping to ensure that nuclear plants can deliver affordable supplies beyond their initial 40-year license period. In addition, new reactor designs are being developed that offer improved economics, reduced waste generation, increased safety, and resistance to proliferation.

R&D on distributed and hybrid systems, which includes renewable, fuel cell, and turbine technologies, continues to expand in recognition of the potential environmental benefits and the advantages of increasing distributed generating capacity.

Particular emphasis is placed on technologies that can have a major, long-term impact on greenhouse gas reduction, as well as other benefits, in both domestic and international applications. These technologies include wind, photovoltaics, and biopower renewable systems, and carbon capture/sequestration. Also included are systems to ensure a robust, reliable electricity and natural gas infrastructure, which is needed to serve emerging, competitive, regional and interregional markets.

The Objective's Measures and Strategies

DOE has established the following performance measures. These measures provide the basis by which the Department will know that it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department. The following strategies describe the way in which the Department will work toward achieving this

objective. These activities will be translated into annual budgets and performance plans for the Department.

Electricity Policy

Measures:

- By 2003, enhance modeling capabilities in the areas of electricity transmission, reliability, and market design so that models can better estimate cost, energy, and environmental impacts, and be used to develop and support policies that provide reliable, clean, and affordable electricity to customers.

Strategy:

- Provide policy, legislative and technology options to encourage the operation of large-scale, interregional, real-time, competitive electricity markets that encompass both centralized and distributed generation sources, while maintaining system reliability and improving environmental performance.

Large, High Efficiency, Advanced Power Systems

Measures:

- By 2005, identify credible candidate designs for fourth generation nuclear power plants that are capable of being deployed in the 2020 time frame.

- By 2008, develop and deploy key enabling power technologies in initial markets, including advanced fuel cells and turbines, and gas separation membranes. By 2015, integrate these technologies through progressive enhancements into a new "Vision 21" generation of fossil fuel based systems:

Vision 21 Energy Plant: The Vision 21 plant depicted here is extremely compact and efficient, with near-zero emissions. Fuels include municipal waste and coal.

  - For use with multiple feedstocks.
  - To achieve near-zero emissions of traditional pollutants.
  - To nearly double the average efficiency of today's operating plants.
  - To be compatible with carbon sequestration systems available in the same time frame.

- By 2015, demonstrate a suite of low-cost and environmentally-safe capture/ sequestration technologies capable of offsetting all projected increases in U.S. greenhouse gas emissions.

Strategies:

- Enhance the economics and environmental performance of electricity generation by expanding the use of multi-product facilities that can also produce heat, clean fuels, and/ or chemical products.

- Pursue evolutionary improvements in existing CO_2 capture systems and explore

revolutionary new greenhouse gas capture and sequestration concepts with a view toward significant cost reductions.

- Develop advanced fossil- and nuclear-based power generation systems that can meet future environmental goals at reasonable cost.

Preserving DOE's Infrastructure

DOE's R&D for large power systems is supported by a variety of major facilities. A considerable infrastructure of DOE owned and operated reactors, accelerators, and hot cells is dedicated to expanding our knowledge of nuclear science and technology. These nuclear facilities are shared across the business lines of National Nuclear Security, Science, Energy Resources, and Environmental Quality. An example of a non-nuclear facility is the Wilsonville Power System Development Facility, which is the most advanced facility in the world for testing future fossil-fueled power technologies. Ensuring the viability of DOE's R&D infrastructure is vital to meeting its goals and objectives.

Renewable, Distributed, and Hybrid Energy Systems

Measures:

- Relative to a 1996 level of 6.5 gigawatts, provide technologies to double renewable energy (non-hydroelectric) generating capacity by 2004, and triple it by 2010. This goal includes (the following do not account for interactions among or between renewable energy supply options):
  - Wind: increase total domestic wind-electric generating capacity from 2.5 GW in 1999 to 10 GW by 2010.
  - Solar: increase total domestic sales of solar-electric (photovoltaic) capacity from 0.4 GW in 1996 to 1 GW by 2004, and to 30 GW by 2020.
  - Geothermal: from the base year of 1999, double the number of States with geothermal-electric facilities from 4 to 8 by 2006; increase from 2.5 to 7 million the number of U.S. homes utilizing geothermal energy by 2010; provide 6 GW of electric generating capacity by 2010 compared with 2.8 GW in 1999; increase the fraction of the electricity used by western states that derives from geothermal resources from 1 percent in 1999 to 10 percent in 2020.
- By 2004, make available for stationary, military, and auxiliary power markets a 5-kilowatt, solid-state fuel cell that has both hybrid and distributed power system applications.
- By 2005 provide technologies that support an increase in the Nation's distributed power to 8 percent of the new electricity capacity, and 20 percent by the end of 2010.
- By 2010, double (from the 1999 level) the installed capacity of combined heat and power systems in the United States to make use of thermal energy otherwise rejected in the generation of electric power.
- By 2010, triple (from the 1999 level) domestic use of bio-based products and bio-energy.

Strategies:

- Improve the performance and expand the use of non-hydroelectric renewable energy generating capacity in the United States.
- Develop technologies to increase the amount of the Nation's distributed power (i.e., electric generating systems connected to the distribution portion of the grid).

Technology Improvements of Operating Plants

Measures:

- Between 2003 and 2008, provide technologies to improve the environmental performance of existing coal-fired power plants and reduce environmental compliance costs by 25-75 percent, compared to existing technologies and strategies.
- By 2010, develop and deploy technologies that will improve the availability of operating nuclear power plants from 75 percent to 85 percent.
- Maintain the current level of national hydro-power capability and economic competitiveness.

Strategies:

- Develop technology to improve the performance of older fossil and nuclear power plants, permitting continued operation in an increasingly competitive and environmentally-constrained industry.
- Develop hydroelectric power technologies that are more "fish friendly."

Enhanced Energy System Reliability

Measure:

- For the entire period of this plan, each Power Marketing Administration will receive "pass" as its monthly control compliance rating based on the North American Electric Reliability Council (NERC) performance standards.

Strategy:

- Through the Power Marketing Administrations, market and reliably deliver Federal hydroelectric power with preference given to public bodies and cooperatives.

Boosting Efficiency and Enhancing Process Economics Through Multi-Product Strategies

Historically, the vast majority of domestic electricity generation has been from facilities that produce only electricity and operate at about 30 percent efficiency due to generation, transmission, and distribution losses. Most of these losses are in the form of heat lost during generation. New and emerging technologies, such as advanced turbines, fuel cells, gasifiers, and materials that can act as molecular sieves, are opening up new possibilities. Captured waste heat can be used for buildings or industrial processes. Clean fuels and chemicals can be produced in addition to electricity. Multi-product plants based on these technologies could also be designed with flexibility to use a variety of feedstocks such as coal, natural gas, biomass, and waste fuels.

OBJECTIVE ER3

Increase the efficiency and productivity of energy use, while limiting environmental impacts.

Introduction

In order to meet this objective, DOE develops technology that makes possible cleaner and more efficient vehicles, more energy efficient buildings, and cleaner and more productive industries. To enable commercial production of cleaner and more efficient vehicles, R&D efforts are focused on advanced engines, batteries, and fuels cells to dramatically improve the efficiency of passenger vehicles and light and heavy trucks. Emphasis is also placed on achieving effective, affordable emissions-control technologies for diesel engines. R&D to increase the energy efficiency of buildings focuses primarily on heating, cooling, air conditioning; building material and envelope; building design and operations; and lighting and appliances. Carefully considered performance standards for buildings and appliances reduce overall energy use and improve the quality of building energy services. One of many related efforts is the Federal Energy Management Program within DOE, which is working to reduce the cost of energy at Federal facilities by improving energy and water efficiency, promoting use of renewable energy, and managing utility costs. Another example is the DOE Weatherization Program, which is aimed at improving the energy efficiency of homes for low-income families. (More than 4.7 million homes have been weatherized since 1977, saving $1.80 in energy costs for every dollar invested.) DOE's industry R&D agenda is driven by technology road-mapping activities carried out by the private sector. The aim is to develop and deploy technologies and methods that can significantly improve the efficiency of the Nation's most energy intensive industries and reduce environmental emissions. There are nine "Industries of the Future" in the Department's industry R&D portfolio—the latest additions being mining and agriculture. Included is a "Bio-based Products and Bio-energy Initiative" that is adding emphasis to the Agriculture and Forest Products programs.

The Objective's Measures and Strategies

DOE has established the following performance measures. These measures provide the basis by which the Department will know that it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department. The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

Clean and Efficient Vehicles

Measures:

- By 2003, develop advanced clean diesel engine technologies that enable commercial production of pickup trucks, vans, and sport utility vehicles (SUVs) capable of achieving at least a 35 percent fuel efficiency improvement relative to gasoline-fueled trucks.

- By 2004, develop advanced diesel engine and vehicle systems technologies for Class 7 and 8 trucks that allow fuel flexibility, reduced emissions, and reduced parasitic losses (aerodynamic drag, rolling resistance, and drive line losses), thereby increasing the average fuel economy of new, long-haul heavy trucks to 10 miles per gallon (mpg) from the approximately 7 mpg of the late 1990s.

- By 2004, develop advanced technologies to enable production-capable prototype automobiles with approximately three times the fuel economy of conventional automobiles (1993 base year) and achieve the goal of the Partnership for a New Generation of Vehicles.

Strategy:

- Develop and deploy advanced vehicles, fuels, and systems that will significantly increase gas mileage and reduce environmental emissions without compromising safety, comfort, and cost.

Efficient and Affordable Buildings

Measures:

- Reduce annual energy consumption of buildings by 2 Quads (quadrillion BTUs), and save consumers a cumulative $65 billion by 2010.

- Reduce energy consumption in Federal facilities by 35 percent by 2010 relative to the 1985 consumption level, and reduce carbon (equivalent) emissions by about 100 million metric tons.

Strategy:

- Develop products and strategies to increase the efficiency of new and existing residential and commercial buildings.

Clean and Productive Industries

Measures:

- By 2010, reduce industry energy consumption per dollar of output (i.e., energy intensity) to 25 percent below its 1990 level, and reduce cumulative industry energy costs by $4.5 billion.

Strategy:

- Develop technologies and methods that can significantly improve the efficiency of the Nation's energy intensive industries and reduce environmental emissions.

OBJECTIVE ER4

Inform public policy makers, energy industries, and the general public by providing reliable energy information and analysis.

Introduction

By providing information on energy supply, consumption, prices, and the use of alternative technologies, DOE facilitates informed policymaking, technology choices, and efficient energy markets. Much of this information, including development of energy supply and consumption data, and national and international energy projections, is carried out by the Energy Information Administration, an independent statistical and analytical agency within the Department. Program offices at DOE also publish information on potential technical and economic performance of new technologies and approaches.

The Objective's Measures

DOE has established the following performance measures. These measures provide the basis by which the Department will know that it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for the Annual Performance Plans and published with annual budgets. The following strategies describe the way in which the Department will work toward achieving this objective. These measures will be translated into annual targets for performance plans and budgets for the Department.

- Publish each year a domestic and international *Annual Energy Outlook* that forecasts future energy supply and consumption through the year 2020.
- Maintain and improve web-based networks for the Energy Resources organizations to ensure wide distribution of information about Energy Resources programs, such that the average number of monthly users of Energy Resources Web Sites will grow at least 20 percent per year through 2005 (from a baseline of about 70,000 per month in 1997).
- Periodically provide policy makers with analysis of legislative, regulatory, and other policy issues likely to affect the security, reliability, affordability, environmental impacts, and diversity of the Nation's energy sector.
- Periodically prepare National energy policy plans and energy policy statements for public dissemination.

The Objective's Strategies

The following strategies describe how the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

- Provide forecasts for energy supply and consumption through the year 2020.
- Make information more easily accessible to the general public by designing and issuing on-line products for electronic dissemination.

- Undertake information and education programs to familiarize the general public with DOE energy technologies and their applications, availability, and benefits (e.g., environment, health, economics, and reliability).

- Maintain expertise and analytical tools to enable analysis of energy policy issues, and actively participate in the policy making processes with other Federal and State agencies and with Congress.

OBJECTIVE ER5

Cooperate globally on international energy issues.

Introduction

International cooperation is the key to strengthening world energy markets, speeding technology development and deployment, and addressing global environmental challenges. Oil markets, and increasingly other energy markets, are truly global. Ensuring market competition and emergency preparedness requires international cooperation, as well as domestic action. Technology development and deployment efforts are also global in nature, involving billions of dollars of trade, hundreds of national and multinational companies, and a similar number of government agencies, both domestic and foreign. The Department actively supports international cooperation in technology development, emergency preparedness, and policy coordination through the International Energy Agency and numerous other multi-lateral and bilateral efforts.

The Objective's Measures

DOE has established the following performance measures. These measures provide the basis by which the Department will know that it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department.

- Achieve $3 billion in annual export sales of energy-efficiency technologies by 2010.
- Achieve $5 billion in annual export sales of renewable energy systems by 2010.
- For U.S. companies in energy efficiency, renewables, oil and gas recovery, and clean coal technology, remove barriers to markets in China, Indonesia, the Philippines, Brazil, India, South Africa, the Newly Independent States, and other developing economies.
- Implement an international agreement with Brazil to assist that country in instituting economic reforms, attracting foreign capital and technologies, and promoting clean coal technologies.
- Through government-to-government efforts, provide information that affects the legal/ regulatory framework of at least one developing country each year in a way that encourages U.S. private sector energy investment.

The Objective's Strategies

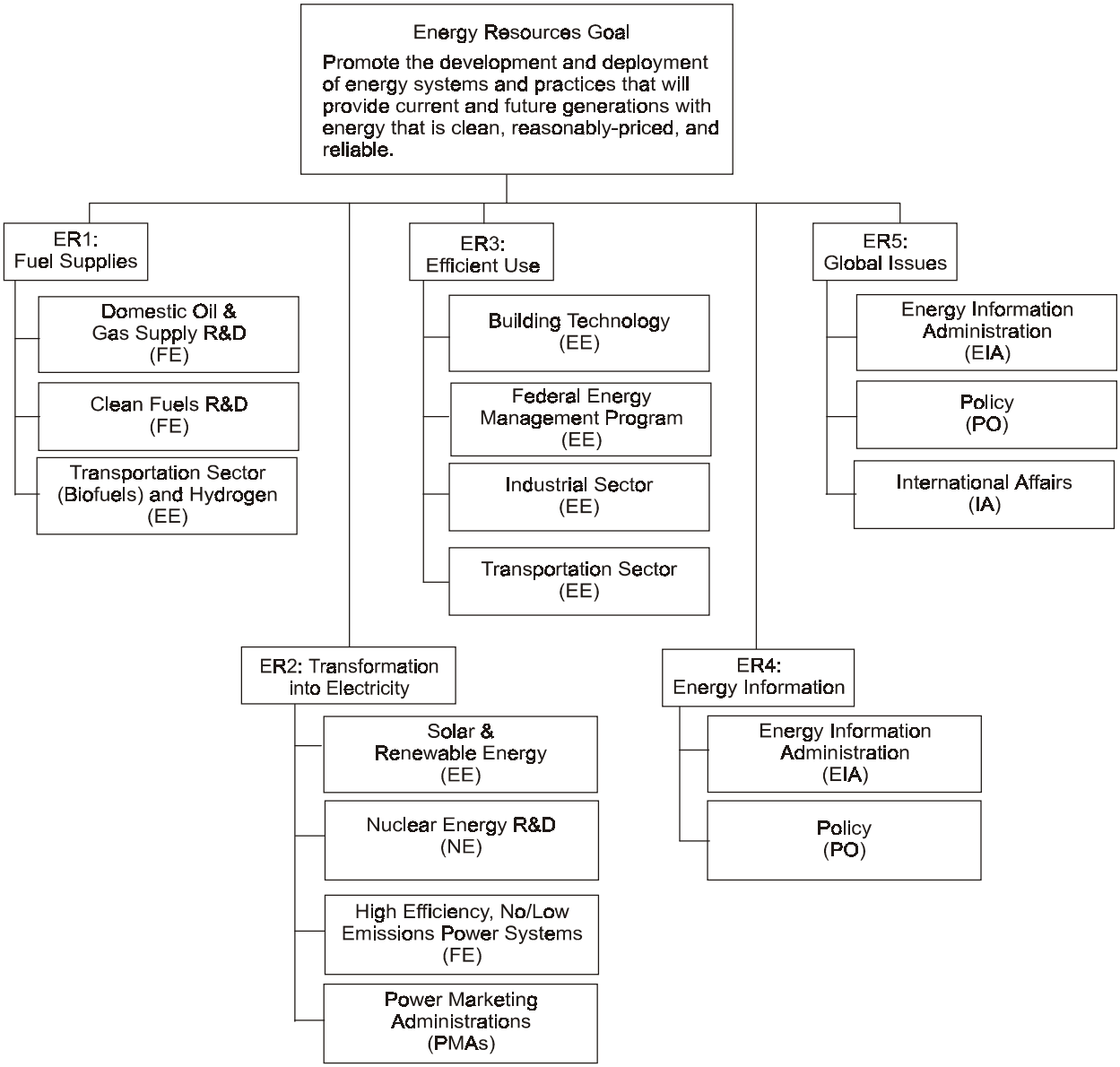
The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

- Enhance energy security by increasing the capacity and diversity of international oil and gas producers.
- Promote open energy markets.
- Promote deployment of clean and efficient energy systems.

- Assist the Administration in obtaining commitments from key developing countries to reduce greenhouse gas emissions.

Linkage to Budget Structure

The Energy Resources general goal is supported by five objectives. Each objective is being pursued through long-term strategies. DOE's Budget Decision Units fund work in pursuit of long-term strategies. The annual performance measures are discussed with the Decision Units in the Annual Performance Plan, which is submitted with the budget for each fiscal year. The following chart shows the relationship between Decision Units and objectives.



NATIONAL NUCLEAR SECURITY BUSINESS LINE

The Department of Energy is required by various laws to enhance U.S. national security through the military application of nuclear technology and to reduce the global danger from the proliferation of weapons of mass destruction. The National Nuclear Security Administration (NNSA), a semi-autonomous Administration within the Department, carries out these responsibilities. Established in March 2000 pursuant to Title 32 of the National Defense Authorization Act for FY 2000 (Public Law 106-65), NNSA is structured to provide clear and direct lines of accountability and responsibility for the management and operation of the Nation's nuclear weapons, naval reactors, and nuclear nonproliferation activities.

Three major offices within NNSA carry out the Department's national nuclear security mission. The Office of Defense Programs (with an annual budget of about $4.6 billion) is responsible for maintaining the safety, security, and reliability of the U.S. nuclear weapons stockpile. The Office also maintains the capability to design and produce nuclear weapons and maintains the capability to resume underground nuclear testing. The Office of Naval Reactors (with an annual budget of about $700 million) provides the U.S. Navy with safe, militarily effective nuclear propulsion plants. Naval Reactors ensures the safe and reliable operation of those plants—beginning with technology development, continuing through reactor operation, and ultimately, disposing of the reactors plants. The Office of Defense Nuclear Nonproliferation (with an annual budget of about $800 million) is responsible for promoting international nuclear safety and nonproliferation by implementing major nonproliferation programs and providing key analytical and technical support to international agreements related to weapons of mass destruction. The Office is also responsible for: research and development of technologies to detect proliferation; implementation of the Highly Enriched Uranium Purchase Agreement; elimination of surplus U.S. weapons plutonium and highly enriched uranium; and assistance to help Russia eliminate its surplus weapons-grade plutonium.

Four staff offices outside of the NNSA retain policy, oversight, and some national security responsibilities: the Offices of Security and Emergency Operations, the Office of Intelligence, the Office of Counterintelligence, and the Office of Independent Oversight and Performance Assurance. The Office of Worker Transition and Community Assistance, which is also outside of NNSA, manages programs to minimize the social and economic impacts of changes in the Department's activities.

Situation Analysis

The national security environment is becoming increasingly complex for the United States. For

Computer Scientist and Mathematician Terri Calton of Sandia National Laboratories, Albuquerque, New Mexico, reviews design specifications for the B61 tail assembly shown in the foreground and on the screen behind her.

almost 50 years, America's national security has relied on the deterrent provided by nuclear weapons. Designed, built, and tested by the Department of Energy and its predecessor agencies, these weapons helped to win the Cold War, and they remain a key component of the Nation's security posture. With the end of the Cold War, the Department faces a new and complex set of challenges in its national nuclear security mission. One of the most critical challenges is being met by the Stockpile Stewardship Program, established by Congress in 1993. As directed by the President, this program is maintaining the nuclear deterrent in the absence of underground nuclear testing. Another critical challenge is the proliferation of weapons of mass destruction (WMD) and nuclear weapons materials. It is one of the most serious dangers the United States now faces.

Nuclear Weapons Stockpile Stewardship. Exercising world leadership in arms control, the United States halted production of nuclear warheads and declared a moratorium on underground nuclear testing in the early 1990s. In 1993, President Clinton continued the moratorium on nuclear explosives testing and initiated the Stockpile Stewardship Program, challenging the DOE and the DoD "to explore other means of maintaining our confidence in the safety, reliability, and performance of our weapons." The President also directed the Department to retain the capability to resume underground nuclear testing within three-years of a decision to do so, should it ever be necessary.

As weapons, facilities, and experienced personnel continue to age, maintaining the safety, security, and reliability of the nuclear deterrent in the absence of underground nuclear testing is becoming a more difficult, yet achievable, task. The Stockpile Stewardship Program requires significant advances and future investments in computing and experimental capabilities, and in

Senator Richard Lugar at the Cooperative Threat Reduction (CTR) converter factory.

new technologies and facilities. Ensuring the 40 plus year old complex can react to program challenges while meeting today's operational standards continues to be a daunting task. Maintaining institutional knowledge about nuclear weapons is also a challenge. In a highly competitive market for computer science, engineering, and technical talent, skilled workers must be recruited and then trained by more experienced staff within the NNSA workforce. Many of those with years of experience are reaching retirement age or, in some cases, being attracted to other career opportunities.

Stockpile Stewardship and Nuclear Arms Control. The Stockpile Stewardship Program is carried out in full consonance with and supportive of START agreements and other nuclear nonproliferation initiatives. The President's moratorium on nuclear testing is designed to encourage other nations to also refrain from nuclear testing. Activities within the Stockpile Stewardship Program directly support the *Nuclear Weapons Stockpile Plan* (NWSP), which is approved by the President on an annual basis. The current NWSP requires DOE to sustain the stockpile levels specified in the START I Treaty until START II enters into force, and then to retain the capability to reconstitute the stockpile to START I levels.

Future arms control agreements, such as the START III Treaty now being discussed, are expected to further reduce deployed strategic nuclear forces. This will increase inventories of surplus plutonium and highly enriched uranium in the United States and Russia. Already, hundreds of tons of weapons plutonium and highly enriched uranium in both countries are no longer needed for defense purposes. To eliminate the danger of unauthorized use or diversion of surplus fissile materials, the current excess inventories—as well as additional excess material from future arms reductions—must be disposed of expeditiously. The United States and the Russian Federation are now in the fifth year of a 20-year contract to convert 500 metric tons of weapons grade uranium from dismantled Russian nuclear weapons into low-enriched uranium, which will be fabricated into fuel elements for commercial nuclear power reactors in the United States.

Nonproliferation. In November 1994, President Clinton stated, "The proliferation of weapons of mass destruction continues to pose an unusual and extraordinary threat to the national security, foreign policy, and economy of the United States." At least 20 countries are known to be or are suspected of developing weapons of mass destruction—a sobering statistic that is underscored by the underground nuclear tests conducted by India and Pakistan in 1998. In an Executive Order issued in July 1998, the President declared that the proliferation of nuclear, biological, and chemical weapons and the means of delivering such weapons constitutes a national emergency.

The fragmentation of the former Soviet Union (FSU) has led to particular concerns about the accountability, control, and disposition of nuclear weapons, components, materials, and information. The safety and security of existing nuclear weapons and materials stockpiles may become increasingly at risk should the overall situation deteriorate in FSU countries. In 1994, a

Warhead and Fissile Material Transparency Lab-to-Lab Program technical experts view a radiation measurement demonstration at Chelyabinsk-70.

National Academy of Sciences report stated that the threat of nuclear weapons or materials falling into the hands of terrorists or states of concern through theft or diversion is a "clear and present danger."

Our domestic security is increasingly dependent on our ability to detect and counter nuclear, chemical, biological, and cyber weapons. In the area of nuclear weapons, our security continues to depend on our ability to prevent nuclear materials from falling into the wrong hands. It is essential that we develop technologies and systems to monitor, protect, and account for nuclear materials—and to dispose of them. Further, our technologies must keep pace with the increasingly sophisticated means used by smugglers or thieves to remove such material from safekeeping in sites throughout Russia and other countries. For chemical and biological threats, we must develop new sensors and detectors. And, in addition, we must train and equip teams to respond to incidents. Finally, the Nation has an infrastructure that is more and more dependent on computer technology and telecommunications services to provide vital services, such as those provided by the energy sector. While such technologies provide enormous benefits, they are extremely vulnerable to cyber attacks. At the same time, assets, such as power plants,

transmission lines, and oil storage facilities are also vulnerable to physical attack.

Naval Reactors. International events and crises continue to arise to which the United States must respond. The resources of the United States Navy are frequently called on to project a forward presence and quickly protect our national interests. Nuclear powered submarines and aircraft carriers must perform safely, reliably, and effectively as they meet military deployment objectives. In the next decade, the Navy plans to commission a new Virginia class of attack submarines and in 2013, the Navy will commission a new CVNX class of aircraft carriers to meet its evolving national defense responsibilities for the first part of the 21st century.

Key External Factors

Most of the programs in the National Nuclear Security Business Line (NNSBL) focus on nuclear weapons, nuclear facilities, nuclear processing, transportation of nuclear materials, and nonproliferation aspects of nuclear power. Other programs focus on international efforts to reduce the global danger posed by weapons of mass destruction. The prime external factor potentially affecting performance in all areas is the public's perception of these national nuclear security issues. To maintain public support, each of the programs in the NNSBL maintains high standards related to environment, safety, health, and security, and makes every effort to communicate with the public on these matters. Hence, an effective program of stakeholder communication is important. Public support, in turn, dictates Congressional support for national nuclear security programs.

Second Line of Defense ribbon cutting ceremony at Sheremetyevo International Airport, Moscow.
Left to Right: Sec. Richardson, Sen. Domenici, Customs Chairman Dragonov and Customs Department Head Kravchenko.

Interagency Crosscutting Coordination

DOE integrates national nuclear security work with the efforts of many other agencies of the U.S. government. Principally, DOE coordinates its nuclear weapons stockpile activities with the Department of Defense through the Nuclear Weapons Council and the Stockpile Stewardship Interagency Executive Review Group, which includes key officials and experts in the national security community. For naval nuclear propulsion work, the U.S. Navy and the Department have a unique partnership, defined in an Executive Order and Title 42 of the U.S.C. Section 7158. For nonproliferation and arms control programs, the National Security Council coordinates policy. The State Department is the lead agency for all policy matters dealing with other countries. Within this community of agencies, DOE maintains the nuclear stockpile, provides technical support for treaty negotiation, verification and compliance, and develops technical capabilities for detecting the proliferation of weapons of mass destruction. In addition, the Department provides technical support for the international effort to control proliferation of fissile materials. To dispose of excess fissile materials that had been used in U.S. and Russian nuclear weapons, DOE uses the expertise of the United States Enrichment Corporation (USEC, Inc.), which is purchasing Russian-origin uranium, and the Tennessee Valley

Authority to dispose of U.S. highly enriched uranium. In addition, the Nuclear Regulatory Commission regulates the activities where DOE makes use of the capacity of the U.S. commercial nuclear industry.

In the areas of security and emergency operations, DOE participates in interagency groups such as the Joint Security Policy Board, and works with the Departments of Defense, State, and Justice, and the National Security Council. In response to threats of terrorism and weapons of mass destruction, DOE is working with these same agencies to train and equip first responders and to conduct exercises that include local law enforcement. The Technical Support Working Group, with representation from these agencies, promotes an exchange of technologies developed to counter threats and improve both our security systems and our ability to protect our facilities.

Congressional and Stakeholder Consultations

DOE consults with Congress frequently as Congress reviews our programs during the annual authorization and appropriation process. As a result, DOE modifies its performance measures and strategies to reflect direction provided in authorization acts and funding provided in appropriations. In addition, DOE modifies its measures and strategies to incorporate input from stakeholders and from program evaluations and analysis as discussed in the next section.

Program Evaluation and Analyses

The mission for DOE's national nuclear security programs is contained in the Atomic Energy Act of 1954, as amended, and Title 32 of the National Defense Authorization Act for Fiscal Year 2000, Public Law 106-65. The objectives, performance measures, and strategies are strongly influenced by a number of internal and external reviews and reports that, collectively, provide the Department's program managers with appropriate information to properly orient programs and budgets and maintain a balanced set of activities.

Nuclear Weapons Stockpile Stewardship. For nuclear weapons stockpile activities, the performance measures and strategies are embodied in the *Stockpile Stewardship Plan*. They are driven by requirements set by Presidential Decision Directives and by the technical activities and capabilities needed for the Annual Certification process. On April 5, 2000, the Annual Certification Memorandum was transmitted to the President by the Secretaries of Energy and Defense. This is the fourth consecutive year in which the capabilities of the Stockpile Stewardship Program have been used to assess and inform the President that the stockpile remains safe, secure, and reliable, and that no underground nuclear testing is required at this time.

DOE updates the *Stockpile Stewardship Plan* annually and incorporates the results into work plans. In addition, DOE has recently completed its *National Security Technology Roadmapping of the Research and Development Portfolio* to ensure that the suite of R&D programs is fully supportive of the Stockpile Stewardship Program. Finally, a number of internal and external evaluations and analyses also provided information used to update program performance measures and strategies. They include:

- The Secretary's *30-Day Review of the Stockpile Stewardship Program* conducted in late 1999, concluded that stockpile stewardship is on track, both in terms of specific science, surveillance, and production accomplishments, and in terms of developing a program management structure that improves the

process for certifying the safety, security, and reliability of the nuclear weapons stockpile. The Review also found that additional pressures such as increased security requirements, newly discovered stockpile issues, and resource limitations have collectively forced the program, overall, to be "wound too tight" with too little program flexibility or contingencies.

- Concerns over the loss of key personnel within the DOE's nuclear weapons complex led to a Congressionally directed report by the Commission on Maintaining U.S. Nuclear Weapons Expertise. The report offered 12 recommendations to support the recruitment and retention of scientific, engineering, and technical personnel for the nuclear weapons program. Implementation of these recommendations is ongoing. A Congressionally-mandated follow-up report entitled, *Nuclear Skills Retention Measures within the Department of Defense and the Department of Energy*, will be issued by December 2000.

- Section 3158 of the Strom Thurmond National Defense Authorization Act for Fiscal Year 1999 (Public Law 105-261) directed the Secretary of Energy to develop clear and specific criteria for judging whether the science-based tools that are being used by DOE are performing in a manner that will provide an adequate degree of certainty that the stockpile is safe and reliable. In meeting this commitment, DOE submitted a report to Congress in June 2000, that included a description of the information needed to determine that the nuclear weapons stockpile is safe and reliable, and the relationship of the science-based tools to the collection of that information. As directed by Section 3159, of Public Law 105-261, an independent panel was established to examine the certification process as well as the criteria developed to comply with Section 3158.

Extraction generator used to synthesize radiopharmaceuticals. With funding from the Initiatives for Proliferation Prevention programs, Pacific Northwest National Laboratories and the Khoplin Radium Institute partnered to develop the methodology to synthesize ^{99}Tc radiopharmaceuticals, which are sold to hospitals in the St. Petersburg, Russia, area. These products provide treatment for over 12,000 patients.

Naval Reactors. For the Naval Reactors program, the performance measures and strategies reflect the long-standing partnership through which the Department of Energy provides the U.S. Navy with naval nuclear propulsion systems. Semi-annual reviews of performance, in addition to monthly financial and technical work reviews with the government contractor routinely evaluate the progress of these efforts.

Nonproliferation Activities. Nonproliferation and national security programs within the Office of Defense Nuclear Nonproliferation benefit from the advice of the Nonproliferation and National Security Advisory Committee which reviews its activities. In addition, the Materials Protection, Control, and Accounting Program has been examined by the National Research Council, the General Accounting Office, and the Department's

Inspector General. These studies and other information provided by the program's technical survey team resulted in a programmatic reassessment in 1999. The Department's work in Russia is also subject to review by a special Task Force of the Secretary of Energy Advisory Board.

For fissile materials disposition efforts within the Office of Defense Nuclear Nonproliferation, the performance measures and strategies reflect Records of Decision from environmental reviews as well as a technical baseline reviewed by independent experts selected by the National Academy of Sciences. In addition, as required by Congress, DOE conducted an independent project review of the three planned U.S. plutonium disposition facilities. Finally, the United States and Russia recently agreed to the top-level schedule to dispose of their own plutonium. This agreement will guide subsequent programmatic activities and provide a means to track those activities.

Resource Requirements

Consistent with the Administration's outyear budget projections, the activities in this business line are expected to be funded at about $7 billion each year. The Department will continue to identify resources within the 050 National Defense account (specifically the 053 subfunction, Atomic Energy Defense Activities) to meet its national nuclear security responsibilities. A stable level of funding continues to be important to assure appropriate planning and program performance. The Stockpile Stewardship Program will require significant investments in people, computing and modeling capabilities, experimental facilities, and infrastructure to maintain the safety, security, and reliability of the Nation's nuclear weapons.

Fulfilling personnel resource requirements remains a major challenge. To assure continuity of Stockpile Stewardship, Naval Reactors, and nonproliferation programs, DOE needs a focused effort to recruit and retain key technical and scientific personnel with the appropriate skill mix. In addition, unprecedented growth in nonproliferation operations in Russia requires the Department to strengthen and expand its Moscow Office. Adequate program management and project oversight by Federal staff must be ensured for these highly visible and high-priority programs in Russia.

NATIONAL NUCLEAR SECURITY GENERAL GOAL

Enhance national security through the military application of nuclear technology and reduce the global danger from weapons of mass destruction.

DOE, through the National Nuclear Security Administration, is responsible for the military application of nuclear technology. In the Department, this encompasses activities to maintain the safety, security and reliability of the nuclear weapons stockpile and the Naval Nuclear Propulsion Program. To reduce the global danger from weapons of mass destruction, the Department provides expertise and develops capabilities to detect and help to prevent the proliferation of materials, technology, and expertise related to nuclear, chemical, and biological weapons. DOE is also responsible for eliminating the surplus weapons-usable plutonium and highly enriched uranium of the United States and assisting Russia in similar endeavors.

OBJECTIVE NS1

Maintain and refurbish nuclear weapons in accordance with directed schedules to sustain confidence in their safety, security, and reliability, indefinitely, under the nuclear testing moratorium and arms reduction treaties.

Introduction

DOE pursues a broad range of activities to maintain the safety, security, and reliability of the nuclear weapons stockpile without nuclear testing. The efforts support the *Nuclear Weapons Stockpile Plan* (NWSP) which is approved by the President on an annual basis. The NWSP is a six-year plan developed jointly by the Department of Energy (DOE) and Department of Defense (DoD). It specifies the exact quantities of nuclear weapons, by warhead type and by year, for the entire stockpile. Within the Stockpile Stewardship Program, the specific set of activities that entail work on stockpiled weapons is referred to as Directed Stockpile Work (DSW). It is this collection of activities that enables DOE to achieve Objective NS1. DSW comprises a set of integrated activities that involves DOE through NNSA, the three national laboratories (Los Alamos, Lawrence Livermore, and Sandia), the Nevada Test Site, and the production plants (Pantex, Kansas City, Y-12, and Savannah River) within the nuclear weapons complex. In close coordination with DoD through the Nuclear Weapons Council, DOE plans, evaluates, and schedules the work to be done on each weapon system. The DSW program encompasses surveillance, maintenance, design, and manufacturing activities required to maintain the nuclear weapon stockpile and to conduct the annual certification. The design and manufacturing activities include work to refurbish aging components in weapons as part of the Stockpile Life Extension Program (SLEP). Where existing processes and/or infrastructure can not support DSW activities, Campaigns have been initiated to develop new capabilities to ensure the continued safety, security and reliability of the stockpile. DSW also includes dismantlement of nuclear weapons removed from the stockpile.

The Objective's Measures

DOE has established the following performance measures. These measures provide the basis by which the Department will know that it has achieved the objective or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department.

- Annually report to the President on the need or lack of need to resume underground nuclear testing to certify the safety, security, and reliability of the nuclear weapons stockpile.

- Meet all annual weapons maintenance and refurbishment schedules developed jointly by DOE and DoD.

- Meet annual schedules for the safe and secure dismantlement of nuclear warheads that have been removed from the U.S. nuclear weapons stockpile.

The Objective's Strategies

The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

- Conduct a program of Directed Stockpile Work (DSW) that supports the Stockpile Life Extension Program (SLEP) and is integrated and linked to Campaigns (see Objective NS2) and Infrastructure (see Objective NS3).

- Complete surveillance, maintenance, design, and manufacturing activities necessary for the refurbishment and certification of the stockpile as identified in directive schedules.

- Apply the improved technologies and tools developed by the Campaigns to achieve DSW performance measures.

- Dismantle nuclear weapons in a safe and secure manner.

Alterations and modifications to weapons systems, such as the B61-11, help exercise critical design and manufacturing skills at the DOE national laboratories and production plants.

OBJECTIVE NS2

Achieve the robust and vital scientific, engineering, and manufacturing capability that is needed for current and future certification of the nuclear weapons stockpile and the manufacture of nuclear weapon components under the nuclear testing moratorium.

Introduction

DOE is pursuing activities to achieve the scientific capability that is needed for certification of the nuclear weapons stockpile in the near and long term, and the manufacture of nuclear weapon components under a nuclear testing moratorium. These R&D efforts, which involve close interaction with DoD, are managed through a series of 17 Campaigns. Each is a focused scientific and technical effort that has definitive milestones, specific work plans, and specific goals. Altogether, the Campaigns cover three important areas: science and computing, applied science and engineering, and production readiness.

The Objective's Measures

DOE has established the following performance measures. These measures provide the basis by which the Department will know that it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department.

- Achieve the stated Campaign goals and the supporting mid-level milestones in accordance with the *Stockpile Stewardship Plan*.
- Develop increased-teraop computing capability and perform three-dimensional high-fidelity physics and full-system simulations of weapon performance and safety by FY 2004.
- Develop a 36-month capability to respond to projected problems/needs in the nuclear weapons stockpile.
- Provide a reliable source of tritium no later than FY 2007.

Engineering analysis and environmental testing provide vital information about the design of nuclear weapons systems.

The Objective's Strategies

The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

- Conduct a series of science and computing Campaigns pertaining to: certification of primaries, secondaries, and weapon engineering; materials properties; advanced radiography; weapon performance in hostile environments; inertial confinement fusion and ignition; and simulation and computing.

- Conduct a series of applied science and engineering Campaigns pertaining to: advanced design and production technologies; enhanced surveillance; and enhanced surety.

- Conduct a series of advanced readiness campaigns pertaining to: pit and secondary manufacturing; high explosives manufacturing and weapon assembly/ disassembly; non-nuclear components; and tritium production.

OBJECTIVE NS3

Ensure the vitality and readiness of DOE's national nuclear security enterprise.

Introduction

DOE must ensure that it has the appropriate workforce and physical infrastructure to meet the national nuclear security goal now, and in the future. The construction of new facilities and maintenance of existing facilities is vitally needed to support other objectives within the National Nuclear Security Business Line. Workforce issues include staffing and training throughout DOE's national nuclear security enterprise, including support contractors.

To attract and retain a skilled workforce and to obtain the required funding for facilities, the public's trust in DOE's national nuclear security enterprise is needed. The Department must manage its national nuclear security programs in a safe, secure, cost-effective, and environmentally-sound manner.

The Objective's Measures

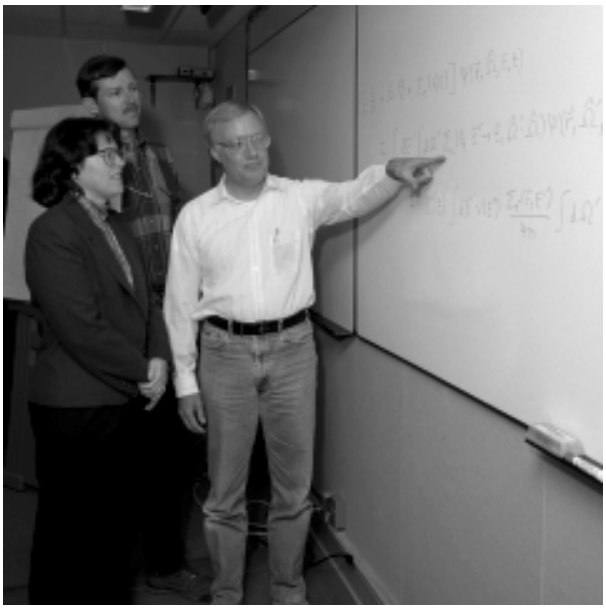
DOE has established the following performance measures. These measures provide the basis by which the Department will know that it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department.

- Ensure the physical infrastructure and facilities are operational, safe, secure, and compliant, and that needed facilities sustain their specified state of readiness and capability to respond to emergencies.
- Ensure a capability to resume underground nuclear testing within three years of a decision to do so, in accordance with the President's nuclear testing moratorium.
- Ensure the availability of a workforce with the critical skills necessary to meet long-term mission requirements.
- Maintain the DOE assets that support secure transportation of nuclear weapons and components.
- Complete construction of the second arm of the Dual-Axis Radiographic Hydrodynamic Test Facility (DARHT) in FY 2002; complete construction and begin operation of the Tritium Extraction Facility (TEF) in FY 2006; complete construction of the Special Materials Complex in FY 2007; and complete construction of the National Ignition Facility (NIF) in FY 2008 in accordance with the cost rebaselining.
- Achieve annual recurring cost savings from separation of workers that is at least three times the cost of separation.
- Support local community transition activities that will create or retain, cumulatively, 20,000 to 25,000 new private sector jobs.

The Objective's Strategies

The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

- Provide an appropriately-sized, cost-effective, safe, secure, and environmentally-sound enterprise for national nuclear security programs.
- Maintain nuclear test readiness, in accordance with Presidential direction.
- Implement the recommendations of the Commission on Maintaining U.S. Nuclear Weapons Expertise, which are consistent with commitments in the joint DOE/DoD *Report on Nuclear Expertise Retention Measures*.
- Continue restructuring, modernizing, and implementing integrated safety and security management throughout the national nuclear security enterprise.
- Continue with construction of new facilities such as the DARHT, the TEF, and the NIF, on schedule and on budget.



The national laboratories and production plants have established advanced degree and post-doctoral programs, as well as mentoring activities designed to further educate the next generation of stockpile stewards in nuclear weapons science.

The Dual-Axis Radiographic Hydrodynamic Test Facility (DARHT) at Los Alamos National Laboratory will examine the shape and size of an imploding pit model from two different directions, with greatly improved resolution.

OBJECTIVE NS4

Reduce the global danger from the proliferation of weapons of mass destruction (WMD).

Introduction

DOE contributes to enhancing national security by reducing the global danger from weapons of mass destruction. The Department provides policy leadership, technology development, and program implementation to:

- Prevent the proliferation of WMD;
- Detect WMD proliferation;
- Monitor nuclear treaties and agreements;
- Strengthen the nuclear nonproliferation regime;
- Counter WMD terrorism;
- Improve international nuclear safety; and
- Reduce inventories of U.S. and Russian surplus weapons fissile materials in a transparent and irreversible manner.

To reduce the global danger from proliferation, DOE works with many agencies within the U.S. government, including the Department of State, Department of Defense, Customs Service, Justice, and USAID, the IAEA, the Russian Federation, the NIS, nine countries with Russian-designed nuclear reactor plants, USEC, Inc., and the Tennessee Valley Authority. Therefore, interagency collaboration and international cooperation in these efforts are vitally important to the success of DOE's activities in this area.

The Objective's Measures

DOE has established the following performance measures. These measures provide the basis by which the Department will know that it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department.

- Provide leadership and technical support to interagency nonproliferation and arms control efforts to strengthen the international nonproliferation regime :
  - Support preparations for implementation of the Comprehensive Test Ban Treaty (CTBT), and completion of both negotiations for the Fissile Materials Cutoff Treaty (FMCT) and agreements for transparent dismantlement of nuclear warheads by the end of 2005.
  - Under the Nuclear Cities Initiative with Russia, accelerate the closure of two Russian nuclear weapons assembly/ disassembly facilities.
  - Install sustainable physical security and accountancy upgrades to protect over 400 metric tons of weapons-usable nuclear material inadequately secured in more than 300 buildings at 80 Russian sites by 2010.

- Consolidate Russian weapons-usable nuclear material into fewer buildings at fewer sites and convert at least 20 metric tons of excess highly enriched uranium (HEU) to low enriched uranium (LEU) to reduce proliferation risks and overall security costs by 2015.

- Implement comprehensive reforms of DOE export control practices by 2002.

- Demonstrate technologies to detect WMD proliferation including:

  - Conduct an integrated operational demonstration of biological agent detectors and hazard prediction models in an urban environment by 2002.

  - Perform an airborne demonstration of new technology for detecting WMD proliferation by 2005.

  - Deliver the first operational, next generation, space-based, optical nuclear explosion detector to the Air Force by 2005.

- Improve the safety of 66 reactors at 21 Soviet-designed nuclear power plants and assist the nine countries with Russian-designed nuclear reactor plants to implement self-sustaining nuclear safety programs that include internationally accepted safety practices by 2006.

- Eliminate surplus U.S. HEU within approximately 20 years primarily by down-blending the material to LEU for peaceful use as fuel for commercial reactors.

- Eliminate surplus U.S. plutonium within approximately 20 years by irradiating it as mixed oxide fuel and converting some of the material to an immobilized form.

- Implement a bilateral agreement with Russia to eliminate quantities of surplus Russian plutonium in rough parallel to U.S. reductions.

- Ensure that the nonproliferation objectives of the Highly Enriched Uranium Purchase Agreement are achieved, including the primary objective of the conversion and down blending of 500 metric tons of weapons grade uranium derived from dismantled Russian nuclear weapons, into low enriched uranium over 20 years, i.e., by 2015.

The Objective's Strategies

The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

- Materials Protection, Control, and Accounting:

  - Help Russia to install security upgrades and consolidate currently unsecured nuclear material into fewer buildings and sites.

  - Expand cooperation with the Russian Navy to include all nuclear material of proliferation concern.

  - Ensure the operational sustainability of installed material protection, control, and accounting (MPC&A) upgrades so that they provide long-term, continuing enhanced security.

- Help Russia to develop and support its infrastructure responsible for nuclear procedures, laws, inspections and training.

- Arms Control and Nonproliferation:

  - As part of Initiatives for Proliferation Prevention and the "Nuclear Cities Initiative," locally engage weapons scientists, engineers, and technicians in peaceful projects to prevent "brain drain" and foster economic diversification.

  - Complete ratification and implementation of U.S. protocol for IAEA "Strengthened Safeguards System" and support U.S. responsibilities for declarations and on-site inspection at DOE facilities.

  - Conduct analyses and technology development efforts for transparency activities (focusing on verified warhead dismantlement) to help ensure that nuclear reductions are transparent and irreversible.

  - Work with Russian Customs through the Second Line of Defense program to combat trafficking of illicit nuclear material across border and control points.

  - Maintain core competency as technical experts to U.S. government agencies on nuclear export control initiatives.

Under the Nuclear Cities Initiative Program, a scientist at the Avangard Electromechanical Plant in Sarov exhibits a kidney dialysis technology.

Nuclear Cities Initiative Director Bill Desmond (2nd from left), dedicating the Snezhinsk International Development Center with Russian officials.

- Nonproliferation and Verification R&D:
  - Develop and demonstrate technologies needed to remotely detect the early stages of a proliferate nation's nuclear weapons program.
  - Improve capabilities to locate, identify, and characterize nuclear explosions.
  - Produce operational satellite-based nuclear explosion monitoring sensor systems.
  - In cooperation with the Russian Federation, develop capabilities to better detect radiation signatures from weapons material to prevent smuggling and to increase the transparency in weapons dismantlement.
  - Improve the U.S. capability to detect the proliferation of chemical and biological agents at an early stage and to minimize the consequences if chemical or biological agents are used.
- International Nuclear Safety:
  - Assist countries to reduce the risks from Soviet-designed nuclear power plants and implement self-sustaining nuclear safety improvement program capable of reaching internationally accepted safety practices.
  - Implement projects in the areas of operational safety, training and simulators, safety assessments, and fire safety, and other hardware upgrades.
  - Promote nuclear safety culture improvements internationally by providing strong leadership in international nuclear safety organizations and centers.
  - Work with other G-7 countries to assist in the shut down of the Chornobyl plant, to safely decommission it, and to stabilize the unit 4 shelter at Chornobyl.
- U.S. HEU Disposition:
  - Transfer quantities of surplus U.S. HEU to USEC, Inc. and the Tennessee Valley Authority to make LEU fuel for commercial reactors; and over time, arrange for disposition of additional lots of surplus HEU through down-blending and commercial use.
- U.S. Plutonium Disposition
- Implement the U.S. hybrid strategy for plutonium disposition in rough parallel with plutonium disposition in Russia, which includes the design, construction, and operation of three U.S. plutonium disposition facilities:
  - A pit disassembly and conversion facility to convert surplus weapons plutonium to an unclassified oxide form suitable for disposition and international inspection.
  - An immobilization facility using the can-in-canister approach to immobilize surplus "non-pit" plutonium in a ceramic material, that is then surrounded with vitrified high-level radioactive waste.
  - A MOX fuel fabrication facility to convert oxide material into a MOX fuel; and irradiate the MOX fuel in existing, domestic, commercial reactors.

- Russian Plutonium Disposition:
  - Cooperate with Russia in conducting tests and demonstrations of plutonium disposition technologies.
  - Participate in U.S. government efforts to implement the provisions of the bilateral agreement with Russia for the disposition of surplus weapons plutonium.
  - Assist in U.S. efforts to secure international financing to support plutonium disposition in Russia.
  - Develop advanced reactor technology.
  - Accelerate efforts under the Expanded Threat Reduction Initiative.
  - Initiate and assist in the design of plutonium disposition facilities to be constructed in Russia.
- Russian HEU Transparency Implementation:
  - Monitor the contracted quantity of HEU from dismantled Russian nuclear weapons, (currently 30 metric tons per year, blended down to LEU) to USEC, Inc., which is purchasing the material pursuant to the February, 1993 Agreement between the United States and the Russian Federation.
  - Conduct special monitoring inspections in Russia and maintain permanent presence offices in Russia to be assured that the LEU being purchased by USEC, Inc. derives from HEU removed from dismantled nuclear weapons.

OBJECTIVE NS5

Provide the U.S. Navy with safe, militarily effective nuclear propulsion plants, and ensure their continued safe and reliable operation.

Introduction

This objective encompasses all Naval nuclear propulsion work, beginning with technology development, continuing through reactor operation and, ultimately, reactor plant disposal. Through Naval Reactors, a joint DOE/Navy program, the Department is ensuring the safe operation of the reactor plants in operating nuclear powered submarines and aircraft carriers comprising 40 percent of the Navy's major combatants, and is fulfilling the Navy's requirements for new reactors to meet evolving national defense demands. The long term development work accomplished under this objective ensures nuclear propulsion technology provides options to maintain and upgrade current capabilities, as well as meet future threats to U.S. security.

The Objective's Measures

DOE has established the following performance measures. These measures provide the basis by which the Department will know that it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department.

- Ensure the safety, performance, reliability, and service life of operating reactors.

- Develop new technologies, methods, and materials to support reactor plant design, including the next-generation submarine reactor, which will be complete by FY 2004, and initiate detailed design efforts on a reactor plant for the next generation aircraft carrier, CVNX, construction of which will begin in 2006 and be complete by 2013.

- Maintain outstanding environmental performance—ensure no personnel exceed Federal limits for radiation exposure and no significant findings result from environmental inspections by State and Federal regulators.

The Objective's Strategies

The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

- Conduct planned development, testing, examination, and evaluation of nuclear

USS ENTERPRISE (CVN 65) Salutes Naval Reactors – 50 Years of Excellence. (1998 photo)

fuel systems, materials, and manufacturing and inspection methods to ensure that Naval nuclear reactor plants are able to meet Navy goals for extended warship operation.

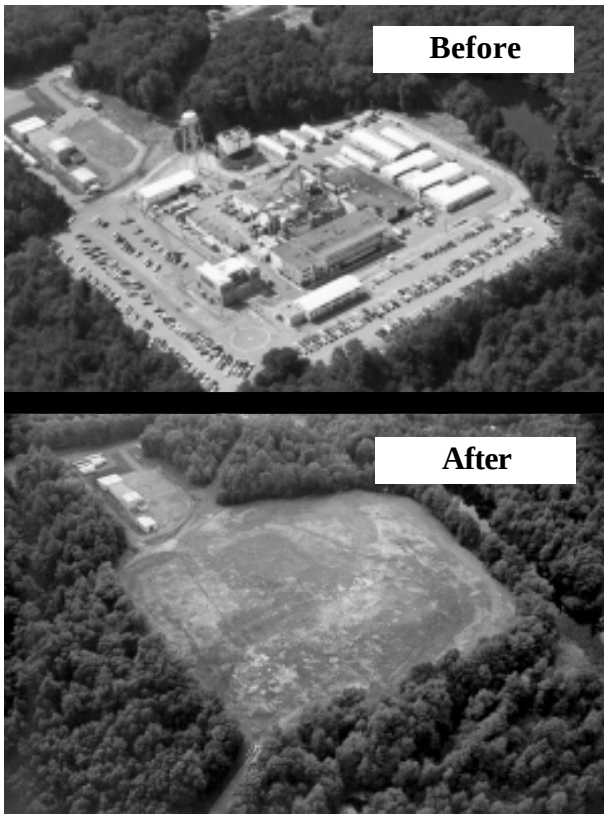
- Complete scheduled design, analysis, and testing of reactor plant components and systems, including performance analysis to ensure the operational safety and reliability of reactor plants for use in Navy nuclear powered warships.

- Accomplish planned core and reactor component/system design and technology development efforts to support the Navy's acoustic requirements.

- In support of the Program's and Department's environmental cleanup goals, safely and responsibly inactivate the land-based, prototype Naval nuclear reactor plants that have been shut down.

- Maintain a utilization factor of at least 90 percent for test reactor plants to ensure their availability for planned tests of cores, components, systems, materials, and operating procedures and for scheduled training; and provide for development of servicing equipment to help ensure reactor safety and reliability.

- Maintain outstanding environmental performance through radiological, environmental, and safety monitoring and cleanup of Naval Reactors facilities.



The Windsor Site in Connecticut–from operational site to greenfield.

Objective NS6

Ensure that the Department's nuclear weapons, materials, facilities, and information assets are secure through effective safeguards and security policy, implementation, and oversight.

Introduction

DOE must ensure that its nuclear materials, facilities, and information assets are secure. Success in this objective requires the Department to have in place effective safeguards and security policies, vigilant implementation of those polices, and watchful oversight. The safeguards and security-related functions of the Department include physical security, cyber security, and emergency management. The Department's efforts include work with classification and declassification agencies (DoD, Defense Threat Reduction Agency, CIA, and State) as well as the emergency response agencies of the Federal government (NRC, FEMA, EPA, FBI, ATF, and the Public Health Service).

The Objective's Measures

DOE has established the following performance measures. These measures provide the basis by which the Department will know that it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department.

- Prevent the theft or unauthorized loss of nuclear weapons, nuclear weapon components, special nuclear materials as well as classified and unclassified information and assets.

- Reduce DOE site vulnerability and risk and national energy emergency vulnerabilities.

- Consolidate DOE safeguards and security costs to facilitate improvements in planning, management, direction, tracking, and monitoring of the safeguards and security program.

The Objective's Strategies

The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

- Develop and implement plans and policies to enhance security.

- Develop and implement cost-effective technical solutions to protect DOE's critical assets, which include nuclear weapons in DOE custody, nuclear weapon components, special nuclear materials, classified information, and DOE facilities. Design and develop national energy-sector technical methodologies to enhance the protection of the sector's critical infrastructure assets, for example, addressing stability, countermeasures, and inter-sector interdependencies. Implement the Cyber/ Computer Security Program Plan.

- Maintain inventory control of plutonium (Pu), highly enriched uranium (HEU), and waste.

- Effectively maintain information on visits and assignments by foreign nationals to DOE Federal and contractor sites.

- Audit documents declassified by DOE and other agencies to ensure that nuclear weapon design information is not inadvertently released, and review DOE information to classify that which warrants protection in the interest of national security and declassify that which does not warrant such protection.

- Reduce DOE facilities' vulnerability to chemical and biological threats through sensor development and chemical protective equipment.

- Demonstrate improvement of a comprehensive emergency management system whose function is to ensure effective Departmental response to all DOE emergencies. Maintain robust emergency response assets in accordance with Presidential Decision Directives, the Atomic Energy Act, Executive Orders, and Federal emergency plans.

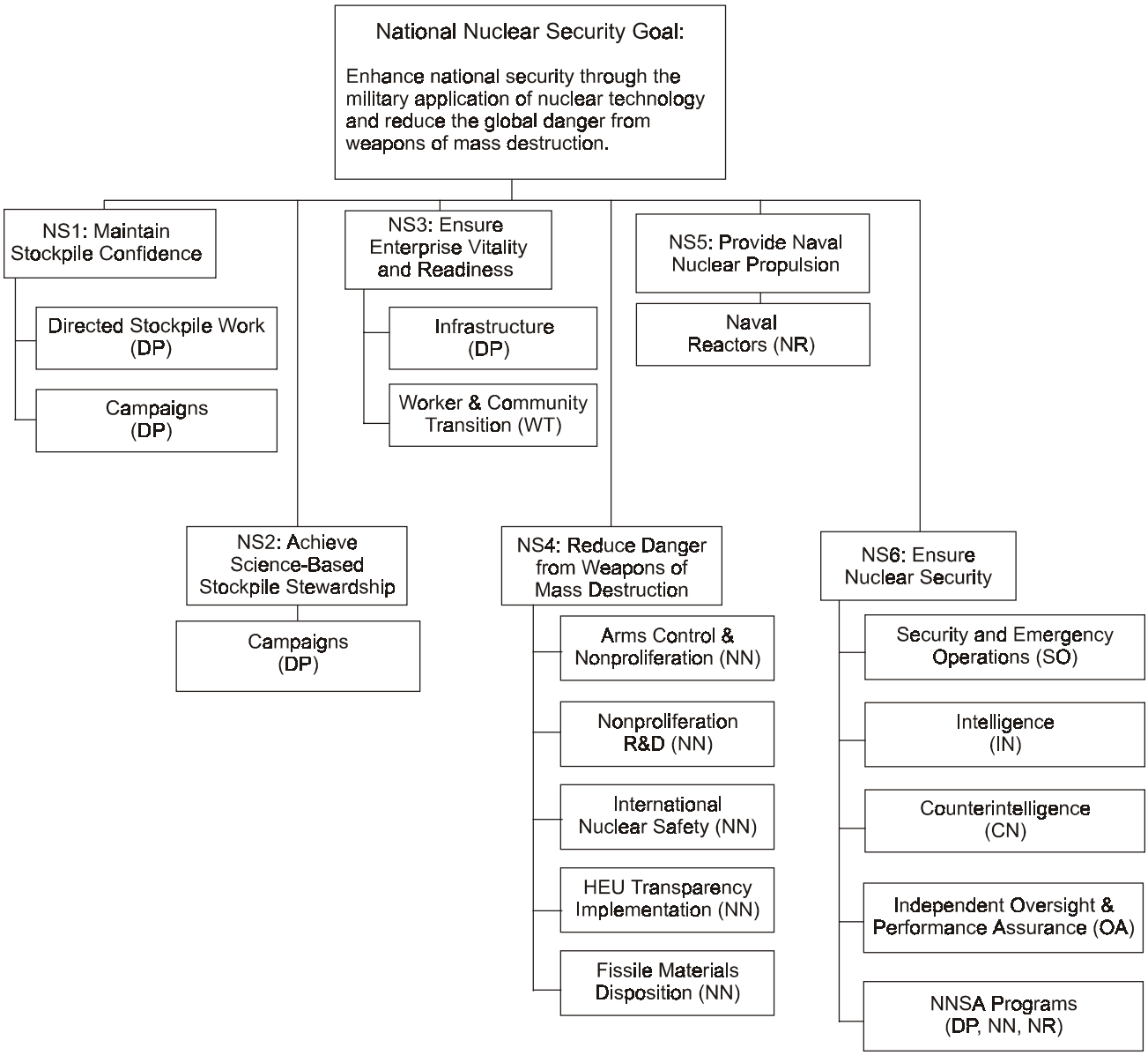
- Conduct safeguards and security evaluations at 20 major sites and perform continuous cyber security inspections and no-notice reviews at 14 major Departmental sites to provide an independent assessment of the status of safeguards and security programs for the Secretary and to establish a baseline of findings.

- Perform regular assessments of emergency management programs at DOE sites.

- Strengthen the ability to manage safeguards and security as an activity that has a specifically identified budget and the ability to enhance awareness of safeguards and security issues throughout the NNSA and the DOE complex.

Linkage to Budget Structure

The National Nuclear Security general goal is supported by seven objectives. Each objective is being pursued through long-term strategies. DOE's Budget Decision Units fund work in pursuit of those long-term strategies. The annual performance measures are discussed with the Decision Units in the Annual Performance Plan, which is submitted with the budget for each fiscal year. The following chart shows the relationship between Decision Units and objectives. However, the consolidation of funding for safeguards and security (Objective NS6) has not been completed. Therefore, for FY 2001 many programs fund these efforts.



ENVIRONMENTAL QUALITY BUSINESS LINE

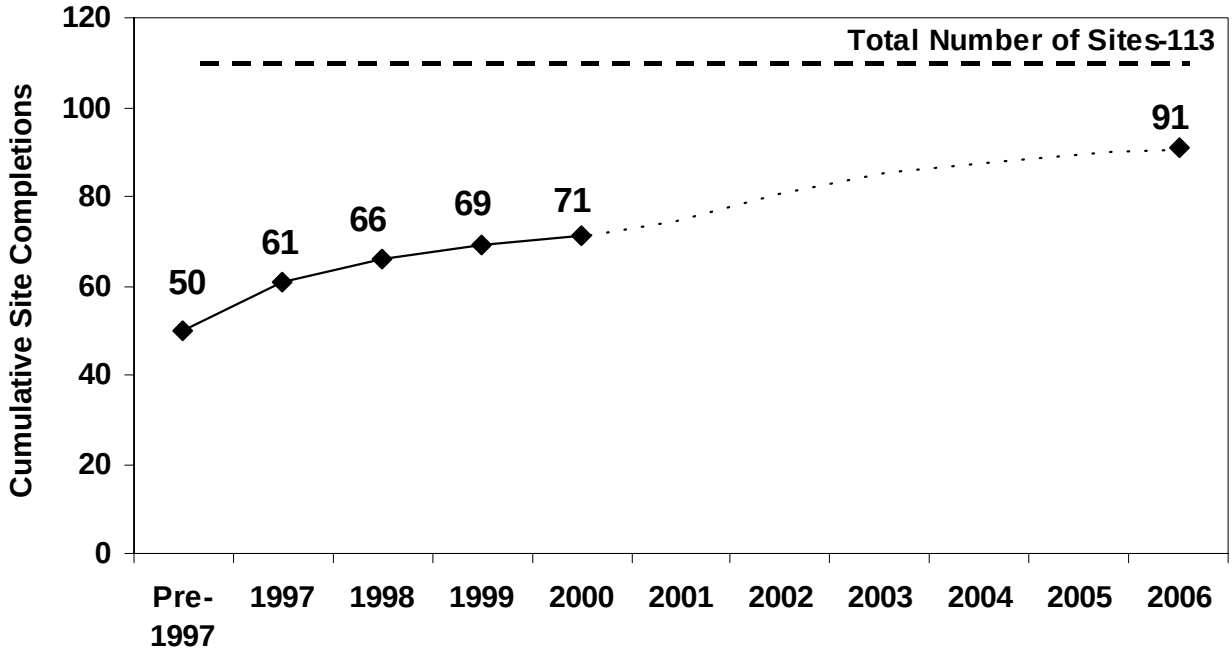
The Department of Energy is committed to honoring the government's obligation to clean up its sites across the country that supported the Nation's production and testing of nuclear weapons; to dispose of spent nuclear fuel from civilian nuclear power plants; to dispose of Department-owned spent nuclear fuel and high-level radioactive wastes; and to protect human health and the environment.

During the Cold War, the nuclear weapons complex generated large amounts of waste, which pose unique problems. There exist vast volumes of contaminated soil and water, radiological hazards from special nuclear material, and a large number of contaminated buildings and structures. Key statistics illustrate the magnitude of cleanup activities. DOE is challenged to:

- Remediate 1.7 trillion gallons of contaminated ground water, an amount equal to about four times the daily U.S. water consumption.
- Remediate 40 million cubic meters of contaminated soil and debris, enough to fill about 17 professional sports stadiums.
- Safely store and guard more than 18 metric tons of U.S. surplus weapons plutonium, enough for thousands of nuclear weapons.
- Manage over 2,000 tons of intensely radioactive spent nuclear fuel, some of which is corroding.
- Store, treat, and dispose of radioactive and hazardous waste, including over 160,000 cubic meters that are currently in storage and over 100 million gallons of liquid, high-level radioactive waste.
- Deactivate and/or decommission about 4,000 facilities that are no longer needed to support active DOE missions.
- Implement important nuclear non-proliferation programs for accepting and safely managing spent nuclear fuel from foreign research reactors that contain weapons-usable highly enriched uranium.
- Provide long-term care and monitor (i.e., provide stewardship) for potentially hundreds of years following cleanup.

The Department is responsible for the cleanup of 113 geographic sites located in 30 states and one territory. A geographic site is an area of land or series of buildings where cleanup work is to be done. Sites range in size from as small as a football field to larger than the state of Rhode Island. Altogether, these sites encompass an area of over two million acres—equal to the size of Rhode Island and Delaware combined. Despite the complexity and size of the challenge, DOE has made substantial progress over the past decade in cleaning up the nuclear weapons complex. At the beginning of FY 2000, the Department had finished active cleanup at 69 of the 113 geographic sites, leaving 44 to be completed.

This Drum Mountain scrap pile, now cleared, was more than two stories high, at the Paducah Gaseous Diffusion Plant in Kentucky. There were approximately 2,000 tons of empty crushed drums, which previously contained UF_4 (Uranium Tetrafluoride).



DOE's goal is to complete cleanup at an additional 22 geographic sites by the end of FY 2006, increasing the total completed to 91 out of 113. At the sites remaining after 2006, which includes our largest sites, DOE will continue treatment for the remaining "legacy" waste streams, and manage legacy nuclear materials (including nuclear material stabilization and disposition). To protect human health and the environment, the Department will implement long-term stewardship activities after active cleanup is completed at the sites.

Weldon Spring Site in Missouri is scheduled to be completed in 2002.

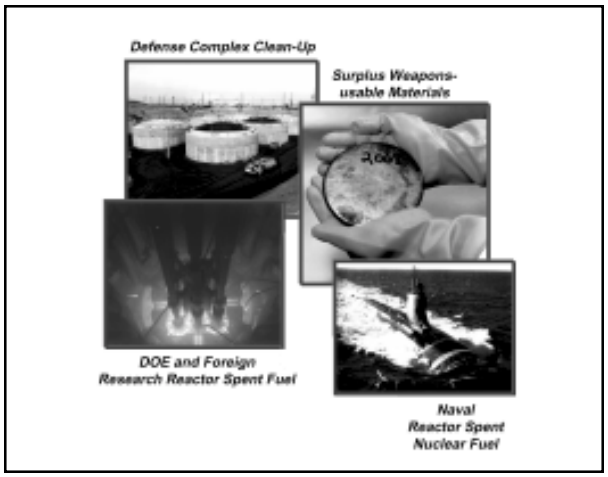
The production of nuclear weapons has left as a legacy approximately 100 million gallons of high-level waste in liquid and sludge/slurry forms. The waste is stored in underground tanks in Washington, South Carolina, and Idaho. By 2035, the United States will also have accumulated over 63,000 metric tons of spent nuclear fuel from commercial reactors, over 2,400 metric tons from reactors that produced material for nuclear weapons and research reactors, and approximately 65 metric tons from the Navy's nuclear powered ships. The spent fuel

from commercial nuclear power reactors is currently stored at reactor sites in 33 States at 72 power plants and one commercial storage site. Furthermore, some 700,000 metric tons of depleted uranium hexafluoride are the legacy of production of both the civilian and military fuels.

Geologic disposal is the national strategy for the ultimate disposition of this spent fuel and high-level radioactive waste. Geological disposal is also a technical foundation for our international stance on nuclear nonproliferation and it provides a viable path forward for managing other materials such as excess fissile materials from weapons production.

The Department is working to characterize Yucca Mountain, Nevada, to determine its suitability as a geologic repository site for these wastes. In 1998, DOE completed a viability assessment that drew on 15 years of study. This assessment concluded that work should proceed toward a decision on whether to recommend the site to the President. A draft environmental impact statement was published for public comment in 1999. If the site is recommended for development as the repository, the Department will submit a final environmental impact statement to accompany the site recommendation.

Under current schedules, DOE will complete in 2001, the work to support a Secretarial decision on whether to recommend the site to the President. This decision will consider the views of the State of Nevada, affected Indian tribes, and the Nuclear Regulatory Commission, as required by the Nuclear Waste Policy Act. If the President in turn, recommends the site to the Congress and Congress affirms the President's recommendation, the Department then would submit a license application to the NRC for construction authorization. Under current plans, acceptance of spent nuclear fuel and high-level radioactive wastes at the repository would begin by FY 2010.



DOE-managed nuclear materials destined for disposal in a geologic repository.

Situation Analysis

Our strategic plans for the Environmental Quality Business Line draw on information in the *Status Report on Paths to Closure*, which was published in March 2000 (DOE/EM-0526). This status report updates earlier life-cycle cost and schedule estimates for completing cleanup that were reported in *Accelerating Cleanup: Paths to Closure* (DOE/EM-0362).

DOE uses life-cycle planning (see the cited reports) to develop a comprehensive picture of the cost, schedule, and scope of completing the environmental cleanup mission. In developing the projections for the cost, schedule and scope, DOE plans its work in a manner that places a high priority on ensuring a safe workplace, minimizing risk to public health and the environment, and maintaining compliance with all applicable regulatory requirements.

Life-cycle planning is essential to DOE's approach to project management. As part of the planning process, each DOE site developed detailed project baselines that define the cost, overall cleanup requirements, specific cleanup milestones, and critical interactions between projects over time. The detailed project baselines

were then organized into more than 400 discrete projects complex-wide [known as Project Baseline Summaries (PBSs)]. Each PBS provides information on scope, technical approach, schedule, cost, regulatory drivers, and performance metrics. These PBSs form the basis for the summary-level goal and the cleanup objective included in this Strategic Plan.

This plan for the Environmental Quality Business Line should be viewed as a step in an ongoing planning process that will continue to evolve in response to stakeholder comments, programmatic decisions, changing circumstances, and future budgets. The Department must maintain public trust and confidence to move the cleanup program forward. DOE has asked the public to help in the formulation of a long-term approach to cleaning up the weapons complex. DOE incorporates suggestions from stakeholders in order to improve overall site strategies as well as end states, compliance, integration, cleanup priorities, and records of decision for specific projects.

The process of characterizing the Yucca Mountain site has been far more time-consuming than that envisioned when the Civilian Radioactive Waste Management Program was established in 1983. DOE has had to respond to diverse technical, oversight, operational, budgetary, regulatory, and political challenges that have evolved over time. Currently, the Department is engaged in litigation over its inability to begin accepting waste by January 31, 1998, as originally envisioned in the Nuclear Waste Policy Act of 1982. In addition, the schedule of the program will ultimately depend on the level of funding that is appropriated each year by Congress.

Key External Factors

A number of external factors have the potential to influence the outcome of environmental programs within DOE. These include:

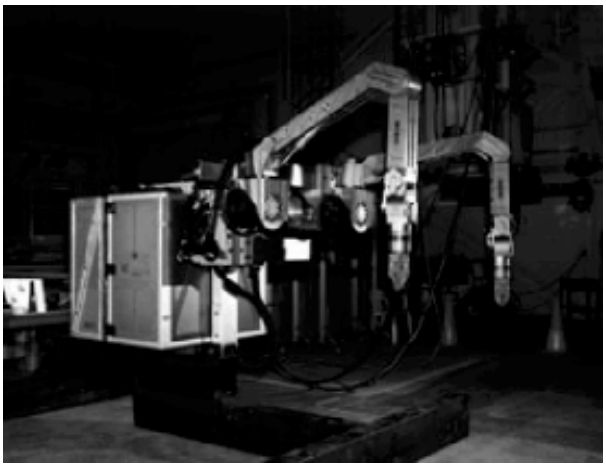
Regulatory Requirements. Environmental laws and regulations and Federal Facility Compliance Agreements drive the Department's cleanup decisions.

The Environmental Protection Agency (EPA) is in the process of developing new, site-specific radiation protection standards for Yucca Mountain. Concurrently, the NRC and the Department of Energy have been updating their respective implementing regulations. A new site-specific revision of the Department of Energy's siting guidelines (10 CFR 963) was issued for public comment in the Federal Register in 1999. The Department intends to use these new repository siting guidelines as the planning basis for the next statutory milestone, the Secretary's decision on site recommendation. The NRC will amend its proposed rule when the EPA issues its final standards.

Cleanup Standards/End States. The end states for the cleanup efforts are not fully defined at many sites. The extent of cleanup that is required greatly affects the cost, schedule, and scope of needed activities at DOE's contaminated sites. Decisions regarding cleanup levels must consider the availability of cost-effective technologies, the potential health risk to workers and other populations, and the possibilities of collateral ecological damage. Land-use and cleanup strategies are inextricably linked. The proposed use for the land (i.e., residential, industrial, or restricted) affects the amount and type of cleanup. In turn, the range of possible land uses is determined, in part, by the feasibility of cleanup and by requisite long-term stewardship activities. In each case, DOE will decide about

the end state of a site only after consultations with other representatives of the Administration, Congress, affected Tribal Nations, representatives of regulatory agencies, State and local authorities, and other stakeholders.

Uncertain Work Scope. Uncertainties are inherent in the environmental cleanup program due to the complexity and nature of the work. There are uncertainties in our knowledge of the types of contaminants, their extent, and concentrations; and the level of uncertainty differs from site to site. At some sites, the precise nature and quantity of waste and materials is still unknown and suitable cleanup technologies have not yet been identified. Work scope projections address long periods of time, and that adds uncertainty. At several sites the cleanup mission will continue another 40 to 50 years. Future program scope may also increase due to the transfer of additional facilities and/or sites, further impacting the uncertainty of out-year work scope and schedules.



The Dual Arm Platform was used for a variety of decontamination and decommissioning tasks at the Argonne National Laboratory's CP-5 reactor facility in Illinois. This technology significantly reduces worker exposure and improves efficiency by either allowing personnel to perform D&D operations remotely or as a fully functional robot.

Availability of Technological Solutions. The development and deployment of innovative technologies will help to meet national needs for regulatory compliance, lower life-cycle costs, and reduced risk to the environment and public health. Suitable cleanup technologies do not always currently exist, making it difficult to estimate cleanup scope and the associated costs.

Interagency Crosscutting Coordination

In order to succeed in achieving our environmental quality objectives, DOE has developed working relationships with a number of Federal agencies, State and local governments, Tribal Nations, private industry and Congress. The Department closely coordinates its planning efforts with these stakeholders. We negotiate and sign environmental compliance and cleanup agreements with the Environmental Protection Agency (EPA) and State regulatory agencies, as appropriate. We negotiate key parameters, such as required cleanup levels, with the appropriate regulators and stakeholders for each site.

DOE conducts frequent meetings with State, tribal, and stakeholder groups to discuss disposal options for mixed low-level radioactive waste (MLLW) and low-level radioactive waste (LLW) prior to making final decisions regarding disposition. Many of the institutional controls that will be required must be maintained and enforced by local governments.

With respect to the Civilian Radioactive Waste Management Program, the Department is engaged in continued formal and informal interactions with the Nuclear Regulatory Commission, EPA, and the Nuclear Waste Technical Review Board. In addition, the program interacts with the State of Nevada and local communities within the State on technical, policy, and operational issues.

Congressional and Stakeholder Consultations

In order to ensure that its environmental programs will be successful, DOE works to incorporate the divergent views of all concerned stakeholders. They include States, other government agencies, Congress, local citizens, environmental groups, other interest groups, members of academic institutions, various DOE offices, regulators, and Tribal Nations. All stakeholders must become true partners for cleanup to be conducted in the safest, most efficient, and most cost-effective manner possible. Each DOE Field Office has specific points of contact for public participation; some also have liaisons for budget and tribal issues. Stakeholders are called upon to help with the establishment of goals and strategies, and they are afforded opportunities to provide input during the applicable document review and comment processes.

Similarly, in implementing the Nuclear Waste Policy Act, DOE maintains both formal and informal relationships with Federal regulatory agencies, Congress, the State of Nevada, affected units of local government, and diverse program stakeholders including environmental groups, technical and professional organizations, policy groups, electric utilities, and Tribal Nations. Each program milestone presents opportunities for public participation and consultation, and many key program actions are subject to the formal public comment process.

In addition, DOE works with the Defense Nuclear Facilities Safety Board (DNFSB) to implement recommendations regarding nuclear health and safety at the Department's defense nuclear facilities. DOE solicits advice and guidance from the Environmental Management Advisory Board (EMAB) on a wide variety of topics relating to the management of the environmental cleanup program. The EMAB's membership consists of State and local government representatives, technical experts, and stakeholders. The Department also solicits advice from Site Specific Advisory Boards that have been established for 11 sites. These Boards provide consensus advice and recommendations to the Department's environmental restoration and waste management activities.

Program Evaluation and Analyses

A program evaluation process is essential in order to sustain continuous progress in Environmental Quality Business Line activities. DOE continually evaluates its programs and adjusts them as needed. The Department monitors its complex-wide performance measures and reports on them on an annual basis. The evaluation process is focused on the period through 2006, for which there is a well-defined context for addressing cleanup challenges. Supporting information on the cost, schedule, and scope is less detailed further into the future. Beyond 2006, the estimates are at a planning level, and they are based on assumptions that are more uncertain because they pertain to time periods beyond the foreseeable future. A life-cycle perspective is considered; however, the emphasis is on the near-term through 2006—a time frame with a much clearer context for addressing cleanup challenges.

The performance measures for DOE's environmental cleanup activities are aggregated by project to the site level, to the Operations/ Field Office level, and to a total program level, as applicable. At each level, performance measures are tracked, evaluated, and interpreted to determine areas requiring improvement. The Operations and Field Offices have contract management practices in place to evaluate, review, and hold contractors to high performance standards. The Department evaluates progress and results against its objectives and performance

measure goals during monthly and quarterly reviews.

Statutory external reviews of the civilian radioactive waste program are conducted by the Nuclear Waste Technical Review Board (NWTRB). The Office of Civilian Radioactive Waste Management also conducts in-depth reviews of program activities, schedules, and expenditures every two months.

Resource Requirements

DOE will achieve its goals and objectives only if it has adequate financial, human, infrastructure, technical, and information resources. In developing this Plan, the Department made the following assumptions:

- Uncertainties are inherent in the environmental cleanup program due to the complexity and nature of the work. Resource requirements and completion schedules will be updated as we realize new opportunities and/or encounter new challenges.

- Information resources for environmental cleanup will be based on the requirements established for the Integrated Planning Accountability and Budgeting System (IPABS).

- Science and technology investments will bring about significant reductions in risk, cost, and schedule for completion of the cleanup mission. These investments will provide the scientific foundation and the new technologies and approaches that will be needed.

- A highly skilled workforce, both at Headquarters and the Field, currently exists. However, the workforce needs to be supplemented with technical program and project managers with experience in project management and project sequencing. There is an additional need for experts that can effectively evaluate large-scale construction and remediation projects—their technical approaches, project scope, and consistency and trends across the complex.

ENVIRONMENTAL QUALITY GENERAL GOAL

Aggressively clean up the environmental legacy of nuclear weapons and civilian nuclear research and development programs at the Department's remaining sites, safely manage nuclear materials and spent nuclear fuel, and permanently dispose of the Nation's radioactive wastes.

This Environmental Quality goal is supported by three objectives that are closely aligned with the Department's budget structure. The first objective is to cleanup sites that were involved in nuclear weapons production. The second objective is to dispose of spent nuclear fuel and high-level radioactive wastes, and the third objective is to manage waste generated from the uranium enrichment process used to support the nuclear weapons complex and the civilian nuclear power industry.

OBJECTIVE EQ1

Safely and expeditiously clean up sites across the country where DOE conducted nuclear weapons research, production, and testing, or where DOE conducted nuclear energy and basic science research. After completion of cleanup, continue stewardship activities to ensure that human health and the environment are protected.

Introduction

To meet this objective, DOE will continue to implement its site closure initiative that was started in 1997 and continue to improve the management of its environmental programs. The Department will accelerate cleanup in order to close as many sites or portions of sites as possible by 2006 and reduce life-cycle costs at those sites where cleanup activities continue. DOE plans to achieve this objective in a manner consistent with its operating principles of ensuring worker safety, reducing risks to public health and the environment, meeting regulatory compliance commitments, and incorporating the views of the public.

Despite the complexity and size of the task, DOE has made substantial progress—at the start of FY 2000, active cleanup is finished at 69 of the 113 geographic site locations. By completing site cleanup more quickly, DOE reduces the length of time it must bear the fixed costs associated with maintaining the infrastructure of a site (a major component of DOE's overall costs). Hence, the Department intends to complete as much cleanup as possible by 2006, which reduces significantly life-cycle costs.

Even after completing cleanup, DOE will maintain a presence at most sites to monitor, maintain and provide information on the contained residual contamination. These activities are designed to maintain long-term protection of human health and the environment. Such long-term stewardship will include passive or active institutional controls and, often, treatment of groundwater over a long period of time. The extent of long-term stewardship required at a site will depend on the end state reached at that particular site. Each site's end state will be determined after consultation among DOE and other representatives of the Administration, Congress, Tribal Nations, representatives of regulatory agencies, State and local authorities, representatives of non-governmental organizations, and the general public.

Waste Isolation Pilot Plant in New Mexico received the first waste shipment on March 26,1999 at 4 a.m.

The Objective's Measure

The completion of cleanup work at geographic sites is the key measure of success for this objective. Nevertheless, site cleanup is a very complex task, generally involving numerous activities over many years. To ensure continuous progress across the complex, the Department monitors and annually reports performance results. Some of the types of measures are: volume of waste treated and disposed, number of release site cleanups completed and facilities decommissioned, quantity of nuclear material stabilized, quantity of spent nuclear fuel moved to dry storage and prepared and shipped for consolidation, and number and type of innovative technologies deployed.

- Complete cleanup of an additional 22 geographic sites by the end of FY 2006, increasing the total completed to 91 out of 113.

The Objective's Strategies

The following strategies describe the way in which the Department will work toward achieving this objective. In striving to meet this objective, protecting the health and safety of our workers, the public, and the environment is the Department's top priority. These activities will be translated into annual budgets and performance plans for the Department.

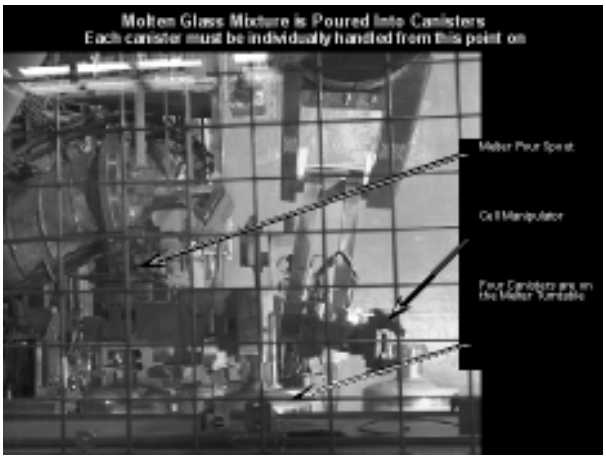
- Complete cleanup activities and close as many sites as possible by 2006, and provide continuing stewardship at those sites.

- With regard to DOE sites that have enduring missions, complete cleanup activities at as many of them as possible by 2006.

- Make substantial cleanup progress at those sites that will not be completed by 2006, which include the Hanford Site in Washington, the Savannah River Site in South Carolina, the Oak Ridge Reservation in Tennessee, and the Idaho National Engineering and Environmental Laboratory in Idaho.

- Continue to advance science and technology in order to solve currently intractable cleanup problems.

- Continue to: improve project management approaches and practices; implement an accelerated site closure and completion initiative; recognize that the Department's cleanup program and its stakeholders need to explore new ways to address large complex projects; define, refine, and implement long-term stewardship requirements; and conduct pollution prevention activities.



Molten glass mixture of high-level waste is vitrified at the Defense Waste Processing Facility (DWPF), Savannah River Site. Shown is the DWPF Melt Cell.

OBJECTIVE EQ2

Complete the characterization of the Yucca Mountain site and, assuming it is determined suitable as a repository and the President and Congress approve, obtain requisite licenses, construct and, in FY 2010, begin acceptance of spent nuclear fuel and high-level radioactive wastes at the repository.

Introduction

The Nuclear Waste Policy Act (NWPA), enacted by Congress in 1982 and amended in 1987, established a process for the development of a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste at Yucca Mountain, Nevada. The process requires that the Secretary of Energy:

- Undertake site characterization activities at Yucca Mountain to gather information and data required to evaluate the site.
- Prepare an environmental impact statement (EIS).
- Decide whether to recommend approval of the development of a geologic repository at Yucca Mountain to the President.

If the President recommends approval of the site to Congress, and if the site designation takes effect, the Department will submit a license application for repository construction to the Nuclear Regulatory Commission. If construction is authorized, repository construction will begin and, under current schedules, acceptance of wastes at the repository will commence by FY 2010.

Based on eighteen years of detailed scientific study and characterization of the Yucca Mountain site, a site recommendation consideration report is currently being prepared for the Secretary.

The performance measures and strategies described below outline the Department's plan of work over the time period of this Strategic Plan.

Cross-drift tunnel in Exploratory Studies Facility at Yucca Mountain, Nevada.

The Objective's Measures

DOE has established the following performance measures. These measures provide the basis by which the Department will know that it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department.

- Prepare and determine whether to submit a site recommendation to the President in FY 2001.

- In FY 2002, develop a license application for construction authorization by the Nuclear Regulatory Commission.

- In FY 2005, commence major procurement activities for transportation services.

- Commence acceptance of waste at the repository by FY 2010.

The Objective's Strategies

The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

- Complete Site Recommendation Report activities:

  – In FY 2000, select the reference design and the reference natural systems models for site recommendation and license application.

  – In FY 2001, complete a Yucca Mountain Site Recommendation Consideration Report that will provide the technical basis for a possible Site Recommendation and conduct public hearings on this report.

  – In FY 2001, issue a Final Environmental Impact Statement as required by the Nuclear Waste Policy Act and finalize a Site Recommendation Report for the Secretary of Energy to submit to the President, and then to the Congress.

- In FY 2002, to support the repository license application, complete technical analyses for plutonium waste forms and for Department-owned and Naval spent nuclear fuel and high-level radioactive waste.

- In FY 2002, complete all testing and analysis requirements to support the license application design, complete that design, and prepare all other inputs necessary for an application to the Nuclear Regulatory Commission for authorization to construct a repository at the Yucca Mountain site. Following submittal of the license application, support hearings before the Nuclear Regulatory Commission related to the application.

- In FY 2008, submit a license application amendment to the Nuclear Regulatory Commission to receive and possess wastes, and begin acceptance of waste at the repository in FY 2010.

OBJECTIVE EQ3

Manage the material and facility legacies associated with the Department's uranium enrichment and civilian nuclear power development activities.

Introduction

Until recently, the Department and its predecessor agencies were responsible for the enrichment of uranium used in both military and civilian applications. As a by-product of 50 years of uranium enrichment operations, vast quantities of depleted uranium hexafluoride (UF_6) were created. Most of the depleted UF_6 that has accumulated since the 1940s is stored in the locations where it was produced. These locations are the gaseous diffusion plants near Paducah, Kentucky, and Portsmouth, Ohio, and at the East Tennessee Technology Park (formerly K-25) at the Oak Ridge Reservation in Oak Ridge, Tennessee.

On July 1, 1993, responsibility for uranium enrichment operations at the Portsmouth and Paducah facilities was transferred from DOE to the United States Enrichment Corporation (now called USEC, Inc.). Gaseous diffusion plant operations at the Oak Ridge facility ceased in 1985. The Department continues to execute its responsibility for the safe storage and ultimate disposition of depleted UF_6. On August 2, 1999, the Secretary announced his Record of Decision to convert the approximately 700,000 metric tons of depleted uranium hexafluoride inventory to a more stable form as quickly as is practicable.

The Department also maintains a number of shutdown and standby facilities associated with civilian nuclear energy research. Among these, the Fast Flux Test Facility (FFTF) is in standby and is awaiting the outcome of a Programmatic EIS to determine whether it will be operated in the future or permanently shutdown.

The Objective's Measures

DOE has established the following performance measures. These measures provide the basis by which the Department will know that it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department.

- By FY 2005, complete the construction of and begin operating a facility or facilities to convert depleted uranium hexafluoride to a more stable form.
- Maintain the inventory of depleted uranium hexafluoride without any exposure to any members of the public, with no worker receiving any exposure above regulatory limits, and with no significant impact to the environment.
- Publish the programmatic environmental impact statement for nuclear facility infrastructure including the FFTF and support a Secretarial Record of Decision in December 2000.
- By FY 2005, complete a preconceptual design for an accelerator transmutation of waste (ATW) system that is based on actinide burning in a subcritical reactor.
- Complete process qualification for production waste equipment to process and dispose of depleted UF_6 and start waste form production by December 2002.

The Objective's Strategies

The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

- Work with State, local, and Federal regulators to ensure that the Department's inventories of depleted uranium hexafluoride are stored and maintained in a safe and efficient manner.

- Manage the development and implementation of a long-term strategy for the conversion and disposition of depleted uranium hexafluoride in a manner that makes useful and safe conversion products and cost-effectively disposes of the remainder.

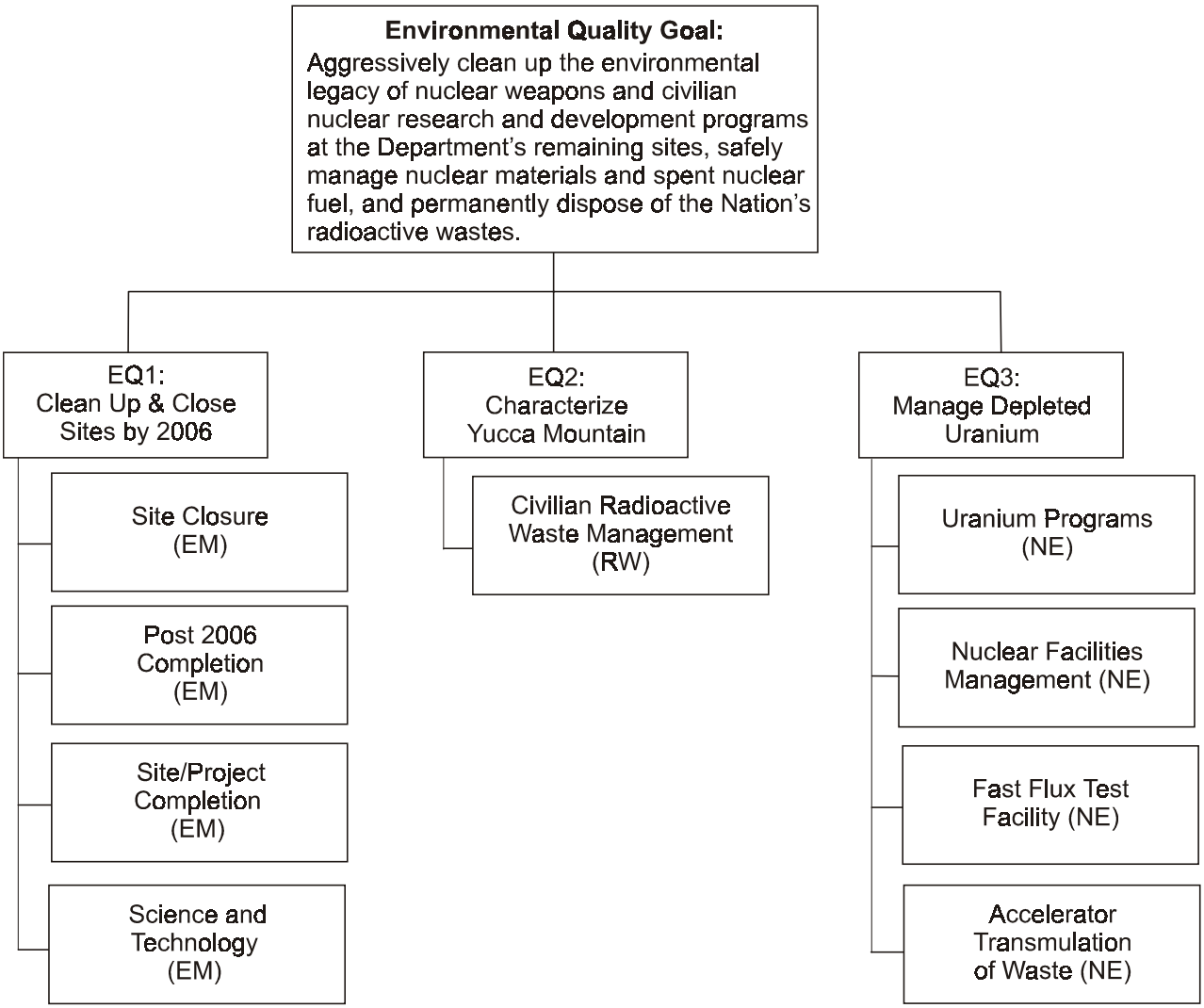
- Effectively manage arrangements with the United States Enrichment Corporation (USEC, Inc.) on the lease of facilities and electric power supplies, and reimbursable services.

- Maintain in a safe and stable configuration nuclear energy research facilities that are presently in either shutdown or standby condition.

- Continue to develop technologies for electrometallurgical treatment that could resolve problems with DOE's spent nuclear fuel.

Linkage to Budget Structure

The Environmental Quality general goal is supported by three objectives. Each objective is being pursued through long-term strategies. DOE's Budget Decision Units fund work on those long-term strategies. The annual performance measures are discussed with the Decision Units in the Annual Performance Plan, which is submitted with the budget for each fiscal year. The following chart shows the relationship between Decision Units and objectives.



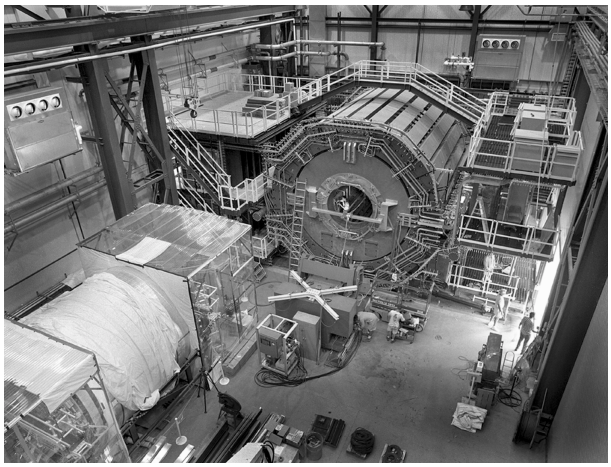
SCIENCE BUSINESS LINE

The Department of Energy's investments in science are investments in America's future. Over the last half-century, our Nation's economic prosperity, quality of life, and security stemmed from strong public commitments to basic research. Most experts agree that publicly-funded science is expected to take on even greater importance in the new century. Public investments fill important gaps in scientific knowledge that are outside marketplace forces, and they build the scientific foundations for the technology breakthroughs of the future.

As the Nation's third largest government sponsor of basic research, DOE pushes the envelope of fundamental knowledge, attempting to unravel some of nature's most complex and stubborn scientific mysteries. The Department is a recognized leader in many of the *physical* sciences and makes substantial contributions in the fields of *computation, biology, chemical,* and *environmental* sciences through research efforts supportive of DOE's missions. The Department's accomplishments in science, along with those of its predecessor agencies, are partially reflected through its support to 68 Nobel Laureates from 1934 through 1998.

Powerful accelerators, light sources, neutron beam facilities, plasma and fusion science facilities, genome centers, and advanced computational centers are just some of the major instruments of science that distinguish DOE's capabilities and enhance the Nation's science base. These unique capabilities are needed for DOE's basic science mission. They also enable the Department to:

- Build the scientific foundations for advancement of new options for clean and affordable energy.
- Develop an understanding of the underlying phenomena and creates new options for managing the adverse health and environmental impacts associated with energy production and use.
- Seek deep insights and pursue new ways to control energy and matter at the most fundamental levels.
- Equip our Nation with some of the premier instruments of science and support a scientific workforce that will assure our continued leadership, prosperity, and security well into the 21st century.

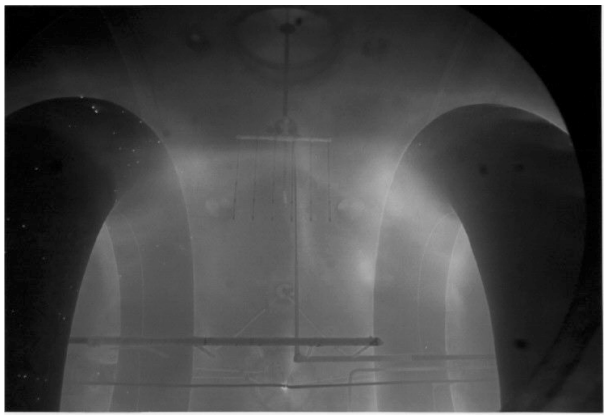


The Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory will enable scientists to explore some of the most fundamental forms of matter by creating conditions similar to those at the creation of the Universe.

Situation Analysis

The discoveries and breakthroughs attained by DOE's science programs both contribute to fundamental scientific knowledge and provide the foundation for the applied research and technology programs within the Department. Fundamental scientific support for DOE's applied-science business lines is critically important. These research programs are directed at scientific and technological issues that are becoming more complex. To meet the challenges of the future, we need to explore entirely new approaches and options—not just evolutionary and incremental changes in technology.

Rapidly expanding economies and populations in developing nations will demand more energy, and many of the currently available energy sources have significant adverse environmental consequences on local, regional, and global scales. Basic energy research is needed as a foundation for improving technologies that can provide alternative forms of fuels; seek out new supplies of traditional fuels; convert known fuels to more efficient, environmentally benign forms; and generate, store, and transmit electricity with less waste. Fundamental science is also needed to track pollutants through their intricate interactions with the environment and to uncover new ways to dispose of toxins and reduce climate-changing greenhouse gases. Advances in scientific computation can be applied to enhance global climate modeling, analyze energy use, and test strategies for mitigating adverse effects of energy use. By unraveling the human genome and understanding the cellular environment, we will have the scientific foundation to develop capabilities to more rapidly detect and analyze chemical, biological, and nuclear threats. These complex challenges require cross-disciplinary approaches for both managing research projects and making substantial progress.



In fusion, the nuclei of two hydrogen isotopes are combined to form a helium nucleus, thereby releasing a large amount of energy. To control fusion on Earth, hydrogen must be compressed to high densities and heated to hundreds of millions of degrees. One approach, the tokamak (pictured here) confines the hot dense "plasma" with strong magnetic fields.

Scientific breakthroughs sponsored by DOE have also contributed to the start-up and growth of many new businesses and industries in the United States. Technology innovation continues to expand the market share of U.S. companies in the multi-hundred billion dollar per year global energy technology market. Business can now be conducted worldwide with a few keystrokes, using computing and communications tools based on advances in computational science and high-energy physics that were supported in part by DOE. New private-sector commercial activities have arisen in such public research areas as:

- Hydrogen-based energy systems;
- High-temperature superconducting wires and devices;
- Teraflop computers that set world benchmarks for speed;
- Medical diagnosis and imaging technologies;

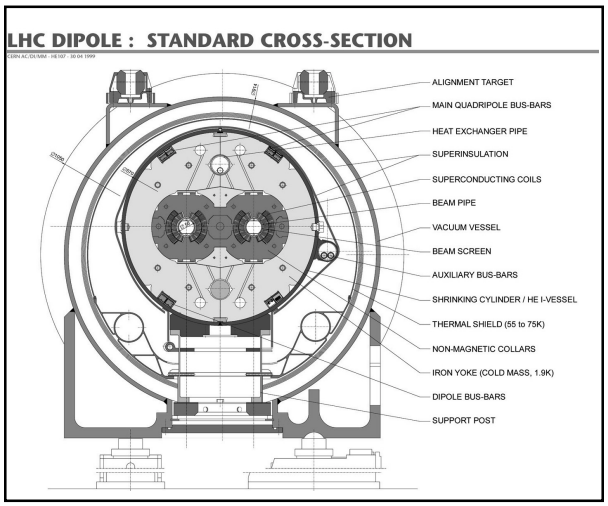
- Biomolecular design based on DNA sequencing;
- Portable energy storage; and
- Ion beam and plasma technology.

Scientific Excellence. With the current trend of reduced investment by industry in long-term basic research, government agencies are being called upon to assume more of the burden for the long-term well being of the Nation's science interests, and to deliver more for less. The imperative for the science community has never been greater to deliver the most valuable research within available budgets. To ensure value for the research dollar and excellence in performance, DOE depends on rigorous peer reviews and on scientific advisory committees. Peer review and advisory committees not only contribute to assuring the high quality of the work performed for DOE, they help the Department to recognize and track emerging trends and needs within the scientific community. This overall approach is recognized by many to be among the best and most thorough processes in the field of public research. DOE places a continued high priority on managing these processes well and searching out improvements and refinements that will further strengthen the Department's scientific management tools.

Multidisciplinary Research. The need for greater cooperation and synthesis across programs and disciplinary boundaries has become apparent as the scientific questions being asked grow increasingly complex and are tied to pressing societal issues. This evolution toward ever more multidisciplinary research requires new skills, greater teamwork, and new perspectives—all of which can be offered by scientists with interdisciplinary training. Accordingly, this Strategic Plan and DOE's science portfolio include various crosscutting initiatives, some of which were formulated during the planning processes. They and similar initiatives hold the keys to some of the most promising future areas of science.

International Collaborations. The trends toward increasing international collaboration in science raise issues regarding the roles and responsibilities of participating nations. If DOE is to be perceived by the international community as a dependable research partner, the Department must receive sufficient long-term, stable political and budgetary support to be able to make and live up to commitments for long-term science projects. Otherwise, we risk being excluded from important collaborative ventures that are in our national interest.

Integration of Science and Applied Research. DOE needs to achieve greater integration between basic and applied research programs. Highly participatory strategic planning processes, the development of science and technology roadmaps, and coordinated workshops that focus on integration all help to strengthen the linkages between science and its potential beneficiaries.



The Large Hadron Collider, now being built at the European Laboratory for Particle Physics (CERN) promises discoveries of great scientific importance that will advance our understanding of matter and energy. U.S. participation in this large international collaboration ensures full access for the U.S. research community to this frontier in physics.

Coordination Between Headquarters and Field Elements. To improve coordination between DOE Headquarters and its field elements, the Department is making a major effort to strengthen relationships, bring clarity to roles and responsibilities, and improve communications. The Office of Science is encouraging greater dialogue, accelerating its planning activities, and taking other steps to improve operations so that administrators and scientists throughout the complex function in a seamless, connected way.

Key External Factors

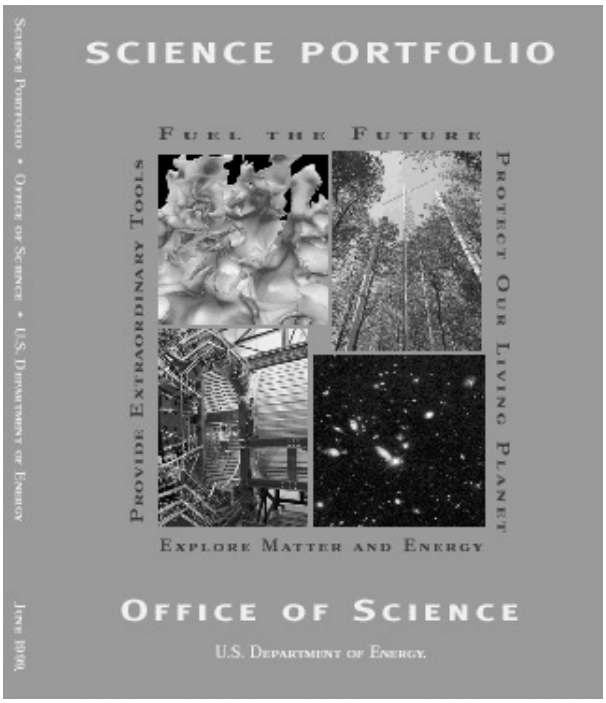
Despite large-scale downsizing and government-wide budget cuts over recent years, both the White House and the Congress have consistently supported science programs. This support reflects the widely held public view that basic research is important to U.S. competitiveness and long-term national interests. While there are differences from agency to agency, the budgets of most Federal programs and agencies have remained at least stable, and many have accommodated at least some modest growth when viewed against inflation. Continued and possibly expanded support is justified for Federal science programs given that there was a 38 percent decline in private-sector R&D spending by the 112 largest U.S. electric utilities between 1993 and 1996; that world energy consumption is projected to increase by four times the current levels within the 21st century; and that the pace of scientific discovery and technological advancement is accelerating, fostering fierce international competition for technological and market advantage. Continued support for DOE's science programs is anticipated, with modest increases expected over the near term. This factor will affect, to greater or lesser degrees, all of the four science objectives. President Clinton requested that the 1997 report from PCAST on the Nation's energy R&D portfolio "address the Nation's energy and environmental needs for the next century." DOE also launched a detailed effort to review the portfolio of science activities at DOE. This effort was based on a strategic framework informed by over a hundred of the Nation's leading scientists, technologists, planners, and futurists. Considering major external factors and core competencies of DOE, several important science themes emerged as part of the review effort and planning process, giving rise to focused discussions and greater attention on complex and adaptive systems, including nanotechnology; computation; and carbon sequestration, to name a few. Complex and adaptive systems impacts science Objective SC3. Computation is crosscutting, but strongly impacts Objective SC4 and, carbon sequestration impacts Objective SC2.

Interagency Crosscutting Coordination

Throughout DOE's programs in biological and environmental research, computational disciplines, and basic energy sciences, the Department coordinates closely with other agencies, especially in conducting science programs in which several agencies have specific roles. An example is the program to sequence the human genome. Additionally, DOE is a member of the Administration's National Science and Technology Council, which works to ensure interagency cooperation and coordination. DOE's partners include, but are not limited to the National Science Foundation, the National Institutes of Health, the National Aeronautics and Space Administration, and the Department of Defense. Additional information about the coordination and crosscutting activities with other Federal, State and local agencies is available in Appendix A.

Congressional and Stakeholder Consultations

The framework for the Science Business Line resulted from two national workshops held in 1998. They included the participation of more than a hundred leading scientists, technologists, high-tech managers, science communicators, and futurists from laboratories, other government agencies, Congress, DOE offices, and academic institutions. During post-workshop development of the strategic framework, the Director of DOE's Office of Science engaged in numerous conversations with the scientific community, the Congressional committees of jurisdiction, the Office of Management and Budget, and broader stakeholder communities.



The Science Portfolio is part of a broader DOE initiative to review all of the R&D, basic and applied, within DOE in light of our long-term strategic framework.

As the strategic planning progressed, interim versions of the framework were posted on the Web, and broad-based review and feedback were encouraged and received. Finally, DOE's major science advisory committees were briefed on the evolving product, and their responses were factored into the final version of this Plan.

Program Evaluation and Analyses

The Office of Science conducts extensive peer reviews and engages several advisory committees in its efforts to ensure that DOE programs are adequately reviewed and evaluated. Virtually all research projects supported by the Office of Science undergo regular peer review and merit evaluation based on procedures set down in 10 CFR Part 605 for the extramural grant program and in analogous processes established for the laboratory programs and scientific user facilities.

The Office of Science also makes extensive use of the six standing committees constituted under the Federal Advisory Committee Act—the Basic Energy Sciences Advisory Committee, the Biological and Environmental Research Advisory Committee, the High Energy Physics Advisory Panel, the Nuclear Science Advisory Committee, the Fusion Energy Sciences Advisory Committee, and the Advanced Scientific Computing Advisory Committee. Critical advice and valuable recommendations are regularly obtained from these committees of independent experts on program content, scientific quality, future directions, research priorities, and proposed scientific user facilities.

To develop the goals, objectives, and strategies contained within the Science Business Line, DOE drew on the participation of advisory committee members and many others, in two national workshops. Additionally, background and supporting concepts were raised and discussed in

many sources from advisory committees, building on material and ideas contained in reports such as:

- *Planning for the Future of High Energy Physics: (February 1998).* A subpanel report of the High Energy Physics Advisory Panel.

- *Scientific Discovery through Computing: (March 2000).* A review and plan submitted to Congress on the computational needs of DOE science programs.

- *Nanoscale Science, Engineering and Technology Research Directions: (September 1999).* A study conducted in preparation for the national, interagency research initiative in nanotechnology.

- *Complex Systems–Science for the 21st Century: (August 1999).* A review of the issues, opportunities and plans for the science behind fundamental complex structures.

- *Human Genome Project Five Year Plan (1999-2003): (October 1998).* A collaborative plan developed during a series of DOE and National Institutes of Health workshops and advisory committee meetings.

- *Carbon Sequestration Research and Development: (December 1999).* A collaborative review and resulting science/technology roadmap developed by the Office of Science and the Office of Fossil Energy.

- *Priorities and Balance Within the Fusion Energy Sciences Program: (September 1999).* A review and evaluation of the balance, priorities, and long-range goals within the research program, prepared by the Fusion Energy Sciences Advisory Committee.

Additionally, the draft goals, objectives, and strategies were provided to the Advisory Committees for review and comment. Not only did documented reviews and evaluations serve to disseminate information about the strategic framework, but in addition, the reviewers and evaluators had an opportunity to participate and influence the outcome of the planning process. Project-level peer reviews (distinct from the Advisory Committee process) have had a strong bearing on the research priorities and funding allocations *within* individual strategies, rather than on the nature of the strategies.

Numerous authoritative studies have concluded that extensive use of milestones and quantitative measures are inappropriate for evaluating the progress of basic research. For example, the National Academy's Committee on Science, Engineering, and Public Policy report, *Evaluating Federal Research Programs: Research and the Government Performance and Results Act* (1999), states:

> *"For applied research programs, progress toward specified practical outcomes can usually be measured annually by using milestones and other fairly standard approaches common in industry and in some parts of the federal government. For basic research, in contrast, progress toward practical outcomes cannot be measured annually, and attempts to measure such progress annually can in fact be harmful. Basic research progress can be reported annually in terms of quality, leadership, and relevance to agency goals, but practical outcomes can be measured only against a far longer historical perspective."*

The Committee's recommendations include the following strong warning:

> *"The use of measurements needs to recognize what can and cannot be measured. Misuse of measurement can lead to strongly negative results; for example, measuring basic research on the basis of short-term relevance would be extremely destructive to quality work."*

The offices responsible for fundamental research programs within the Office of Science evaluate and analyze their research activities using qualitative peer review mechanisms. Although peer review is the paramount performance measure, some other appropriate measures are used in conjunction with peer review. These include selected quantitative indicators or metrics; customer evaluations of user facilities; milestones for construction projects; and qualitative assessments of the outcome of prior research, including those provided by historical retrospectives, annual program highlights, and high-profile reviews conducted by the National Academy of Sciences and other independent organizations.

Resource Requirements

With the modest increase over the past three years in DOE's science research budget, the Department has been able to selectively fund high-priority new initiatives while preserving, with some shifts in emphasis, the core research activities.

In the future, the need to keep pace with advances in science will require substantial modifications to existing instrumentation and, in many cases, completely new facilities. The associated additional costs cannot be accommodated within a largely level funding base. Additionally, many of the support facilities and buildings that are essential to the continuation of the science are aging and in disrepair—some as old as 50 years. The poor conditions of these general-purpose facilities have adverse implications for the safety, security, cost, and continuity of DOE's science laboratories. Further, it will be increasingly difficult, to attract and retain the next generation of qualified scientists under the current working conditions in such facilities.

Two important human resource issues are anticipated to strongly influence our science programs in the years to come. Each presents vulnerabilities and challenges that must be addressed. First, a recent study by the National Science and Technology Council projects possible shortfalls in the science and technology workforce of the future. This problem will affect both the private and public sector research communities. DOE co-chaired this study and will be proactive in helping to implement some of the solutions.

The second issue is of immediate concern to DOE's science programs. An alarmingly high percentage of Federal science program managers are already at retirement age or within one to two years of being eligible. This situation creates a high risk for the Science Program that has been difficult to address because of inherently lean operations and externally imposed staffing constraints. These constraints have limited the ability to create an effective succession plan. At risk is the critical experience in managing large, complex scientific programs, as well as vital institutional and historical knowledge vested with these senior technical staff. Because the exodus of these employees is likely to be concentrated over a short period of time, it will be a challenge to achieve the desired smooth transition to a younger workforce.

Finally, the international scientific community is growing more connected and the pace of science is being accelerated because of advances in computation and communication. By taking advantage of the latest technologies in these areas, which requires considerable resources, DOE stays at the forefront of research, creates opportunities for much more collaborative approaches to science, and provides wider and more timely dissemination of the vast amount of scientific information that the Department generates. Through investments in new capabilities in computation and communication, DOE is able to increase inter-laboratory collaboration, conduct experiments from remote locations, and use scientific simulation as a potential substitute for more costly experimentation.

SCIENCE GENERAL GOAL

Advance the basic research and instruments of science that are the foundations for DOE's applied missions, a base for U.S. technology innovation, and a source of remarkable insights into our physical and biological world and the nature of matter and energy.

DOE science programs lead the Nation in many of the physical sciences and contribute major advances in the biological, environmental, chemical, and computational sciences. These programs extend the frontiers of scientific knowledge in service to DOE's applied missions in energy resources, environmental quality, and national security, and in support of a fundamental science mission to explore the nature of matter and energy. The Department's programs directly support award-winning researchers, as well as provide access for many other scientists who, sponsored by other agencies, universities, not-for-profit institutions, and companies, utilize the Department's premier instruments of science for the benefit of the Nation.

OBJECTIVE SC1

Provide the leadership, foundations, and breakthroughs in the physical sciences that will sustain advancements in our Nation's quest for clean, affordable, and abundant energy.

Introduction

The science programs at DOE, discover basic knowledge and provide the foundation for the applied research and technology programs within the Department's Energy Resources Business Line. Sustained advances in technologies for energy production and energy efficiency are made possible by the long-term research conducted within the Office of Science's programs in Basic Energy Sciences, Fusion Energy Sciences, and Biological and Environmental Research. In particular, these science programs contribute to breakthroughs in the understanding of fundamental processes and phenomena in:

- chemistry;
- materials;
- plasmas and fusion;
- plant, microbial, and other forms of solar conversion;
- electrochemical sciences;
- combustion and catalysis;
- and many other relevant fields.

The research addresses key issues in the development of new fuels, clean and affordable electric power, and efficient energy use.

DOE's science programs serve as a cornerstone for U.S. leadership in many scientific disciplines. They are pursued through research programs at universities and national laboratories, and the research is conducted in cooperation and partnership with the applied research programs in DOE, other Federal science agencies, and industry.

The Objective's Measures

DOE has established the following performance measures. These measures provide the basis by which the Department will know it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department.

- Improve understanding of hydrogen-related surface chemistry leading to efficiency gains for hydrogen production and storage, and increased use of hydrogen both as a primary fuel and in fuel cells.
- Make advances in the synthesis of superconductivity materials that may lead to superconducting devices capable of operating at temperatures above 100ºK, magnetic fields above 4 tesla, or currents above 100,000 amperes per square centimeter for more efficient overall systems for the storage and transmission of electric power.
- Develop more adaptable, higher resolution seismic instrumentation, including new sources and detectors, and improved computer algorithms for tomographic imaging of hydrocarbon reservoirs and subsurface transport pathways.

- Advance electrolyte chemistry and improve understanding of ion solutions and surface chemistry that will lead to longer lasting, higher capacity, rechargeable batteries—even thinner and lighter than plastic wrap.

- Develop new metals and ceramics designed at the atomic level, capable of withstanding even greater levels of severe physical and chemical stresses and extremes of temperatures, leading to applications in manufacturing processes and power production.

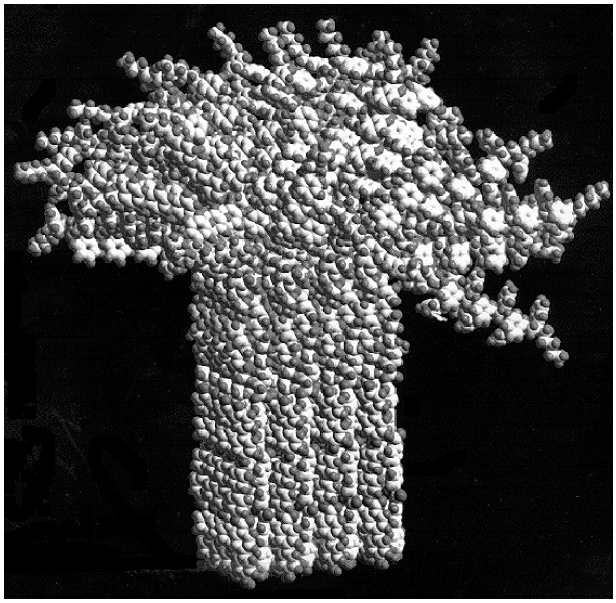
The Objective's Strategies

The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

- Advance the science for the development of new and improved sources of domestic fuels, with research emphasis on chemistry and materials science for energy conversion; plant, microbial, and solar conversion sciences; and geosciences.

- Explore the science that will lead to advanced generation, storage, and transmission of electricity, with research emphasis on metals, ceramics, and condensed matter physics; electrochemical sciences; and plasma science and fusion research.

- Develop the scientific foundations for cleaner, safer, and more efficient energy use, with research emphasis on combustion science, advanced materials for efficiency, engineering sciences, and new catalysis and chemical transformations.



The ability to control and manipulate materials at the atomic, or nanometer, level is ushering in an age of "Nanotechnology" with incredible promise for the U.S. economy. The self-assembling nanostructure pictured above forms an extremely thin film that is "sticky" on one side and "slippery" on the other.

OBJECTIVE SC2

Develop the scientific foundations to understand and protect our living planet from the adverse impacts of energy supply and use, support long-term environmental cleanup and management at DOE sites, and contribute core competencies to interagency research and national challenges in the biological and environmental sciences.

Introduction

The science programs of DOE—in particular Biological and Environmental Research and Basic Energy Sciences—contribute substantially to our fundamental understanding of the impacts of energy use (including energy by-products) on human health and on local and global environments. Such information is critically needed to assess the health and environmental challenges posed by different energy options, to formulate effective national policies in this area, and to investigate new energy alternatives that offer greater benefits with lower concomitant risks.

DOE science programs also underpin the Department's Environmental Quality Business Line. Research is pursued on long-term science issues that are pertinent to more effective and safer approaches to cleaning up DOE facilities, as well as options for the long-term management and final disposition of waste at DOE sites. Beyond these two important applications, the resulting scientific tools and capabilities often have broader research implications. DOE is frequently called upon to partner with other agencies in pursuit of other national life-science and environmental research challenges, including but not limited to activities such as the Human Genome Project.

The Objective's Measures

DOE has established the following performance measures. These measures provide the basis by which the Department will know it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department.

- Improve the spatial resolution of climate models used to simulate the dynamic behavior of the earth's ocean-atmosphere system from the current 300 km x 300 km to 150 km x 150 km.

- Improve the atmospheric transport and transformation models used to accurately and quantitatively predict the distribution and concentration of pollutants emitted from energy technologies into the atmosphere.

- Modify at least five microbes or microbial enzymes for potential use in cleaning up radioactive wastes, toxic pollutants, or modifying and upgrading fuel stocks.

- Improve the accuracy of biogeochemical models used to simulate both the net amount of carbon dioxide that is exchanged between the atmosphere and major terrestrial ecosystems each year and how much the net exchange is or would be affected by changes in vegetation or the way the land is used.

- Improve the understanding of the biomolecular effects of low-dose radiation, including genetic factors that determine individual sensitivity, to improve the scientific basis for protecting people and the environment from exposure to hazardous energy by-products.

- Develop at least five new radio-pharmaceuticals and the associated instrumentation needed for the precise imaging of gene function in the body; for the diagnosis of cancer, brain function, and heart diseases; for the staging of surgery; and for monitoring the progress of disease therapy.

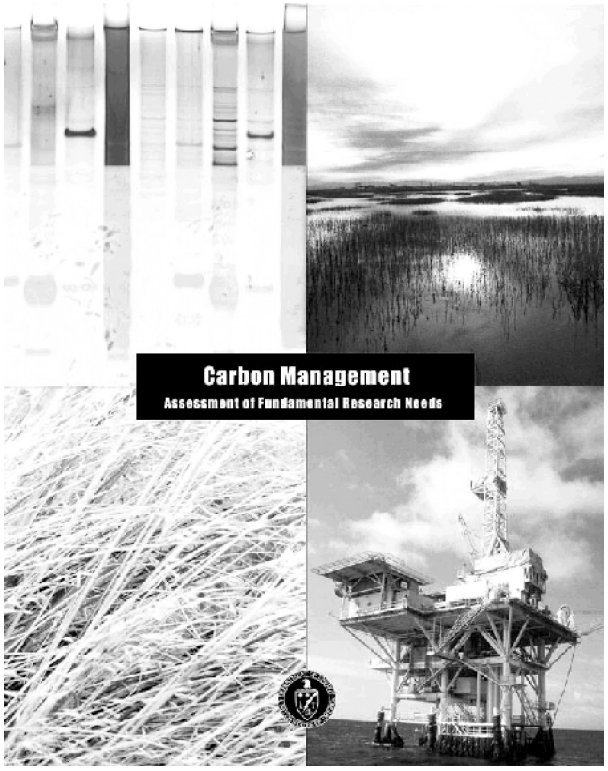
- Create new science-based approaches that minimize energy by-products and protect the biosphere and human health, with research emphasis on pollution minimization, cleanup and remediation, carbon sequestration, and health protection regulation and medical research.

The Objective's Strategies

The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

- Improve our scientific understanding of the sources and fate of energy by-products, with research emphasis on sources and transport in the biosphere and on chemical interactions and transformations.

- Provide a basic understanding of the biology and ecology of energy by-products as they affect humans and the natural world, with research emphasis on human health impacts and risks, ecosystem and biological responses, and regional and global consequences.



A first step toward understanding and perhaps mitigating climate change is an assessment of research needs. This report summarizes the five key areas DOE identified as needing additional research to better understand the complex interdependencies of the global climate.

Objective SC3

Explore matter and energy as elementary building blocks from atoms to life, expanding our knowledge of the most fundamental laws of nature spanning scales from the infinitesimally small to the infinitely large.

Introduction

DOE has a science mission to explore the nature of matter and energy at its most fundamental levels. Support from five science programs combine to address fundamental questions surrounding the essence of matter, time, energy, and space; nature and origins of the universe; building blocks of life; and complex and adaptive systems, some capable of self-assembly and ranging from plasmas and molecular systems of materials to living organisms. The supporting science programs include High Energy Physics, Nuclear Physics, Basic Energy Sciences, Biological and Environmental Research, and Fusion Energy Sciences.

Exploration of the nature of matter and energy is highly collaborative and DOE's endeavors will continue to benefit from many national and international partnerships. In the areas of High Energy Physics, Nuclear Physics, and Fusion Energy Sciences, the Department's research programs and advanced scientific instruments position the United States prominently as an international leader in these physical sciences. DOE's Basic Energy Sciences and the Biological and Environmental Research programs also exhibit leadership through their unique capabilities and research facilities and their special expertise in specific disciplines.

The Objective's Measures

DOE has established the following performance measures. These measures provide the basis by which the Department will know it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department.

- Confirm the existence of the Higgs boson and the first supersymmetric particles.
- Develop a quantitative understanding of how quarks and gluons provide the binding and spin of the nucleon based on quantum chromodynamics, further clarifying the theory of strong interaction as a component of the Standard Model.
- Prepare a coherent model of the origin and fate of the universe, supported by and consistent with observations of neutrino mass, cosmic background radiation, distant quasars and supernovas, and dark matter.
- Develop optical, ion, and plasma beam technology that can lead to electronic circuitry 10 times denser than that on today's chips.
- Complete a draft of the human DNA sequence by the end of 2000 and the entire sequence by 2003, as well as the genomes of many other animals and microbes, to provide the starting material needed to understand both normal and abnormal function including development, function, and disease.

- Validate new approaches and supporting science for plasma confinement and basic plasma phenomena, providing the foundations for possible energy applications.

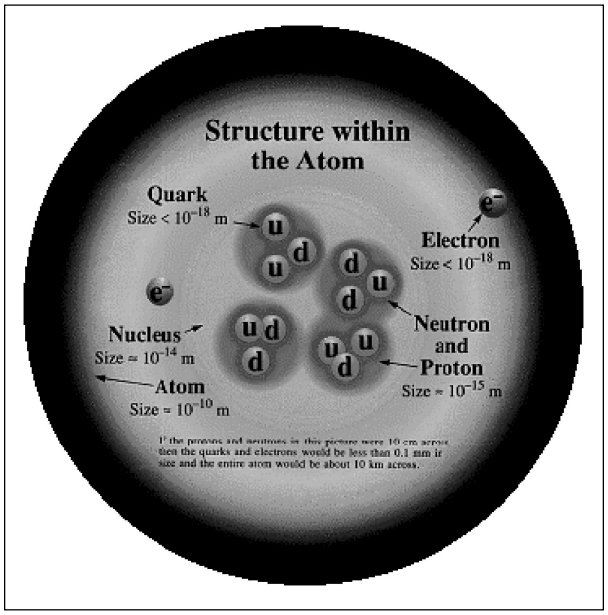
The Objective's Strategies

The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

- Advance the understanding of the nature of matter at the most fundamental level, with research emphasis on elementary particles and their interactions, nuclear matter and interactions, atoms and molecules, and biomolecular building blocks.

- Explore the evolution and fate of the universe through the fundamental relationships of energy, matter, time, and space, with research emphasis on the beginning of the cosmos, creation of nuclei and matter, evolution of astrophysical structures, and formation of life.

- Understand and improve our ability to control complex systems of matter, energy, and life, with research emphasis on complex phenomena and adaptive systems.



The "Standard Model" summarizes the current knowledge of Particle Physics. It is a theory that accounts for all observed particles and their interactions. It explains the forces that hold atoms and nuclei together or lead to their decay. More than three decades of theoretical and experimental efforts went into establishing this fundamental theory.

OBJECTIVE SC4

Provide the extraordinary tools, scientific workforce, and multidisciplinary research infrastructure that ensures success of DOE's science mission and supports our Nation's leadership in the physical, biological, environmental, and computational sciences.

Introduction

DOE plays a unique role in the Nation's science enterprise through its support of a broad variety of unique user facilities and laboratories, including large accelerators, experimental detectors and reactors, synchrotrons, massively parallel computers, high-capacity networks, and high-resolution microscopes. Thousands of scientists from DOE's national laboratories, from universities, private companies, and other agencies of the U.S. government use these extraordinary tools of science to advance the frontiers of knowledge. For many scientists, these facilities provide the only means for conducting the world-class research that has positioned the U.S. as a leader in the physical, biological, environmental, and computational sciences. The Department has a continued and important responsibility to maintain and nurture this infrastructure, along with the national laboratory system and the broader community of scientists that perform DOE's basic research.

The Objective's Measures

DOE has established the following performance measures. These measures provide the basis by which the Department will know it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department.

- Meet milestones for new accelerators, testbeds, and detectors for particle and nuclear physics, and (as supported by the physics communities) next-generation machines such as the Next Linear Collider, Muon Collider, Rare Isotope Accelerator, and advanced laser-based optical accelerators.

- Meet commitments and make progress toward new and upgraded probes and instruments for investigating materials, chemical processes, and life, including the completion of the Spallation Neutron Source, fourth-generation light sources such as free electron lasers and femtosecond x-ray lasers, and new accelerator and reactor designs for the production of research and medical isotopes.

- Create the software that enables parallel-processor supercomputers that are capable of petaflop speeds (a thousand trillion floating-point operations per second) to serve as powerful platforms for solutions to many complex problems and make these computers available to researchers working on problems critical to DOE's missions.

- Complete a needs assessment by early 2001, for modernizing DOE's science laboratories to ensure their continued viability to adequately support DOE research missions in the 21st century by correcting long-standing environmental, safety, health, facility, and infrastructure deficiencies, anticipating the changing nature

and needs of research activities and achieving a world-class research setting.

- Implement effective programs for science education through fellowships in universities and colleges, teacher training for secondary schools, outreach to communities, and broad partnership programs in science and technology.

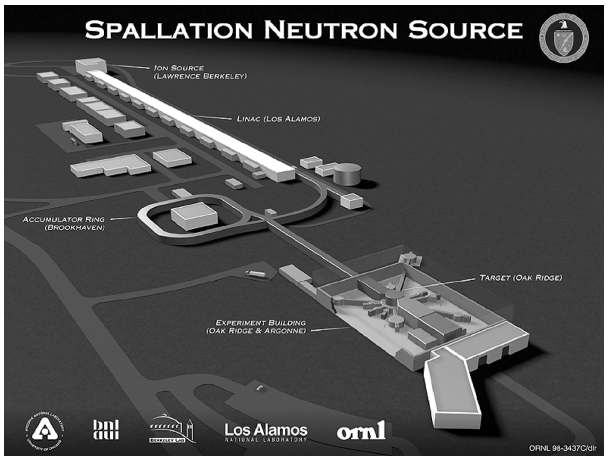
The Objective's Strategies

The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

- Provide leading research facilities and instrumentation that expand the frontiers of the physical and natural sciences, with emphasis on accelerators and detectors for high-energy and nuclear physics; light sources and neutron beam facilities; and specialized scientific facilities.

- Advance scientific computation and simulation as a fundamental tool for discovery, with emphasis on science applications software, ultra-high performance computation and communications facilities, and computer science and enabling technologies.

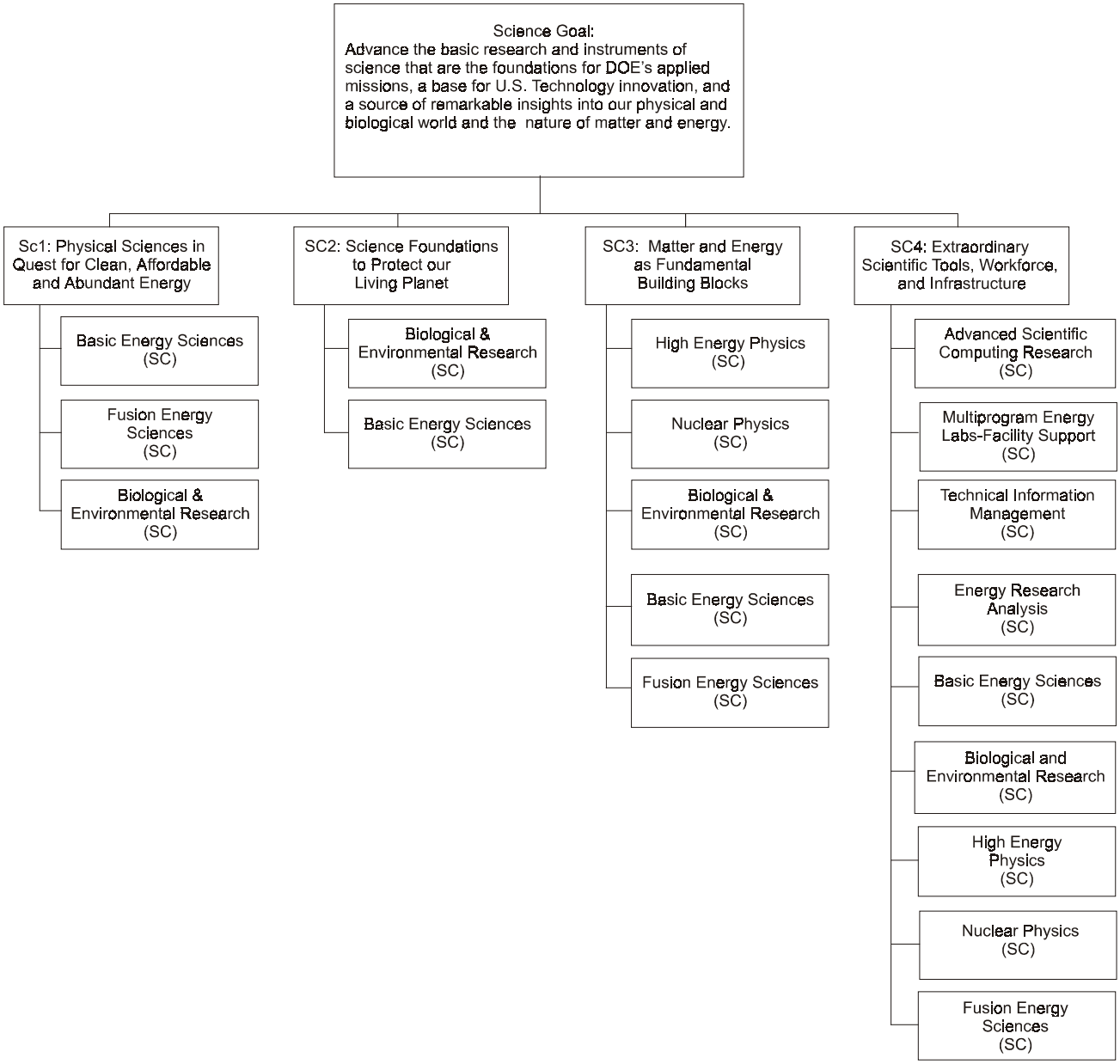
- Strengthen the Nation's institutional and human resources for basic science and multidisciplinary research, with emphasis on the national laboratory system, disciplines essential to our missions, scientific and technical information access and use, science education, and broadening the scope of research performers.



Complementing today's reactor and accelerator-based neutron sources, the Spallation Neutron Source (SNS) at Oak Ridge National Laboratory is being built by a five-laboratory partnership to provide the most intense beam of neutrons in the world. Scientists will use this neutron beam to probe the properties of matter with extremely fine resolution for basic research and industrial applications in many fields from materials to medicine.

Linkage to Budget Structure

The Science goal is supported by four objectives. Each objective is being pursued through long-term strategies. The annual performance measures are discussed with the Decision Units in the Annual Performance Plan, which is submitted with the budget for each fiscal year. The following chart shows the relationship between Decision Units and objectives.



CORPORATE MANAGEMENT

With an annual budget of $18 billion, the Department of Energy is charged with addressing issues of extraordinary technical and scientific complexity and diversity. DOE employs almost 16,000 Federal workers and over 100,000 contractors; it owns and manages over 50 major installations located on 2.4 million acres in 35 states, making it the Nation's fourth largest Federal landowner.

The Department faces multiple performance and management challenges. These challenges have been primarily identified through DOE's own internal reviews and Inspector General reports, but have also been reported by others such as the Office of Management and Budget, General Accounting Office, Congressional committees, and the National Partnership for Reinventing Government (NPR). The most significant management challenges the Department is addressing include:

- Providing ongoing stewardship of some of the most hazardous materials known to mankind. Our safety and health concerns and environmental problems are formidable.

- Ensuring the continued development of our staff to meet human resource challenges: nearly half of the current R&D technical managers will be eligible to retire within five years; serious gaps in needed skills have developed due to significant downsizing; there exists virtually no pipeline to develop future managers; and DOE's corps of technical managers lacks gender and ethnic diversity.

- Improving the organization of the Department and the relationship between the field structure and the program offices to increase efficiency, strengthen management, ensure accountability, and improve reporting requirements.

- Reforming our processes for project management and acquisition of large facilities to better adhere to project schedules and budgets.

- Better integrating the R&D programs within each business line and among the various business lines of DOE to take advantage of technical advances and new ideas in areas of shared interest.

- Increasing the use of competition to select contractors, and improving the management of contractors through the use of the principles of performance-based management.

- Integrating performance and budget planning at the program level through the use of DOE's Strategic Management System and performance-based management.

Situation Analysis

By focusing on the underlying management issues, the Department has made significant progress in aligning resources with agency priorities, streamlining operations, and reducing costs. We have accomplished many of the strategic alignment goals set out in the previous DOE Strategic Plan.

In addition, the Secretary has announced new initiatives to improve administrative management, streamline operations, and better manage DOE's contractors.

Initiatives to improve administrative management are directed at ensuring that resources are effectively focused on supporting DOE's core missions—energy resources, national nuclear security, environmental quality, and science. Initiatives to streamline operations are aimed at making services more convenient and less costly, eliminating redundant and out-of-date systems, and allocating staff resources more efficiently. The Department performs most of its work, both operations and construction, through private contractors. Initiatives to improve DOE's management of its contractors will help ensure that contractor work is accomplished more efficiently and effectively. The Department will continue to review, monitor, and recommend new management initiatives to save taxpayers' money.

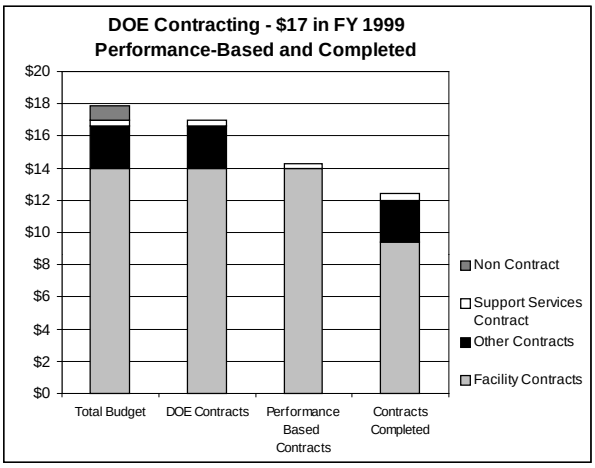
Safety and Health. Because the Department has stewardship over some of the most hazardous materials known to mankind, our safety and health concerns and environmental problems are formidable. These problems challenge DOE's ability to ensure the health and welfare of workers and the public. In response, the Department is implementing several initiatives: Integrated Safety Management (ISM), new processes for self-assessment and corrective action, and independent oversight evaluations.

The Department has a long-term plan for correcting nuclear and occupational safety and health deficiencies. It includes ongoing evaluation of internal operations, final publication of remaining Nuclear Safety Management Rules during FY 2000, and completion of actions to correct deficiencies in the storage of spent fuel by 2005. In addition, the Department is working to implement ISM at all sites by September 2000, and has established a safety council that will ensure ISM targets are met. To signal its seriousness about health and safety, the Department is inserting a clause into contracts that puts the contractor's entire performance-based fee at risk for poor safety performance. The Department also plans to mitigate risks to workers and environmental impacts by issuing aggressive goals to reduce the amount of waste generated by DOE programs and to improve the efficiency of its energy usage over the next ten years.

Contract Management. For an agency that contracts out 94 percent of its budget, excellent contract management is essential. DOE strives to ensure public confidence by competing contracts and by rewarding contractors for outstanding performance. DOE selects and retains contractors based on their performance as measured through our system of performance-based management. The management system is outcome-oriented and holds both the Department and its contractors accountable for results.

DOE has been revising its contracting practices over the last several years, aligning them as closely as our mission permits to Federal acquisition practices routinely employed throughout the government. DOE has awarded, and will continue to award, more contracts through full and open competition than was the practice of DOE and its predecessor agencies during the Cold War. DOE will continue to rely on full and open competition unless there is a need to utilize exemptions as authorized in the Competition in Contracting Act. Such exemptions exist for important and urgent national security requirements and for long-term research activities at DOE Federally-funded research and development centers (FFRDCs). Even when an exemption is authorized, contracts may be awarded through competition, as was done

recently for the Idaho National Engineering and Environmental Laboratory, the Oak Ridge National Laboratory, the Brookhaven National Laboratory, and the National Renewable Energy Laboratory.



Project Management. In June 1999, the National Research Council issued a report on improving project management in the Department of Energy. On June 25, 1999, the Deputy Secretary of Energy announced a Project Management Reform Initiative. The Department subsequently established the Office of Engineering and Construction Management within the Office of CFO. This office has been tasked to formulate policy and procedures for implementing a strong, corporate approach to project management throughout the Department. A cornerstone of that policy is a set of procedures, issued by the Deputy Secretary on June 10, 2000, for planning, programming, budgeting, and executing all capital-assets projects, including information technology projects.

Workforce Planning and Management. Since 1995, the Department has reduced Federal staff from 13,640 to 10,027 through reductions in force, buyouts, and attrition during a hiring moratorium to meet lowered budget levels. As a consequence, the average age in the Department has increased from 44 to 48 over the last 5 years—almost 2 years older than the government-wide average. The fraction of the staff eligible for retirement has increased from 6 percent to 11 percent in the last 5 years and will increase to 34 percent in the next 5 years. These are all signs of a static workforce, with separations exceeding hires by almost 3 to 1.

The Department must ensure that it has the necessary skills to carry out critical missions, and it must begin the process of rebuilding a pipeline of skills for the future as we enter a period when the retirement rate is expected to increase. In November 1998, the Secretary of Energy announced a workforce initiative to identify critical hiring needs and strengthen our technical and management capabilities. Funding for this initiative was not available in FY 2000 leaving the Department almost 700 employees short of projected needs. As we fill these needs, we have the opportunity to focus on diversity to ensure we have a high-quality, representative workforce at the Department.

Inadequate Audit Coverage. The Department obligates approximately $13 billion annually through contracts with its major contractors who perform many of the functions integral to the DOE mission. The Office of the Inspector General (OIG) first identified inadequate audit coverage as a material weakness in 1991. Over the next few years, the OIG worked with Department management and internal auditors at contractor facilities to develop a methodology known as the Cooperative Audit Strategy, for assessing audit risk and coordinating audit activities. The purpose is to most effectively utilize all audit resources (OIG and contractors' internal auditors). While the strategy has succeeded in getting the most out of existing audit capabilities, statutory audit requirements and responsibilities have continued to accrue at a rapid rate. New audit requirements have seriously hindered the OIG's ability to offer assurance that the Department's major contractors are being

reimbursed only for costs that are reasonable and allowable. Furthermore, staffing levels to conduct internal audits have decreased over the past several years. The OIG is planning to focus its reviews on areas assessed to have the most risk or offer the greatest benefits to key Department programs. However, this risk-based approach can only mitigate, not eliminate, the effect of inadequate staffing.

Information Technology. The Department is benefitting from information technology advances. Developments in desktop and communication technology have allowed our staff offices to remain productive as DOE reduced personnel resources. The compound effects of new commercial off-the-shelf software and process improvements are resulting in significant productivity improvements.

The Chief Information Officer is developing for review and comment Departmental policy to ensure that capital planning for information technology (IT) and investment processes are uniform complex-wide and conform with recent legislation (the Clinger-Cohen Act). The new policy defines requirements for all DOE organizations to ensure that their IT investments support mission, program, and business needs.

The policy also defines the critical elements that each DOE organization should address within the selection, control, and evaluation phases of its processes for managing IT investments. These critical elements are based on guidance issued by the U.S. General Accounting Office in 1997. Upon implementation of the policy, the CIO will conduct periodic reviews of management processes for IT investment within DOE organizations. The frequency of these reviews will be based on the value and composition of each organizations's IT investment portfolio.

Field Operations. Effective performance-based management requires clear lines of authority and accountability. On April 21, 1999, the Secretary changed the organization and management structure of DOE to eliminate multiple reporting channels and improve lines of communication, direction, and accountability. The change included:

- Establishing a direct reporting relationship between the Department's Field operations to responsible Headquarters Program Offices.
- Clarifying Field and Headquarters roles and responsibilities.
- Creating a Field Management Council, chaired by the Chief Operating Officer, to assure consistent implementation of DOE policies.

The establishment of the Field Management Council is but the latest in a series of actions to better integrate roles. In the absence of integration, stove-piping occurs, which increases costs, complicates communications, and impedes effective mission accomplishment.

Key External Factors

Laws, regulations, Executive Orders, and Administration initiatives all dictate the priorities and programs in DOE's Corporate Management area. As far as legislation is concerned, DOE expends significant resources to fulfill the requirements of the following Acts:

- Atomic Energy Act of 1954,
- CFO Act,
- Clinger-Cohen Act of 1996,
- Inspector General Act,
- Federal Managers Financial Integrity Act (FMFIA),

- Government Performance and Results Act of 1993,
- Government Management Reform Act,
- Federal Financial Management Improvement Act (FFMIA),
- Federal Acquisition Reform Act of 1996,
- Federal Acquisition Streamlining Act,
- Federal Activities Inventory Reform Act of 1998, and
- Small Business Act.

The Department also attempts to be responsive to Administration initiatives and Executive Orders that address National Security, Pollution Prevention, Energy Efficiency, Environmental Justice, Historically Black Colleges and Universities, Education Excellence for Hispanic Americans, and Tribal Colleges and Universities. Many of the performance measures in the business line reflect our continuing efforts to implement these laws and regulations.

Interagency Crosscutting Coordination

In order to fulfill their government-wide oversight responsibilities, the Department's management offices coordinate with other Federal agencies including the Office of Personnel Management, OMB, Treasury, GAO, EPA, and SBA. Management offices implement policies of oversight agencies and report on related DOE activities. In addition, DOE managers comply with regulations of the Environmental Protection Agency, the Occupational Safety and Health Administration, and the States.

Congressional and Stakeholder Consultations

The objectives, measures, and strategies of Corporate Management result from regular consultations within the Department, with Congress and GAO, with oversight agencies within the Office of the President, and with other Executive agencies. These consultations are part of the normal day-to-day operation of the DOE staff and functional offices. In addition, DOE receives and carefully considers all input received from the general public.

Program Evaluation and Analysis

Many past program evaluations and analyses have greatly contributed to preparation of this plan. Examples include reviews by the National Research Council, the Federal Technical Capability Panel, Departmental Internal Control and Audit Review Council, and Workforce 21. Other contributions came from evaluations that were part of component strategic and annual plans, performance reviews of annual plans, self-assessments, business management oversight performance reviews, semiannual reports to Congress, and annual accountability reports. Extensive peer and program review processes, together with customer and employee surveys, assure that products and services reflect the highest quality achievable.

Resource Requirements

Financial resources are expected to be steady throughout the planning period. As for human resources, the Department needs about 700 additional employees over the next several years. Continued productivity gains from the application of constantly improving information technology are expected.

CORPORATE MANAGEMENT GENERAL GOAL

Demonstrate excellence in the Department's environment, safety, and health practices and management systems that support our world-class programs.

In its crosscutting efforts, the DOE corporate staff ensures that the Department's programs have in place effective management systems and follow sound business practices. *Corporate Management upholds the DOE core values into our daily business practices. Our obligation is to perform as customer-oriented public servants, working for internal DOE customers and ultimately, for the taxpayers. In addition, we have an equally important responsibility to attend to public safety and respect the environment.*

Objective CM1

Ensure the safety and health of the DOE workforce and members of the public, and the protection of the environment in all Departmental activities.

Introduction

This objective is at the center of DOE's core values. In an industrial environment as hazardous as some Departmental workplaces, we take great care to exceed industry standards for safety. To do so is a major challenge. As a Federal agency responsible to the public, we must hold ourselves to the highest threshold of worker and public safety.

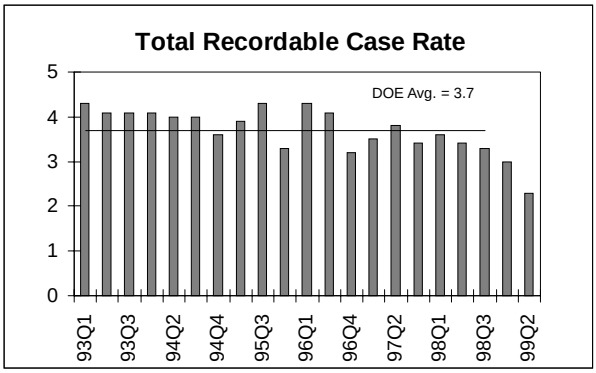
Since 1990, the Department has evaluated its environmental, safety, and health program using 22 performance indicators. A chartered group of safety experts recently consolidated them to 5 complex-wide performance indicators. These five indicators are correlated to performance measures used in the Integrated Safety Management (ISM) System at DOE and can be used to gauge the effectiveness of ISM implementation.

The Department is committed to aggressive pollution prevention and energy efficiency goals. A complex-wide initiative in these areas will set targets for preserving the environment at DOE sites and surrounding areas.

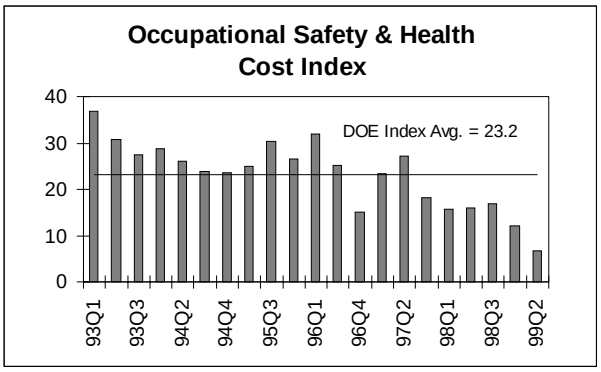
The Objective's Measures

DOE has established the following performance measures. These measures provide the basis by which the Department will know that it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department.

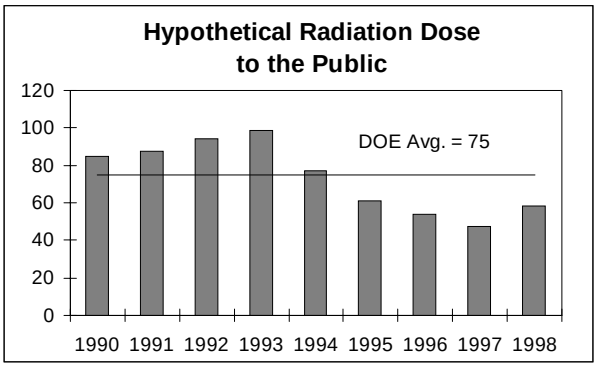
- Reduce the Total Recordable Case Rate, which measures work-related death, as well as injury or illness that results in loss of consciousness, restriction of work or motion, transfer to another job, or medical treatment beyond first aid.



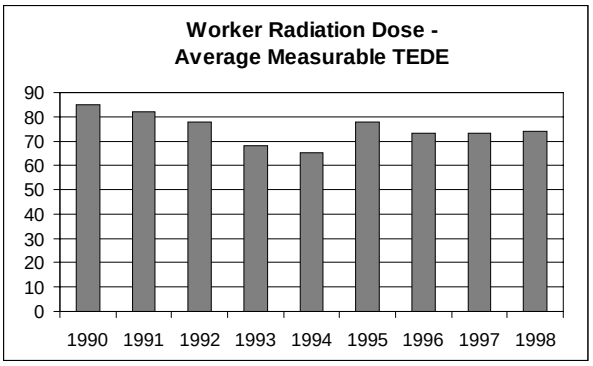
- Reduce the Occupational Safety Cost Index through vigilance in reducing those types of safety-related injuries/illnesses that have the greatest direct and indirect dollar costs as measured by the Cost Index formula.



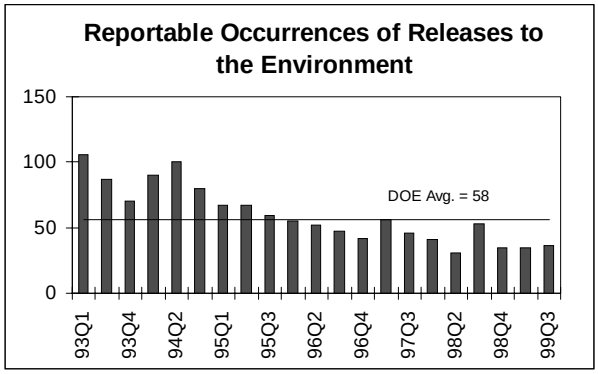
- Reduce the Hypothetical Radiation Dose to the Public, which is the estimated collective radiation dose (person-rem) to the public within 50 miles of DOE facilities due to airborne releases of radionuclides.



- Reduce the average measurable dose to DOE workers, which is calculated by dividing the collective total effective dose equivalent (TEDE) by the number of individuals with measurable dose.



- Reduce the Reportable Occurrences of Releases to the Environment which include: releases of radionuclides, hazardous substances, or regulated pollutants that must be reported to Federal, State, or local agencies.



- Achieve each of the 14 performance measures related to pollution prevention and energy efficiency, reduce generation of waste, purchase more items with recycled content, improve energy usage, reduce usage and release of environmentally harmful material, improve vehicle fleet efficiency, and use alternative fuels.

The Objective's Strategies

The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

- Implement Integrated Safety Management Systems in all major management and operations contracts.

- Maintain current, up-to-date DOE policies, standards, and guidance; and adopt consensus standards to apply to the DOE work environment.

- Continue relationships with external regulators (OSHA, NRC, EPA, and the States) to accommodate their special interests and jurisdiction, as appropriate, and to advance the DOE environment, safety, and health goals.

- Provide products and support in environment, safety, and health that efficiently use centrally managed DOE resources. Programs include the Department of Energy Laboratory Accreditation Program, the Federal Employees Occupational Safety and Health program, and the nationally-recognized Voluntary Protection Program.

- Provide compliance assurance to DOE line management by drawing on the Department's activities to implement the National Environmental Policy Act (NEPA).

- Conduct oversight activities to provide information and analysis in order that DOE, contractor management, and the public have an accurate, comprehensive understanding of the effectiveness, vulnerabilities, and trends of the Department's environment, safety, and health policies and programs.

- Conduct health studies including Occupational Medicine (medical surveillance), Epidemiologic Studies (surveillance and communication of worker injury and illness), Public Health Activities (health studies, health education and promotion, etc., at DOE sites), and International Health Programs (Marshall Islands program and health studies in the former Soviet Union and Spain).

- Support analysis of the medical effects of radiation including the activities of the Radiation Effects Research Foundation. Contribute to the maintenance of the health and welfare of atomic bomb survivors and to the worldwide enhancement of radiation protection practices and standards.

- Implement an agency-wide program of pollution prevention and energy efficiency to ingrain environmental accountability into the Department's daily decision-making process. Make continuous and cost-effective improvements that will reduce the generation of waste; reduce/eliminate use of environmentally harmful materials, equipment, and processes; enhance the reuse of materials among DOE sites; and increase the usage of energy-efficient technologies and processes in all our activities.

OBJECTIVE CM2

Manage human resources and diversity initiatives and implement practices to improve the delivery of products and services.

Introduction

This objective constitutes a pledge that internal DOE customers will receive improved services at reduced costs. The Department's Headquarters staff offices support program elements through the internal delivery of products and services. These include: office space, communication services, and office supplies through the Working Capital Fund; personnel and training services; contract administration; financial management and accounting; and corporate policies on many subjects including diversity goals and resolution of internal disputes.

The Objective's Measures

DOE has established the following performance measures. These measures provide the basis by which the Department will know that it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department.

- Improve DOE human resources management (specific goals are under development and will be included in annual performance plans).
- Achieve the Department's diversity goals for hiring and competitive promotions consistent with current Civilian Labor Force statistics.

The Objective's Strategies

The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

- Align programs pertaining to human resources to DOE's mission by integrating human resource management into DOE's system for planning, budgeting, and program evaluation; continue to recruit, develop, and manage our workforce to sustain world-class programs.
- Implement the critical action items in the annual plan developed by the Federal Technical Capability Panel.
- Implement the milestones in the *DOE Corporate Education, Training, and Development Plan*; develop and implement a new Technical Leadership Development Program; and implement an automated Training Module in the Corporate Human Resources Information System (CHRIS).
- Initiate a major project to implement a modern systems approach: the Business Management Information System (BMIS).

- Conduct self-assessments to measure organizational performance using the National Performance Excellence Standard and the Malcolm Baldridge Criteria. Evaluate results, measure trends, and recommend organizational improvements to DOE leadership.

OBJECTIVE CM3

Manage financial resources and physical assets to ensure public confidence.

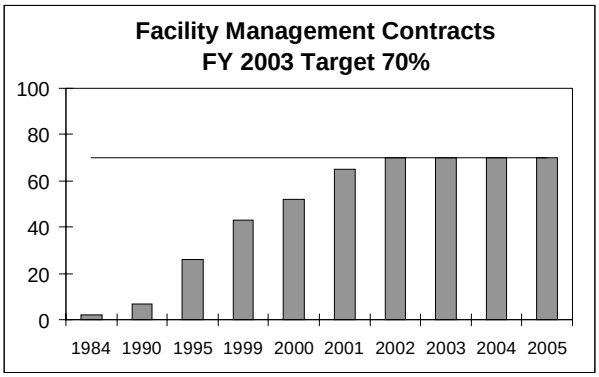
Introduction

In the areas of financial, contractual, project, and assets/materials management, DOE must provide services to internal customers in a manner that assures the public of the Department's integrity. The following performance measures are in accordance with recent legislation including the Chief Financial Officers Act of 1990, the Federal Financial Management Improvement Act of 1996, the Federal Acquisition Reform Act of 1996, and the Small Business Act and the Small Business Investment Act of 1958 as amended.

The Objective's Measures

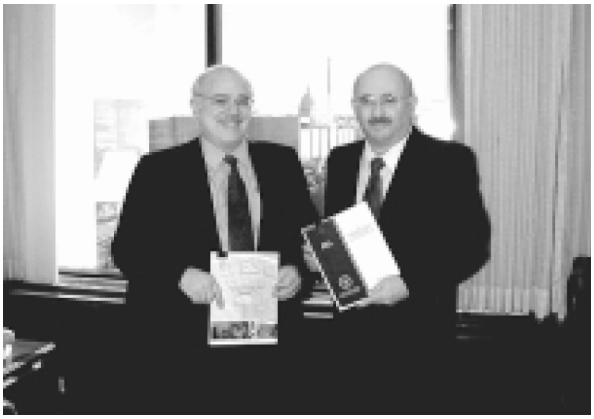
DOE has established the following performance measures. These measures provide the basis by which the Department will know that it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department.

- Achieve 70 percent of facility-management contracts (including management and operating contracts) being competitive awards by 2003. [We believe that 70 percent is a performance ceiling due to exemptions from competition that exist for important and urgent national security requirements and for long-term research activities at DOE Federally-funded research and development centers (FFRDCs)].



- Achieve 80 percent of support-service contracts being performance-based by 2003. (There are contracts with routine tasks where performance is important but not a key factor.)

- Publish by March of each year an annual accountability report that includes the Department-wide audited financial statement which has an unqualified audit opinion.



The Inspector General Gregory Friedman (right) congratulates Chief Financial Officer Michael Telson on the successful completion of the *DOE FY 1999 Accountability Report* and for earning a clean audit opinion of the Department's financial statements.

- Ensure equitable opportunities for minority educational institutions and small, minority, and women-owned businesses to compete for grants and contracts. (Targets are being negotiated and will be finalized after the publication of the Strategic Plan. They will be included in annual performance plan.)

- Plan, program, budget, and execute DOE's projects on schedule and at budget. (Targets are being included in draft DOE Order 413.X. Upon issuance of this order, targets will be included in annual performance plans.)

The Objective's Strategies

The following strategies describethe way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

- Make greater use of competition in the award of new Facilities Management contracts.

- Use the Federal Acquisition Regulation to award new support-services contracts as performance-based contracts in conformance with Federal contract-reform efforts.

- Establish policy, provide guidance, and coordinate Departmental efforts for reporting performance results, FMFIA results, audit resolution results, management representation letters, financial statements, and other financial data.

- Report through periodic reviews on progress toward stated goals to award grants and contracts to minority educational institutions and small, minority, and women-owned businesses.

- Establish a strong corporate capability in the CFO for policy and oversight of project management. For example,

  - Establish project management tracking and control systems.
  - Strengthen line management accountability for project management results.
  - Revise the criteria and processes for project funding decisions.
  - Implement a program to develop and credential program/project managers.

- Implement a crosscutting initiative on nuclear materials stewardship, in order to ensure that the life-cycle management of nuclear materials is safe, environmentally sound, efficient, cost-effective, and transparent (to meet nonproliferation objectives).

- Improve the quality, timeliness, and content of communications concerning the Department's functions and activities.

OBJECTIVE CM4

Manage information technology systems and infrastructure to improve the Department's efficiency and effectiveness.

Introduction

The Office of Chief Information Officer (CIO) meets DOE's responsibilities for management of information technology (IT), as required by the Clinger-Cohen Act of 1996. The policies and management provided by this office extend to the entire DOE complex. While the majority of funding for IT resides in the Department's program elements, the CIO is directed to justify the Department's IT investment and lead in the development of corporate solutions to Departmental problems. The CIO reports to the Deputy Secretary of Energy.

The Objective's Measures

DOE has established the following performance measures. These measures provide the basis by which the Department will know that it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department.

- Ensure economical and effective management of information resources to support DOE missions and objectives.
- Make effective use of commercial applications and solutions for DOE's enterprise-wide IT infrastructure; link IT investments to DOE strategic goals and the needs of business operations; minimize the number of redundant and duplicative systems; and improve enterprise-wide data sharing.

The Objective's Strategies

The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

- Implement the CIO's draft IT capital planning and investment management policy to ensure DOE-wide consistency and uniformity in addressing Clinger-Cohen Act requirements as well as Office of Management and Budget (OMB) and General Accounting Office (GAO) guidance.
- Maintain IT investments using a Department-wide comprehensive capital planning process. Establish IT-investment review boards composed of senior program managers.
- Continue the DOE Strategic Information Management (SIM) Program to ensure alignment of major IT investments with DOE business line goals and objectives.
- Implement an Information Architecture that provides a basis and framework for corporate IT initiatives.
- Establish standards and policy that will leverage commercial technology and common solutions.
- Establish common telecommunications and desktop solutions that will reduce costs, improve interoperability, and increase efficiency.

OBJECTIVE CM5

Use appropriate oversight systems to promote the efficient, effective, and economical operation of the Department of Energy.

Introduction

DOE has adopted performance-based management with its implied use of self-assessment for managing the Department and its activities. However, there is still a need and a statutory requirement for independent oversight, which is provided by the Office of the Inspector General (OIG). Independent oversight is also provided by other Departmental offices at a sub-strategic level.

The Objective's Measures

DOE has established the following performance measures. These measures provide the basis by which the Department will know that it has achieved the objective, or is making progress toward it. These measures will be translated into annual targets for performance plans and budgets for the Department.

- Complete the required annual financial statement audits by dates designated in the law.
- Complete at least 60 percent of the audits planned for each year and replace those not already started with more significant audits that identify time-sensitive issues in need of review.
- Initiate at least 70 percent of inspections planned for the year and replace those not already started with inspections that have greater potential impact.
- Obtain judicial or administrative action on at least 35 percent of cases investigated during the fiscal year.
- Obtain at least 75 percent acceptance rate on criminal and civil cases formally presented for prosecutorial consideration.

The Objective's Strategies

The following strategies describe the way in which the Department will work toward achieving this objective. These activities will be translated into annual budgets and performance plans for the Department.

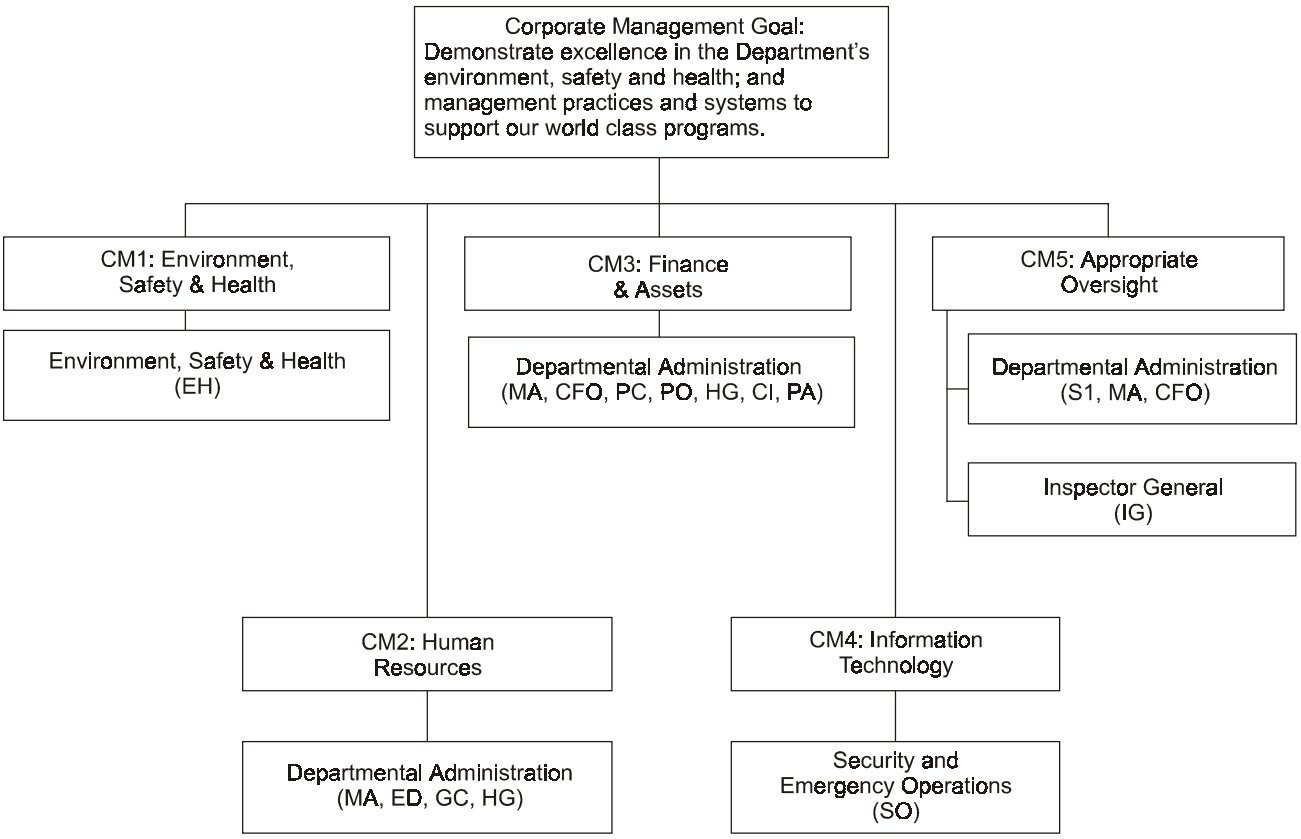
- Complete required financial audits by dates designated in the law.
- Utilize OIG staff to address emerging issues by responding to Departmental priority requests, answering Congressional inquiries, conducting joint reviews with other Federal agencies, testifying before Congress, and assisting the Justice Department in qui tam cases.
- Evaluate the results of the Department's use of performance measures to monitor programs and operations.

- Plan the OIG audit, investigation, and inspection workloads by focusing on the issues that are critical. These plans are documented each year in the OIG Annual Performance Plan. Examples of the most critical issues are:

  - Intelligence/Counterintelligence,
  - Safeguards and Security,
  - Contract/Grant Administration,
  - Program Management and Operations,
  - Environment, Safety, and Health,
  - Infrastructure,
  - Financial Management,
  - Administrative Safeguards, and
  - Information Technology Management.

Linkage to Budget Structure

The Corporate Management goal is supported by five objectives. Each objective is being pursued through long-term strategies. DOE's budget Decision Units fund work on those long-term strategies. The annual performance measures are discussed with the Decision Units in the Annual Performance Plan, which is submitted with the budget for each fiscal year. The following chart shows the relationship between Decision Units and objectives.



DOE'S STRATEGIC PLANNING

DOE's Strategic Planning Process

Improving Performance and Providing Results

During the last decade, Congress and the Administration passed several laws and undertook initiatives to reform management throughout the government. The Government Performance and Results Act (GPRA) of 1993, the Chief Financial Officers Act of 1990, the Government Management Reform Act of 1994 (GMRA), the Federal Acquisition Streamlining Act of 1994, and the Information Technology Management Reform Act of 1996 all focus on improving the way agencies performed their mission and providing increased accountability for taxpayer-funded programs.

DOE's first Strategic Plan was published in April 1994, three and a half years before GPRA required such a plan. That plan identified the four business lines of the Department. Business lines provide the means by which we integrate the Department's activities and by which we plan to utilize effectively our unique scientific and technological assets, engineering expertise, and facilities. The second DOE Strategic Plan, September 1997, was the first that we published under GPRA. In developing that plan, we consulted with Congress as well as program stakeholders.

This plan, our third, builds on our previous plans and upon recent efforts to update and improve our strategies. For example, it benefits from the *Comprehensive National Energy Strategy* and the Environmental Quality plan *Accelerating Cleanup: Paths to Closure*. Also, compared to prior plans, our goals and objectives are greatly improved. They are more quantified, more achievable, and we can measure progress much better.

The DOE Strategic Plan influences all performance planning for the Department. This plan sets the general goals, objectives, measures, and strategies that will be implemented through the Annual Performance Plan, the budget, and the Annual Performance Agreement between the Secretary and the President.

Integrating Planning into Decision-Making

DOE is committed to performance-based management as the approach to manage the Department and its activities. In performance-based management, goals are established through consensus. Self-assessment is the primary tool for assessing and evaluating performance, and measurable results are used as we review our performance improvements and make decisions on the allocation of resources. In this way, the Department uses performance-based management as its tool to:

- Plan for, manage, evaluate, and reward performance by organizations, employees, and contractors;
- Improve the delivery of products and services and facilitate communications with customers and stakeholders;
- Encourage employees and contractors to achieve excellence; and
- Guide decision-making.

Performance-based management reinforces and formalizes the Department's Strategic Management System.

The Department also recognizes that no management approach can anticipate all potential situations. In addition, we accept that because we are stewards of public funds and work for the American taxpayers, how we do our work is often as important as the end-results of our work. Therefore, DOE's performance-based management approach includes the necessary flexibility and mechanisms to ensure effective stewardship of public funds and accountability to the American taxpayer.

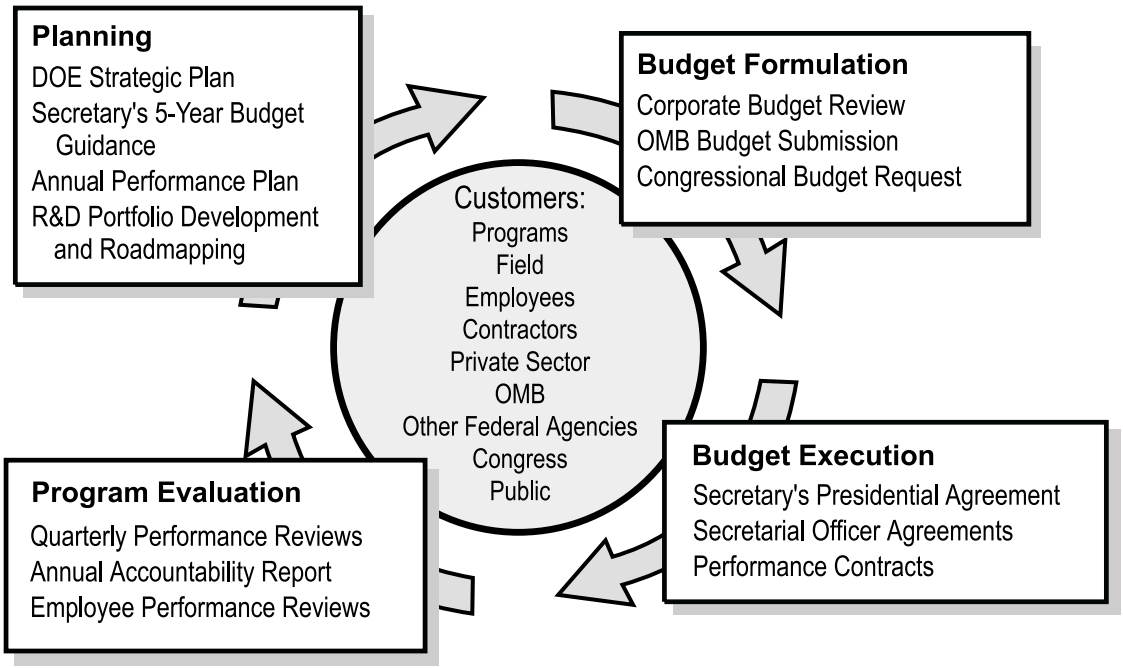
DOE's Strategic Management System

To meet new challenges, the Department had to significantly improve its management processes. In March 1996, DOE developed and implemented a corporate Strategic Management System for the FY 1998 and outyear budget cycles. The system combines the processes for strategic planning, budgeting, and program evaluation that had previously not been well integrated within the Department. It provides the framework to satisfy the financial and management requirements set by the Government Performance and Results Act, the National Partnership for Reinventing Government, and other legislation. The key processes and products that form the framework of DOE's Strategic Management System are graphically portrayed in the figure below.

Performance, as indicated by measurable results, is the basis of the Strategic Management System. Consistent measures are used throughout the processes of planning, budget formulation, budget execution, and program evaluation. Thus, performance means much more than just accomplishing activities. It means measurable progress toward delivering desired outcomes and results to customers.

In plans, performance is defined in terms of measurable results. In budget formulation and execution, resources are allocated and expended to deliver measurable products and services. In evaluation, success is based upon the

Elements of the Strategic Management System Framework



measurement and analysis of what is actually delivered. This concept of performance is now used by all of the Department's organizational levels, i.e., from the DOE Corporate level down to the contractor level. Ultimately, the measurement of performance allows the Department to ensure consistency between the Department's long-term vision and the day-to-day activities of individual Federal and contractor employees.

Performance Starts with Strategic Planning

The Department uses its Strategic Management System to manage the execution of its programs from planning through program evaluation. Strategic planning is an integral first step in the process. The Strategic Plan is the basis for all lower-level planning within the Department. It sets the long-term directions and policies to be carried out by DOE's programs and field organizations. In all of the Department's activities, performance is measured against the general goals, objectives, and measures set out in this Plan.

General goals are long-term and outcome-oriented. They are stated in a manner that allows in the future an assessment of progress, i.e., whether the goals were, or are being, achieved. Because the goals are measurable and quantifiable, the Department can assess its progress in pursuit of the goals over the duration of the Plan.

Objectives define major accomplishments that contribute to achieving the general goal. Objectives are measurable, achievable, and reasonable targets with deadlines. By reasonable we mean that within credible planning assumptions, a DOE program should be able to achieve the objective, and that the objective is meaningful at the national level.

Measures expand on the stated objectives. They specify the basis by which DOE will ascertain that it is making progress toward achieving this objective. Measures define key program events on the way to meeting the objective. They describe precisely what will be measured, as well as the expected time for performing key events. In this sense, we say that the measures establish a baseline for a given program. If direct measurement is difficult, other performance indicators will be used.

Strategies are the activities that support an objective. In most cases, strategies are the activities executed using the funds appropriated by Congress. Although they may not always be stated in outcome-oriented terms, the strategies are essential to accomplishing objectives.

Relationship Between the Strategic Plan, the Annual Performance Plan, and the Budget

GPRA requires that we describe the way in which the performance goals in the Annual Performance Plan relate to the general goals and objectives in the Strategic Plan. The Department attempts to establish a close relationship between these two sets of goals and we believe that consistency between the two sets of goals is essential if we are to establish a clear logic for managing our programs. By requiring us to integrate program budgets with plans, GPRA is fostering better decision-making within the Department and helping us to communicate more effectively the outputs and outcomes that the taxpayers are getting from their investment in DOE.

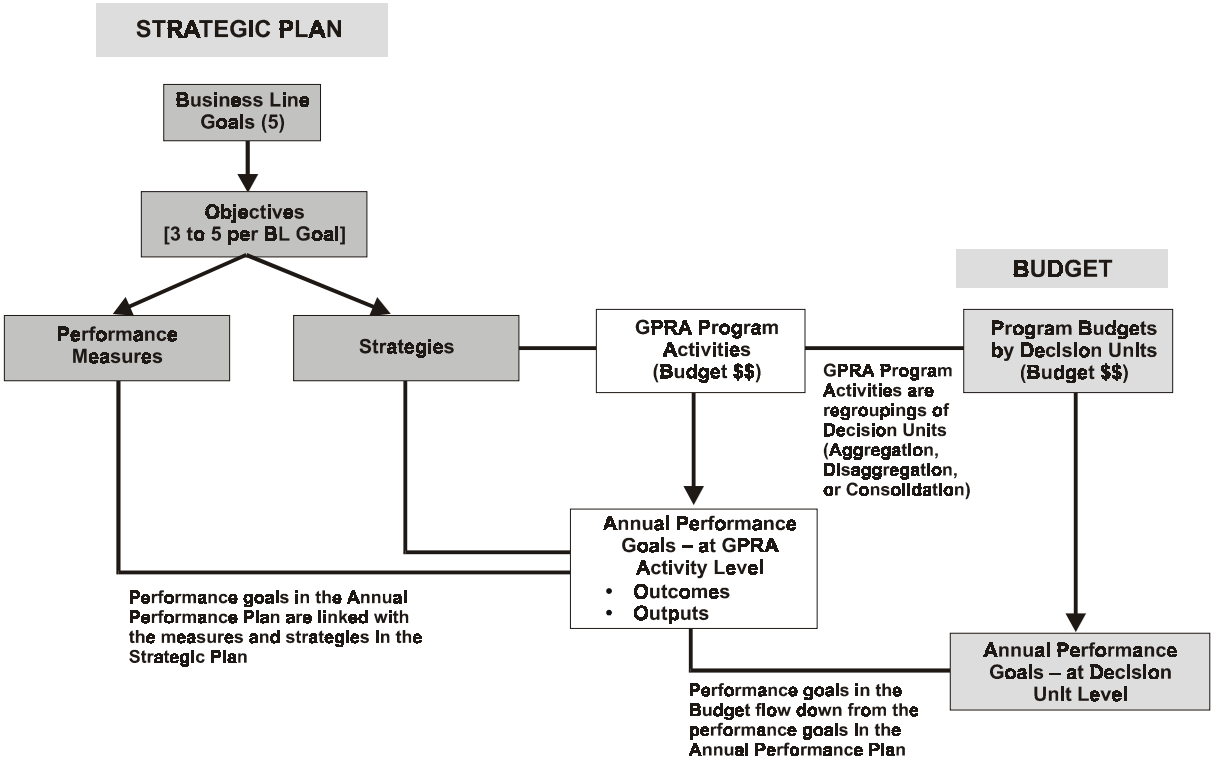
The Department has been executing Annual Performance Agreements between the Secretary and the President since FY 1995. These agreements are now subtitled "Revised Annual Performance Plans" and are directly linked with the Department's Strategic Plan. The

linkage between plans and the budget was originally achieved by using cross-reference tables. As shown by the figure, starting with the FY 2001 Annual Performance Plan, the connection between the two is achieved by organizing annual performance goals under budget "Decision Units." These are GPRA program activities, which are aggregations, dis-aggregations, or consolidations of activities in the Program and Financing Accounts (P&F) in the President's budget. Through the use of Decision Units, DOE integrates performance, budget, and strategic planning in a consistent manner.

This Strategic Plan goes one step further in establishing the connection among goals. In developing this Plan, our intent has been to make measures for the objectives "outcome-oriented," and make the strategies tie directly to the Decision Units (GPRA program activities). This approach will ultimately help us to achieve full integration and clear linkage between plans and program accounts. We recognize, however, that significant work remains to more clearly articulate these measures and strategies. Finally, we will establish in the Annual Performance Plan annual targets for the performance measures contained in the Strategic Plan, as well as "output" measures to show progress on the strategies.

Performance Agreements

For each year, after Congress appropriates funds, the Annual Performance Plans are formalized in the Performance Agreements between the Secretary and President. The Agreement includes adjustments to the annual measures based on actual appropriations. Although not required by GPRA, OMB allows revision of the "final" annual measures in Circular A-11. The Agreement documents the impact of budget adjustments to the Plan, which facilitates the



Relationship Between Strategic Plan, Annual Performance Plan and Budget

reporting of updated results. DOE managers attest by signature on the Agreement their pledges to produce results. Our mid-year review reinforces our focus on performance and provides an intermediate appraisal of status.

Reporting on Performance

DOE's *FY 1995 Annual Performance Report* was the first "condensed" report. It documented our performance in 61 pages of text as compared to the 500-page reports of prior years. At the end of FY 1996, we combined the performance report with the annual financial statements required by the Government Management Reform Act of 1994 (GMRA), to satisfy the requirement to report on the results of funded activities. The financial statements for FY 1996 also served as the annual report and received a "clean opinion" from DOE's Inspector General. For FY 1997, we again received a "clean opinion."

For FY 1998, we implemented OMB's recommendation and prepared an "Accountability Report" that covered the annual reporting requirements of several laws. With one exception, the Inspector General determined that our financial statements presented fairly the Department's financial position. The exception was in the estimate of the environmental liabilities which resulted in a "qualified opinion." In FY 1999, the previous year's issues were resolved and the Department received a "clean opinion" from the Inspector General.

The *FY 1999 Accountability Report* was also the first performance report required by GPRA. Reviews by DOE's Inspector General, the GAO, and our self-assessment highlighted areas where we need to improve. Through analysis of actual performance and its relationship to the desired outcomes, we have worked to improve the process in subsequent planning cycles. As indicated above, the goals and objectives for our third Strategic Plan are more quantified and achievable.

The Federal Energy Management Program (FEMP) provides an example of the effective use of performance measures on programs. The key measure for FEMP is to reduce energy use per square foot of building space. The Energy Policy Act of 1992 (EPAct) set the goal at 20-percent savings as compared to the 1985 baseline by the year 2000. Through FEMP's efforts, the government achieved the 20-percent goal. When the President set even higher goals for the next 10 years, FEMP's budget was increased by 23 percent for FY 2001 in recognition of their past successes and to adjust for the greater difficulty of achieving the next level of savings.

Role of Program Evaluation

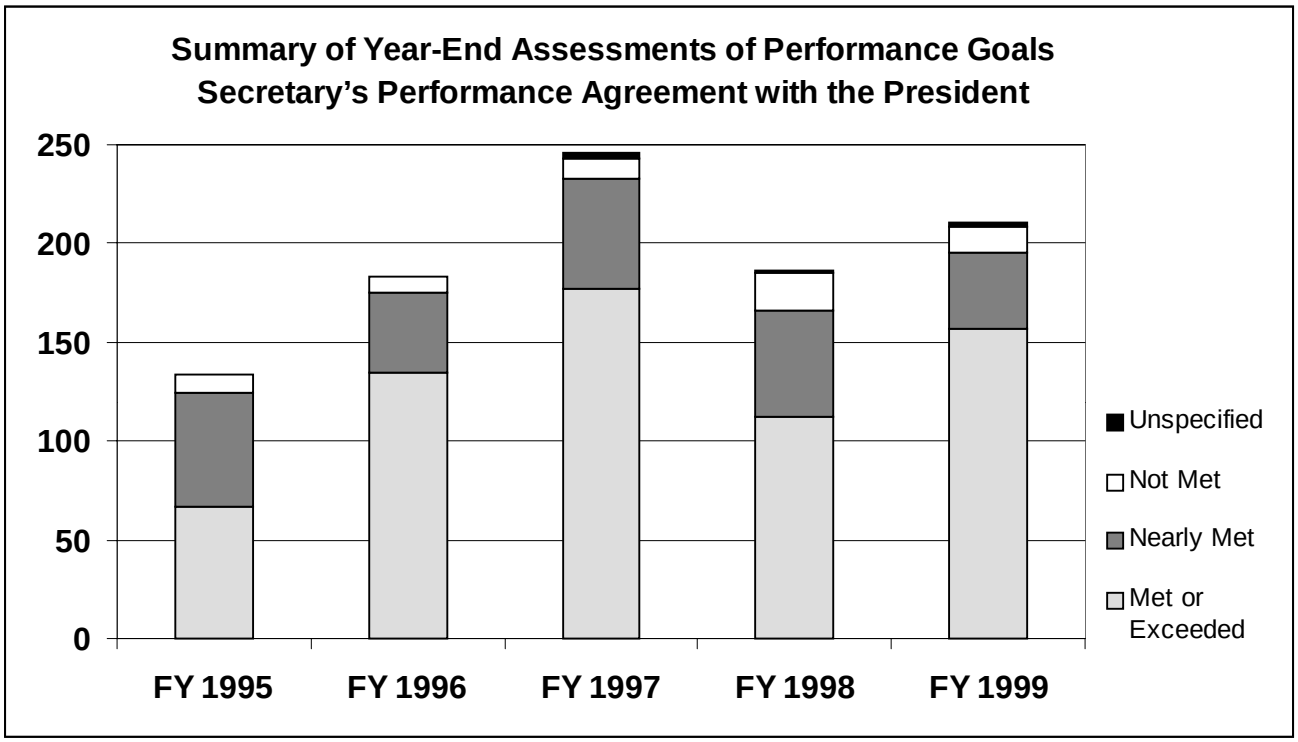
GPRA defines program evaluation as "*an assessment, through objective measurement and systematic analysis, of the manner and extent to which Federal programs achieve intended objectives*." The law requires agencies to describe in their strategic plans the program evaluations used to establish or revise general goals and objectives, together with a schedule for future program evaluations. In this Plan, we have discussed the major program evaluation efforts that have informed the development of our general goals and objectives within each business line. This section provides a more comprehensive description of the Department's processes to evaluate programs. Program evaluation, as defined above covers a broad range of evaluative activities. We group these evaluations into three major categories:

(1) *Measurement of progress against quantitative, results-oriented, performance goals over time:* The Department has developed Annual Performance Agreements between the Secretary and the President each year since FY 1995. The performance goals in these agreements represent our most significant outputs and outcomes for the fiscal year. We track the results toward the goals during the year

and report them once at mid-year and then at the end of year. We make these results publicly available on the World-Wide-Web. The chart below shows a summary of year-end assessments for FY 1995 - FY 1999.

(2) *Reviews and Evaluations: Multi-discipline reviews, cross-program reviews, and management reviews to evaluate whether the programs and organizations are properly focused and are achieving their intended results:* The major evaluations within each business line that the Department has conducted since the publication of the previous Strategic Plan are in the following tables. Through these evaluations, the Department is able to re-assess its programs and reorient them or apply additional resources in order to ensure that they achieve their intended objectives.

(3) *Project reviews to ensure that activities are on schedule and that they will achieve their objectives within the level of resources allocated to the projects:* The Department has conducted external independent reviews and internal independent reviews of nearly all projects involving the acquisition of capital assets or the environmental restoration of DOE facilities over the past two years. The purpose of these reviews was to determine if the scope, underlying assumptions, cost and schedule baselines, and contingency provisions were valid and credible within the budgetary and administrative constraints. There are many outstanding examples of first-rate facilities—completed or under construction—that have met, or are meeting their project objectives, on schedule, and within budget. However, the reviews also revealed that some of our projects have been poorly managed. In FY 1999, to correct these deficiencies, the Deputy Secretary instituted a Project Management Reform Initiative and established a strong corporate organization to strengthen the management of projects. The Department has developed an action plan geared to both the Deputy Secretary's initiative and to address findings in the National Research Council's 1999 report entitled, *Improving Project Management in DOE*. This plan is being aggressively implemented. The steps being taken include:



Program Evaluations through Multi-Discipline Reviews, Cross-Program Reviews, and Management Reviews

Title and Purpose	Date
Energy Resources:	
Technology Opportunities to Reduce U.S. Greenhouse Gas Emissions: Prepared by the National Laboratory Directors for the U.S. Department of Energy. This document was compiled by 11 National Laboratories and represents a peer-reviewed consensus evaluation of technology pathways to reduce greenhouse gas emissions with sustained economic growth. Forty-seven technology pathways are described that have significant potential to reduce CO_2 emissions. The technologies span three broad areas: energy efficiency, clean energy, and carbon sequestration.	Oct. 1997
Federal Energy R&D for the Challenges of the 21st Century: A review, by the President's Committee of Advisors on Science and Technology (PCAST), of the national energy R&D portfolio with recommendations on how to ensure that the United States has a program that addresses its energy and environmental needs for the 21st century.	Nov. 1997
Comprehensive National Energy Strategy: Pursuant to Section 801 of the Department of Energy Organization Act, the *Comprehensive National Energy Strategy* documents the Nation's energy policy; it was developed through active public participation.	Apr. 1998
Powerful Partnerships: The Federal Role in International Cooperation and Energy Innovation: A PCAST review of the potential benefits of various types of energy-related cooperation with other countries, with recommendations for an aggressive U.S. initiative to strengthen cooperation.	Jun. 1999
Energy Research and Development Portfolio: Volume 1 of a 4 volume R&D Portfolio provides an analysis of the complete set of R&D investments supporting Energy Resources.	Feb. 2000
Powering the New Economy: The report summarizes DOE's accomplishments, R&D programs, and ongoing energy challenges.	Sep. 2000
Scenarios of U.S. Carbon Reductions: A peer-reviewed study conducted by an inter-laboratory working group, documents how the four key energy sectors—buildings, transportation, industry, and electric utilities—could respond to directed programs and policies to expand adoption of energy-efficiency and low-carbon technologies.	Sep. 2000

Program Evaluations through Multi-Discipline Reviews, Cross-Program Reviews, and Management Reviews

Title and Purpose	Date
National Nuclear Security:	
Maintaining United States Nuclear Weapons Expertise (Chiles Commission): A report that offered 12 recomendations for the recruitment and retention of scientific, engineering, and technical personnel for the Stockpile Stewardship Program.	Mar. 1999
"30-Day Review": A comprehensive internal review of the Stockpile Stewardship Program.	Nov. 1999
DOE Research and Technology Against the Threat of Weapons of Mass Destruction: Review of the Department of Energy Office of Nonproliferation Research and Engineering (NN-20): A comprehensive review of R&D programs by the Nonproliferation and National Security Advisory Committee.	Feb. 2000
National Security Research and Development Portfolio: Volume 3 of a 4 volume R&D Portfolio provides an analysis of the complete set of R&D investments supporting National Security.	Feb. 2000
A Strategic Approach to Integrating Long-Term Management of Nuclear Materials: A consolidated account to Congress and the public of DOE's unclassified inventory of nuclear materials and a description of how and where they are managed. Includes an examination of opportunities for greater integration, and a description of next steps toward realizing those opportunities.	Jun. 2000
The Stockpile Stewardship Plan: Documents the result of a corporate-level, program review required by the National Defense Authorization Act for FY 1998 multi-year (PL 105-85).	Jun. 2000
Environmental Quality:	
Accelerating Cleanup: Paths to Closure: A site-by-site, project-by-project projection of the technical scope, cost, and schedule required to complete all 353 projects at DOE's 53 remaining cleanup sites in the United States.	Jun. 1998
Environmental Quality Research and Development Portfolio: Volume 2 of a 4 volume R&D Portfolio provides an analysis of the complete set of R&D investments supporting Environmental Quality activities.	Feb. 2000
Status Report on Paths to Closure: Updates the June 1998, *Accelerating Cleanup: Paths to Closure* study and introduces additional analyses that offer new insights into the long-term scope of the Environmental Management program.	Mar. 2000

Program Evaluations through Multi-Discipline Reviews, Cross-Program Reviews, and Management Reviews

Title and Purpose	Date
Science:	
Planning for the Future of High Energy Physics: A subpanel report of the High Energy Physics Advisory Panel on future opportunities, needs, and directions for the field.	Feb. 1998
Human Genome Project Five-Year Plan (1999-2003): Developed during a series of DOE and National Institutes of Health workshops and advisory committee meetings, and reviewed by DOE's Biological and Environmental Research Committee, a collaborative five-year plan addressing the research needs, required actions, and national and international coordination needed to complete the sequencing of the human DNA by 2003.	Oct. 1998
Office of Science Strategic Plan: The Department held two workshops, as part of a long-range planning process to define the goals, objectives, strategies, and the portfolio of research that DOE sponsors.	Jun. 1999
Complex Systems - Science for the 21st Century: addresses the broader issues, opportunities and plans for the science behind fundamental complex structures, how they interact to create new phenomena and assemble themselves into devices, and how they can be designed atom by atom for desired characteristics.	Aug. 1999
Nanoscale Science, Engineering, and Technology Research Directions: A study conducted in preparation for the national, interagency research initiative in nanotechnology, the report describes important research directions based on new tools, new understanding, and a developing convergence of the disciplines of physics, chemistry, materials science, and biology.	Sep. 1999
Priorities and Balance Within the Fusion Energy Sciences Program: A review and evaluation of the balance, priorities, and long-range goals within the research program, prepared by the Fusion Energy Sciences Advisory Committee.	Sep. 1999
Science Research and Development Portfolio: Volume 4 of a 4 volume R&D Portfolio provides an analysis of the complete set of science activities organized around twelve major challenges.	Feb. 2000
Scientific Discovery through Computing: A plan submitted to the U.S. Congress addressing the broad-based computational needs of the DOE scientific community and corresponding future directions in DOE advanced computational modeling and simulation.	Mar. 2000

- Creating a corporate project performance and corrective action tracking system.
- Subjecting projects with significant problems to more stringent reporting requirements and controls by placing them on the Chief Operating Officer's "Watch List."
- Strengthening DOE line management authority and accountability for project execution and performance.
- Strengthening contractor measures and incentives for project execution and performance.
- Establishing a project management oversight capability within the offices of all Lead Program Secretarial Officers.
- Creating a DOE Management Development Program for program and project managers.
- Improving project management through the implementation of best practices in project planning, funding, control, and reporting.

Management Challenges for the Department

The Department strives to continually improve its management processes and to become a more efficient and effective organization. Toward this end, we have established objectives and performance goals in all aspects of management. In a large organization with diverse missions, there are always specific areas that need special management focus. To identify areas that need attention, the Department has instituted an annual self-assessment process pursuant to the Federal Manager's Financial Integrity Act (FMFIA). In addition, we get critical insight into specific problem areas through independent evaluations by the Department's Inspector General, as well as through the studies undertaken by the General Accounting Office.

DOE has taken a proactive approach to dealing with management challenges. These challenges—and the actions we are taking to address them—are being integrated into our GPRA planning process. The following table provides a list of the management challenges that we are currently addressing, as well as those where we have already taken corrective actions. Where we have instituted corrective actions, we establish additional, specific performance goals and track them closely until there is substantial improvement in performance.

DOE Management Challenges	Strategic Plan Business Line and Objectives
Surplus Fissile Material	NS4
Environmental Compliance	EQ1
Nuclear Waste Disposal	EQ1, EQ2
Safety and Health	CM1
Project Management	CM3
Security	NS6
Mission Critical Staffing	NS3, SC4, CM2
Permitting Issues at the Waste Isolation Pilot Plant	EQ1
Contract Management	CM3
Inadequate Audit Coverage	CM5
Slow Transition to External Regulation	See Below
Organizational Structure Blurs Accountability	CM3
Staff Lacks Technical and Management Skills	CM2
DOE Infrastructure	See Below
Management of Export-Controlled Assets	See Below

External Regulation

The Department has examined the issues associated with shifting some of its facilities exclusively to external regulation. On February 19, 1999, the Secretary, via a letter to the House Science and other committees, advised that ".... Our analysis to date indicates that many potential benefits ... have not been demonstrated," and that "Consequently, we have determined that submittal of legislation to exempt certain facilities from Departmental regulations is premature." The Secretary promised that the Department will ".... complete our work with NRC, OSHA, and the States...[and]... evaluate whether the substantial funds required to prepare DOE facilities for a shift to external regulation would be better spent on achieving the Department's cleanup mission goals." The reports of the pilots (i.e., pilot studies of implementing of external regulation) have been delivered to the Congress as promised. The Secretary also promised that the Department would take immediate steps to "... redouble its efforts to provide a safe and healthy workplace ...." Those efforts are currently underway. All actions on this recommendation are complete, and Congress no longer contemplates external regulation of the Department's facilities.

DOE Infrastructure

For many years, the Department has lacked processes to ensure its infrastructure is adequately maintained. As a result, due to decades of deferred maintenance and upgrades, much of the Department's infrastructure is in poor condition. Unsafe conditions, lost-time delays, and more frequent and costly maintenance have resulted from deferring maintenance at our aging facilities.

To improve the condition of its infrastructure, the Department implemented a long-range strategy that strengthens the process for managing capital

assets, including the acquisition, maintenance, modernization, and/or eventual disposal of infrastructure. In addition, a Functional Cost Reporting System, which includes maintenance data has been deployed. It provides information on infrastructure upgrade requirements. We will seek to further enhance the available financial information in the Department's new Business Management Information System, which is now under development. We believe the processes now in place are adequate to maintain our infrastructure.

Export-Controlled Assets

In the past, there has been inadequate control over government personal property by the Department's management and operating contractors at some DOE facilities. This deficiency primarily involved inventory control and reporting. Problems resulted from inadequate policies and procedures, together with a lack of adequate attention by contractors to systems for managing personal property. To remedy this situation, Departmental policies were strengthened to increase emphasis on property management by DOE and contractor employees, to ensure extensive coverage of high-risk property, and to address critical problems identified by audits and investigations. During the period 1995 to 1999, third-party oversight confirmed that DOE's performance improved in the area of inventory management. However, in the last year, two incidents have occurred that suggest DOE may need to initiate additional safeguards to protect export-controlled property. In both cases, comprehensive analyses of root causes uncovered how and why existing procedures were not followed and identified new actions that are needed to prevent similar future security incidents.

Consultations on this Strategic Plan

The Department initiated public consultation on the draft of this Strategic Plan with a press release on February 24, 2000. The DOE Homepage and other public forums were also used to notify the public of the draft Plan, which was posted at a web site together with a comment center. March 31, 2000 was set as the due date for comments but was extended until April 10, 2000. In addition, copies of the draft were circulated to the Office of Management and Budget (OMB), Congress, and other Federal agencies for coordination with their planning processes.

On April 4, 2000, we met with staff representing several Congressional committees, including the House Science Committee, Senate Government Affairs Committee, House Commerce Committee, and Committee on Government Reform. On April 18, 2000, we consulted with the Office of Management and Budget. On April 28, 2000, we met with the staff of the Senate Committee on Energy and Natural Resources. Comments from Congress were received from F. James Sensenbrenner, Jr., Chairman of the House Science Committee, in a letter dated July 13, 2000. All comments were considered and incorporated into the plan as appropriate.

The Department received considerable response to the draft plan from the public. There were over 2,500 visitors to the web site. Several hundred of the visitors were citizens who would otherwise not have access to the Department's plans during the consultation process. We received approximately 500 comments from interested parties including citizens, other Federal agencies, energy industry representatives, educators, and DOE Federal and contractor employees. We also benefitted from the efforts of the Council for Excellence in Government, which reviewed our draft Plan.

Other significant consultations take place continuously in support of ongoing planning activities including those that led up to development of this Strategic Plan. The general public and/or stakeholders provided input during the preparation of the *Comprehensive National Energy Strategy*, *Accelerating Cleanup: Paths to Closure*, DOE's *FY 2000 Stockpile Stewardship Plan*, the *Office of Science's Strategic Plan*, and the DOE Research and Development Portfolios. These and similar consultations inform our strategic planning.

Implementation of the Nuclear Waste Policy Act is an example of DOE's thorough commitment to public consultation. Through formal and informal processes, DOE interacts frequently with Federal regulatory agencies, the Congress, the State of Nevada, affected units of local government, and diverse program stakeholders such as environmental groups, technical and professional organizations, policy groups, electric utilities, and Tribal Nations. Each program milestone presents opportunities for public participation and consultation, and many key program actions continue to be subject to the formal public comment process.

In addition, the Department works with the Defense Nuclear Facilities Safety Board (DNFSB) to implement its recommendations regarding public and worker health and safety at the Department's defense nuclear facilities. The Department also solicits advice and guidance from the Environmental Management Advisory Board (EMAB) on a wide variety of topics related to the Environmental Management Program. The EMAB's membership consists of State and local government representatives, technical experts, and stakeholders. Furthermore, the Department solicits advice from Site Specific Advisory Boards that have been established for 11 sites. The Boards provide consensus advice and recommendations to the Department's environmental restoration and waste management activities.

Interagency Crosscutting Coordination

In many instances, the Department achieves its goals and objectives by relying alone on our unique capabilities and program activities. In other cases, our success depends on ongoing relationships with a number of Federal agencies, State and local governments, Tribal Nations, private industry, and Congress. We recognize that crosscutting government responsibilities such as national security and multi-agency programs in areas such as global climate change, medical research, and science education draw upon the expertise and capabilities of many agencies to achieve common goals. For such efforts, the challenge for each agency is to define its role and to develop programs that best use its unique financial, human, and technical resources to optimize overall government performance. See Appendix A for a detailed list of DOE's interagency crosscutting coordination activities.

The Office of Management and Budget (OMB) and the White House Office of Science and Technology Policy play an important leadership role in coordinating science and R&D efforts. The National Security Council coordinates national security policy covering nuclear weapons, arms control, and nonproliferation issues.

DOE is committed to continue working closely with other Federal agencies and with OMB and Congress to affect interagency crosscutting coordination. The following examples illustrate our efforts to coordinate with other agencies to avoid duplication of effort and reduce the cost to taxpayers.

For nonproliferation and arms control programs, the National Security Council coordinates policy. The State Department is the lead agency for all U.S. policy matters dealing with other countries. The Department of Energy provides technical support for treaty negotiation, verification, and

compliance, as well as technical capabilities for detecting the proliferation of weapons of mass destruction.

The Partnership for a New Generation of Vehicles was launched in September 1993. It is a partnership between the Federal government and the United States Council for Automotive Research—a cooperative research effort among Daimler-Chrysler Corporation, Ford Motor Company, and General Motors. The lead Federal agencies include the Departments of Energy, Commerce, Transportation, and Defense. The Environmental Protection Agency, the National Aeronautics and Space Administration, and the National Science Foundation also contribute. The Operational Steering Group and the Technical Task Force, consisting of senior representatives and technical staff of the partners, set the research objectives and identify special projects and priorities, respectively.

In addition to cost-sharing, the partnership offers many precedent-setting opportunities to combine and build upon complementary technologies that have been developed separately for other purposes. As examples, DoD has extensive expertise in the area of advanced materials (developed originally for high-tech weapons programs); NASA has state-of-the-art expertise in systems integration (developed through work on the space shuttle); and DOE offers advanced technologies in materials, alternative fuels and propulsion systems areas (developed through decades of cutting-edge R&D work).

APPENDIX A: Interagency Crosscutting Activities

As shown on the following table, DOE has many projects in each of its business lines that involve the participation of other Federal agencies.

DOE Business Line/Project	***Federal Agency Participants***
Energy Resources	
Objective ER1: Fuel Supplies	
Transfer of Naval Oil Shale Reserves	DOI (Bureau of Land Management)
Use of Federal Royalty Oil To Re-fill Strategic Petroleum Reserve	DOI OMB, CEQ, DOI, Treasury, White House
Interagency Work Group on Oil and Gas	National Economic Council, EPA, USDA
Energy Production from Federal lands	DOI, EPA
Federal Energy Regulation	DOI, EPA, Corps of Engineers
Power Marketing Administrations/Hydroelectric	FERC, DOI (Bureau of Land Management, Bureau of Reclamation), Army Corps of Engineers, International Boundary and Water Commission
National Water Resource Needs	Army Corps of Engineers
Emergency Response	DoD, State, DOT, GSA, TVA, HHS, VA, NOAA, DOJ, USDA, EPA, NRC, FEMA, IAEA, National Communication System
Domestic Natural Gas Production	DOI (Bureau of Land Management)
President's Commission on Critical Infrastructure Protection	Treasury, DOJ, DoD, DOC, DOT, CIA, FEMA, FBI, NSA
Objective ER2: Transformation into Electricity	
Advanced Turbine Systems	NASA, DOC (NIST), DoD, EPA
Electric Industry Restructuring	FERC, EPA, DOC, NRC
Electric Utility Regulation	FERC, EPA, NRC, DOC, DOJ
President's Commission on Critical Infrastructure Protection	Treasury, DOJ, DoD, DOC, DOT, CIA, FEMA, FBI, NSA
Objective ER3: Efficient Use	
Partnership for a New Generation of Vehicles	EPA, DOT, NASA, DOD, NSF, DOC
Advanced Vehicle Program	DOT, DARPA, EPA
Corporate Average Fuel Economy	DOT, EPA
Federal Energy Management Program	All Federal Agencies
Partnership for Advancing Technology in Housing	HUD, DOC
Buildings for the 21st Century	All Federal agencies
Energy-related Inventions Program	DOC (NIST)
Million Solar Roofs Initiative	All Federal Agencies
Combined Heat and Power (Cogeneration)	EPA
Objective ER4: Energy Information	
Nuclear Energy Research	NRC

DOE Business Line/Project	Federal Agency Participants
Objective ER5: Global Issues	
President's Climate Change Technology Initiative	DOC, NOAA, NIST, EPA, AID, DOT, State
U.N. Framework Convention on Climate Change	NOAA, State, EPA, USDA, DoD, AID, Treasury, DOJ, Labor
21st Century Research Fund	NIH, NSF, NASA, DOC
Science and Technology (Federal Level)	NSF, DoD, NASA, DOC, EPA, DOT, OSTP, NAS
National Nuclear Security	
Objective NS1: Maintain Stockpile Confidence	
Nuclear Weapons Stockpile	DoD
Nuclear Arms Reduction	State, DoD, IAEA
Objective NS2: Achieve Science-Based Stockpile Stewardship	
Nuclear Weapons Stockpile	DoD
High Performance Computing and Communications Program	NSF, DARPA, NASA, NIH, NSA, DOC (NIST), NOAA, EPA, ED, Agency for Health Care Policy and Research
Objective NS3: Ensure Enterprise Vitality and Readiness	
National Nuclear Security Programs	DoD
Objective NS4: Provide Nonproliferation Leadership	
International Arms Control and Nonproliferation	State, DOC, DoD, NRC, IAEA, NASA
International Nuclear Safety Program	State, NRC, DoD, AID, NSC, Office of Vice President
Disposition of Surplus HEU	U.S. Enrichment Corporation, TVA, NRC
Objective NS5: Provide Naval Nuclear Propulsion	
Naval Reactors Program	DoD
Objective NS6: Ensure Nuclear Security	
Nuclear Classification and Declassification Program	DoD, Defense Special Weapons Agency, State, CIA,
Emergency Response	DoD, State, DOT, GSA, TVA, HHS, VA, NOAA, DOJ, USDA, EPA, NRC, FEMA, IAEA, National Communication System
Law Enforcement Initiative	FBI, Treasury (ATF)
First Responder Program	DoD, EPA, FBI, FEMA, Public Health Service
Environmental Quality	
EQ1: Clean Up & Close Sites by 2006	
Uranium Mill Tailings Radiation Control Act	NRC
Science and Technology (Federal Level)	NSF, DoD, NASA, DOC, EPA, DOT, OSTP, NAS
EQ2: Characterize Yucca Mountain	
Civilian Radioactive Waste Management	NRC, EPA, NWTRB, DOT
EQ3: Manage Depleted Uranium	
Depleted UF_6	DNFSB, Ohio's EPA, NRC

DOE Business Line/Project	***Federal Agency Participants***
Science	
SC1: Physical Sciences in Quest for Clean, Affordable and Abundant Energy	
Center for Environmentally Responsible Carbon Dioxide Processes	NSF
Interagency Coordination and Communication Group for Metals	DOE, NSF, AFOSR, ONR, EPA, NASA
National Plant Genome Initiative	NSF, USDA, NIH
SC2: Science Foundations to Protect Our Living Planet	
U.S. Global Change Research Program	USDA, NOAA, NSF, NASA, DoD, HHS, DOI (USGS), State, EPA, OMB, OSTP, Smithsonian Institution
Bioengineering Coordinating Committee	NSF, NIH
SC3: Matter and Energy as Fundamental Building Blocks	
Alpha Magnetic Spectrometer for Space-Based High Energy Physics	NASA, International Participants
U.S. Human Genome Project	NIH
National Nanotechnology Initiative	NFS, DoD, NASA, DOC, NIH
Basic Plasma Science and Engineering	NSF
SC4: Extraordinary Scientific Tools, Workforce Infrastructure	
High Performance Computing and Communications Program	NSF, DARPA, NASA, NIH, NSA, DOC, (NIST), NOAA, EPA, ED, Agency for Health Care Policy and Research, VA
Large Hadron Collider	NSF, CERN
Working Group on Structural Biology at Synchrotron Radiation Facilities	NIH, NFS, DOC (i.e., NIST)
***Corporate Management*:**	
Objective CM1: Environmental, Safety, and Health	
Conduct Health Studies	HHS, NIH, CDC, NCI

Legend:

ACIS = Arms Control Intelligence Staff
AFOSR = Air Force Office of Scientific Research
AFRL = Air Force Research Laboratory
AFSMC = Air Force Space and Missile Systems Center
AFSPACECOM = Air Force Space Command
AID = Agency for International Development
ATF = Bureau of Alcohol, Tobacco, and Firearms
CDC = Center for Disease Control
CFQ = Council for Environmental Quality
CIA = Central Intelligence Agency
CUSTOMS = U.S. Customs Service
DARPA = Defense Advanced Research Projects Agency
DOC = Department of Commerce
DoD = Department of Defense
DOI = Department of Interior
DOJ = Department of Justice
DOT = Department of Transportation
ED = Department of Education
EPA = Environmental Protection Agency
FAA = Federal Aviation Administration
FBI = Federal Bureau of Investigation
FEMA = Federal Emergency Management Agency
FERC = Federal Energy Regulatory Commission
FTA = Federal Transit Administration
GSA = General Services Administration
HHS = Department of Health and Human Services
HUD = Dept of Housing and Urban Development
IAEA = International Atomic Energy Agency
Labor = Department of Labor
NAS = National Academy of Sciences
NASA = National Aeronautics and Space Administration
NCI = National Cancer Institute
NIH = National Institutes of Health
NIJ = National Institute of Justice
NIST = National Institute of Standards and Technology
NLM = U.S. National Library of Medicine
NOAA = National Oceanic and Atmospheric Administration
NRC = Nuclear Regulatory Commission
NSA = National Security Agency
NSC = National Security Council
NSF = National Science Foundation
NWTRB = Nuclear Waste Technical Review Board
ONR = Office of Naval Research
OSD = Office of the Secretary of Defense
OSTP = White House Office of Science and Technology Policy
PHS = Public Health Service
State = State Department
Treasury = Treasury Department
TVA = Tennessee Valley Authority
USDA = U.S. Department of Agriculture
USGS = U.S. Geological Survey
VA = Department of Veteran Affairs

APPENDIX B: DOE Office Designations

CI	Congressional Affairs
CFO	Chief Financial Officer
CN	Counterintelligence
DP	Defense Programs
ED	Economic Impact & Diversity
EE	Energy Efficiency & Renewable Energy
EH	Environment, Safety & Health
EIA	Energy Information Administration
EM	Environmental Management
FE	Fossil Energy
HG	Hearings and Appeals
IA	International Affairs
IG	Inspector General
IN	Intelligence
MA	Management and Administration (formerly Human Resources)
MD	Fissile Materials Disposition (now part of NN)
NE	Nuclear Energy, Science & Technology
NN	Defense Nuclear Nonproliferation (formerly Nonproliferation National Security)
NNSA	National Nuclear Security Administration
NR	Naval Reactors
OA	Independent Oversight and Performance Assurance
PC	Privatization and Contract Reform
PO	Policy
PMAs	Power Marketing Administrations
RW	Civilian Radioactive Waste Management
S1	Secretary of Energy
SC	Science
SO	Security and Emergency Operations
WT	Worker & Community Transition

APPENDIX C: Statutes and Other Authorities for DOE Objectives

This list is representative of the authorities available to the Department to carry out its activities.

Energy Resources

Generally Applicable Statutes:

- **Department of Energy Organization Act** (DOE Act) (42 U.S.C. 7101, et seq.);
- **Energy Conservation and Production Act** (42 U.S.C. 6801, et seq.);
- **Energy Policy Act of 1992** (Pub. L. No. 102-486, 42 U.S.C. scattered sections);
- **Energy Policy and Conservation Act** (42 U.S.C. 6201, et seq.);
- **National Energy Conservation Policy Act** (42 U.S.C. 8201, et seq.);

Objective ER1

Promote reliable, affordable, clean, and diverse domestic fuel supplies.

Statutes:

- **Atomic Energy Act of 1954,** §31 (42 U.S.C. 2051) (research and development relating nuclear processes, atomic energy, and nuclear material);
- **DOE Act,** §102 (9) and (12) (42 U.S.C. 7112(9), (12)) (purposes of DOE — provision of adequate supply of energy at lowest reasonable cost and foster competition among parties engaged in the supply of energy);
- **Energy Policy Act of 1992**
  - §303-305 (42 U.S.C. 13212-13214) (alternative fuels for Federal Government use);
  - §405-414 (42 U.S.C. 13231-13239) (alternative fuels for non-Federal use);
  - §501-514 (42 U.S.C. 13251-13264) (replacement fuels, alternative fuels, and alternative fueled private vehicles);
  - §601-626 (42 U.S.C. 13271-13296) (electric motor vehicles);
  - §1203-1205, 1211-1212 (42 U.S.C. 13312-13314, 13316-13317) (renewable energy);
  - §1301-1341 (42 U.S.C. 13331-13370) (coal);
  - §2015, 2022-2025 (42 U.S.C. 13415, 13432-13435) (oil and gas supply enhancement and demand reduction);
  - §103, 2107, 2116, 2119, 2121-2122, 2124 (42 U.S.C. 13456, 13458, 13476, 13479, 13491-13492, 13494) (energy efficiency, renewable energy, and nuclear energy);
  - §2203, 2206 (42 U.S.C. 13503, 13506) (basic energy research);
- **Energy Policy and Conservation Act**, §101-181 (42 U.S.C. 6211-6251) (domestic supply availability, including Strategic Petroleum Reserve authorities);
- **Federal Nonnuclear Energy Research and Development Act of 1974** (42 U.S.C. 5901-5920) (comprehensive nonnuclear research and development, including coal, oil, and natural gas programs);
- **Chapter 641 of title 10, United States Code** (Naval Petroleum Reserves authority);
- **National Defense Authorization Act for Fiscal Year 1996,** title 34 (Pub. L. No. 104-106) (sale of Naval Petroleum Reserve Numbered 1 and study of future of other Naval Petroleum Reserves);

- **Strom Thurmond National Defense Authorization Act for Fiscal Year 1999,** title 34 (10 U.S.C. 7420 note) (disposal of Naval Petroleum Reserve Numbered 2, Naval Petroleum Reserve Numbered 3, and Oil Shale Reserve Numbered 2);
- **National Energy Conservation Policy Act;**
  - §521-569 (42 U.S.C. 8241-8259, 8271-8278) (Federal energy initiative);
  - §801-804 (42 U.S.C. 8287-8287c) (energy savings performance contracts);
- **Natural Gas Policy Act of 1978;**
  - §301-304 (15 U.S.C. 3361-3364) (emergency natural gas authority);
  - §401-403 (15 U.S.C. 3391-3393) (natural gas curtailment policies);
- **Solar Energy Research, Development, and Demonstration Act of 1974** (42 U.S.C. 5551-5566) (research and development in solar technology);
- **Energy Supply and Environmental Coordination Act of 1974** (15 U.S.C. 791-798) (alternative fuels use by electric power plants);

Executive Orders:

- **Executive Order 12235** (delegates authority under §§302 and 303 of the Natural Gas Policy Act of 1978 to the Secretary of Energy);

Objective ER2

Promote reliable, affordable, and clean transformation of fuel supplies into electricity and related products.

Statutes:

- **DOE Act,** §203 (a) (1) (42 U.S.C. 7133(a)(1)) (assignment of duties related to management of electric power supply);
- **Federal Nonnuclear Energy Research and Development Act of 1974** (42 U.S.C. 5901-5920) (comprehensive nonnuclear research and development, including coal, oil, and natural gas programs);
- **Solar Energy Research, Development, and Demonstration Act of 1974** (42 U.S.C. 5551-5566) (research and development in solar technology);
- **Renewable Energy and Energy Efficiency Technology Competitiveness Act of 1989** (42 U.S.C. 12001-12007) (demonstration and deployment of renewable energy and energy efficiency technologies for buildings and transportation);
- **Energy Supply and Environmental Coordination Act of 1974** (15 U.S.C. 791-798) (alternative fuels use by electric power plants);
- **Bonneville Project Act of 1937** (16 U.S.C. 832-832*l*) (sale and disposition of electric energy generated at the Bonneville project);
- **Flood Control Act of 1944,** §5 (16 U.S.C. 825s) (authority to transmit and dispose of electric power and energy);
- **Reclamation Project Act of 1938,** §9 (c) (43 U.S.C. 485h (c) (Western Area Power Administration);
- **Department of the Interior and Related Agencies Appropriations Acts for Fiscal Years 1986-1995 and 1997** (Pub. L. Nos. 99-190, 99-591, 100-202, 100-446, 101-45, 101-121, 101-302, 101-512, 102-154, 102-381, 103-138, 103-332, 104-208) (clean coal technology);
- **Global Change Research Act of 1990** (15 U.S.C. 2921, et seq.) (interagency program to study and improve the understanding of and response to global change);

! **National Climate Program Act** (15 U.S.C. 2901-2908) (multi-agency program on the effects of climate on energy supply and demand, the natural environment, and other areas);

Objective ER3

Increase the efficiency and productivity of energy use, while limiting environmental impacts.

Statutes:

! **Atomic Energy Act of 1954,** §31 (42 U.S.C. 2051) (research and development relating nuclear processes, atomic energy, and nuclear material);

! **National Energy Conservation Policy Act;**

- §521-569 (42 U.S.C. 8241-8259, 8271-8278) (Federal energy initiative);
- §801-804 (42 U.S.C. 8287-8287c) (energy savings performance contracts);

! **Energy Policy Act of 1992;**

- §303-305 (42 U.S.C. 13212-13214) (alternative fuels for Federal Government use);
- §405-414 (42 U.S.C. 13231-13239) (alternative fuels for non-Federal use);
- §501-514 (42 U.S.C. 13251-13264) (replacement fuels, alternative fuels, and alternative fueled private vehicles);
- §601-626 (42 U.S.C. 13271-13296) (electric motor vehicles);
- §1203-1205, 1211-1212 (42 U.S.C. 13312-13314, 13316-13317) (renewable energy);
- §1301-1341 (42 U.S.C. 13331-13370) (coal);
- §2015, 2022-2025 (42 U.S.C. 13415, 13432-13435) (oil and gas supply enhancement and demand reduction);
- §103, 2107, 2116, 2119, 2121-2122, 2124 (42 U.S.C. 13456, 13458, 13476, 13479, 13491-13492, 13494) (energy efficiency, renewable energy, and nuclear energy);
- §2203, 2206 (42 U.S.C. 13503, 13506) (basic energy research);

! **Department of Energy Metal Casting Competitiveness Research Act of 1990** (15 U.S.C. 5301, et seq.) (technology development for metals industry);

! **Department of the Interior and Related Agencies Appropriations Acts for Fiscal Years 1986-1995 and 1997** (Pub. L. Nos. 99-190, 99-591, 100-202, 100-446, 101-45, 101-121, 101-302, 101-512, 102-154, 102-381, 103-138, 103-332, 104-208) (clean coal technology);

! **Global Change Research Act of 1990** (15 U.S.C. 2921, et seq.) (interagency program to study and improve the understanding of and response to global change);

! **National Climate Program Act** (15 U.S.C. 2901-2908) (multi-agency program on the effects of climate on energy supply and demand, the natural environment, and other areas);

! **Renewable Energy and Energy Efficiency Technology Competitiveness Act of 1989** (42 U.S.C. 12001-12007) (demonstration and deployment of renewable energy and energy efficiency technologies for buildings and transportation);

! **Steel and Aluminum Energy Conservation and Technology Competitiveness Act of 1988** (15 U.S.C. 5101, et seq.) (R&D program to develop competitive manufacturing technologies and increase energy efficiency in the steel and aluminum industries);

Objective ER4

Inform public policy makers, energy industries, and the general public by providing reliable energy information and analysis.

Statutes:

! **DOE Act,**

- §102 (42 U.S.C. 7112) (purposes of the Department);
- §205 (42 U.S.C. 7135) (Energy Information Administration);
- §209 (42 U.S.C. 7139) (energy research office);
- §301-309 (42 U.S.C. 7151-7157) (transfer of functions);

Objective ER5:

Cooperate globally on international energy issues.

Statutes:

! **DOE Act**

- §102 (42 U.S.C. 7112) (purposes of the Department);
- §203(a)(1-4, 6-7, 9-10) (42 U.S.C. 7133(a) (1-4, 6-7, 9-10)) (functions assigned to assistant secretaries);

! **Energy Policy Act of 1992**

- §1203-1204, 1211 (42 U.S.C.13312-13313, 13316) (renewable energy exports programs);
- §1331-1333, 1338 (42 U.S.C. 13361-13363, 13337) (coal export program):
- §1601-1609 (42 U.S.C. 13381-13388) (global climate change);

! **Energy Policy and Conservation Act**, §201-281 (42 U.S.C. 6261-6285) (standby energy authorities and international energy program);

! **Energy Reorganization Act of 1974**, §103(8) and 107(a) (42 U.S.C. 5813(8) and 5817(a)) DOE may encourage and participate in international cooperation in energy and related environmental research and development, and DOE may make arrangements for the conduct of research and development activities with private or public institutions, including participation in joint or cooperative projects of a research, developmental, or experimental nature;

! **Federal Power Act,** §202 (16 U.S.C. 824a) (electricity export authority);

! **Natural Gas Act,** §3 (15 U.S.C. 717b) (exportation or importation of natural gas);

! **Support for East European Democracy Act of 1985,** §502(f) (22 U.S.C. 5452(f)) (export of clean coal technology);

! **Global Change Research Act of 1990** (15 U.S.C. 2921, et seq.) (interagency program to study and improve the understanding of and response to global change);

! **National Climate Program Act** (15 U.S.C. 2901-2908) (multi-agency program on the effects of climate on energy supply and demand, the natural environment, and other areas);

National Nuclear Security

Generally Applicable Statutes:

- **Department of Energy Organization Act (DOE Act)**, §(42 U.S.C. 7101 et seq.);
- **Atomic Energy Act of 1954 (42 U.S.C. 2011 et seq.);**
- **Soviet Nuclear Threat Reduction Act of 1991 (22 U.S.C. 2551 note);**
- **Annual Department of Energy national security authorization Acts, 1977 to present (since 1986, enacted as title XXXI of National Defense Authorization Acts), particularly;**
- **National Defense Authorization Act for Fiscal Year 2000;**
  - §§3141-3156, Department of Energy Facilities Safeguards, Security, and Counterintelligence Enhancement Act of 1999 (42 U.S.C. 7383 note) (new security procedures at DOE facilities);
  - §§3201-3299, National Nuclear Security Administration Act (50 U.S.C. 2401 note, 50 U.S.C. 2401-2484, 42 U.S.C. 7144-7144c) (established the National Nuclear Security Administration);

Objective NS1

Maintain and refurbish nuclear weapons in accordance with directed schedules to sustain confidence in their safety, security, and reliability indefinitely, under the nuclear testing moratorium and arms reduction treaties.

Statutes:

- **Atomic Energy Act of 1954;**
  - §25 (42 U.S.C. 2035) (establishes the Division of Military Application);
  - Chapter 4 (42 U.S.C. 2061-2064) (R&D in the theory and production of atomic energy, including application for military purposes);
  - Chapter 5 (42 U.S.C. 2071-2078) (production of special nuclear materials);
  - Chapter 9 (42 U.S.C. 2121-2123) (military application of atomic energy);
- **National Defense Authorization Act for Fiscal Year 1994,** §3138 (42 U.S.C. 2121 note) (establishes the Stockpile Stewardship Program);
- **National Defense Authorization Act for Fiscal Year 1996,** §3133 (42 U.S.C. 2121 note) (establishes a tritium production program capable of meeting the tritium requirements of the United States for nuclear weapons);
- **Strom Thurmond National Defense Authorization Act for Fiscal Year 1999,** §3159 (42 U.S.C. 2121 note) (establishment of panel to assess annually the certification process for the reliability, safety, and security of the stockpile).

Objective NS2

Achieve the robust and vital scientific, engineering, and manufacturing capability that is needed for the current and future certification of the nuclear weapons stockpile and the manufacture of nuclear weapon components under the nuclear testing moratorium.

Statutes:

- **National Defense Authorization Act for Fiscal Year 1994,** §3138, (42 U.S.C. 2121 note); (establishes the Stockpile Stewardship Program);

- **National Defense Authorization Act for Fiscal Year 1995,** §3131 (Pub.L. No. 103-337) (provides a "Stockpile Stewardship Recruitment and Training Program");
- **National Defense Authorization Act for Fiscal Year 1998;**
  - §3151 (42 U.S.C. 2121 note) (plan for management of warheads in nuclear weapons stockpile);
  - §3155 (42 U.S.C. 7381 note) (program to promote collaboration among the labs, universities, and industry in support of scientific and engineering advancement in DOE defense program areas)
- **Strom Thurmond National Defense Authorization Act for Fiscal Year 1999;**
  - §3135 (Pub. L. No. 105-261) (requirement to maintain F-canyon and H-canyon at a high state of readiness);
  - §3159 (42 U.S.C. 2121 note) (establishment of panel to assess annually the certification process for the reliability, safety, and security of the stockpile);
- **National Defense Authorization Act for Fiscal Year 2000,** §3133 (42 U.S.C. 2121 note) (nuclear weapons stockpile life extension program);

Objective NS3

Ensure the vitality and readiness of DOE's national nuclear security enterprise.

Statutes:

- **Atomic Energy Act of 1954**
  - §25 (42 U.S.C. 2035) (establishes the Division of Military Application);
  - Chapter 4 (42 U.S.C. 2061-2064) (R&D in the theory and production of atomic energy, including application for military purposes);
  - Chapter 5 (42 U.S.C. 2071-2078) (production of special nuclear materials);
  - Chapter 9 (42 U.S.C. 2121-2123) (military application of atomic energy);
- **National Defense Authorization Act for Fiscal Year 1994,** §3138 (42 U.S.C. 2121 note) (establishes the Stockpile Stewardship Program);
- **National Defense Authorization Act for Fiscal Year 1996,** §3133 (42 U.S.C. 2121 note) (establishes a tritium production program capable of meeting the tritium requirements of the United States for nuclear weapons);
- **Strom Thurmond National Defense Authorization Act for Fiscal Year 1999,**
  - §3135 (Pub. L. No. 105-261) (requirement to maintain F-canyon and H-canyon at a high state of readiness)
  - §3159 (42 U.S.C. 2121 note) (establishment of panel to assess annually the certification process for the reliability, safety, and security of the stockpile.
- **National Defense Authorization Act for Fiscal Year 2000** (Pub. L. No. 106-65)
  - §3132 (continuation of processing, treatment, and disposition of legacy nuclear materials);
  - §3162 (fellowship program for development of skills critical to the DOE nuclear weapons complex);
  - §3163 (maintenance of nuclear weapons expertise in DOD and DOE);

Objective NS4

Reduce the global danger from the proliferation of weapons of mass destruction (WMD).

Statutes:

! **Atomic Energy Act of 1954**

- §31 (42 U.S.C. 2051) (conduct atomic energy research and development activities through contracts, agreements and loans with private or public institutions or persons, including foreign governments);
- §§123-131 (42 U.S.C. 2153-2160) (international activities related to atomic energy);

! **Export Administration Act** (Pub.L.No. 96-72 of 9-29-79 and Pub.L.No. 99-64 of 7-12-85 Part 778)

! **FY 1994 Foreign Operations Appropriations Act,** §560 (Pub.L.No. 103-87) (authorizes the Department to institute a program of cooperation between scientific and engineering institutes in the New Independent States of the Former Soviet Union and national laboratories and other qualified academic institutions in the United States);

! **Department of Energy Organization Act**, §102(10) (42 U.S.C. 7112(10)) authorizes DOE to undertake international energy activities, in coordination with the Secretary of State;

- §212 (42 U.S.C. 7143) establishes the Office of Fissile Materials Disposition;

! **Energy Reorganization Act of 1974**, §103(8) and 107(a) (42 U.S.C. 5813(8) and 5817(a)) DOE may encourage and participate in international cooperation in energy and related environmental research and development, and DOE may make arrangements for the conduct of research and development activities with private or public institutions, including participation in joint or cooperative projects of a research, developmental, or experimental nature;

! **Soviet Nuclear Threat Reduction Act of 1991** and subsequent amendments provide authority for the transfer of certain funds to DOE for use in assisting in certain nuclear safety activities in the independent states of the former Soviet Union;

! **Soviet Nuclear Threat Reduction Act of 1991 ("Nunn-Lugar")** (22 U.S.C. 2551 note) authorizes the President to establish and conduct programs to assist the demilitarization of the independent states of the former Soviet Union. Programs include transporting , storing, safeguarding and destruction of nuclear and other weapons; and establishing verifiable safeguards against the proliferation of such weapons and their components. Amendments to the Soviet Nuclear Threat Reduction Act since 1991 have continued and expanded the authority of the President to assist states of the former Soviet Union with demilitarization, nonproliferation and arms control initiatives. These include the Freedom Support Act of 1992 (PL. 102-511); The Former Soviet Union Demilitarization Act of 1992 (Title XIV of the National Defense Authorization Act for Fiscal Year 1993, PL. 102-484, and Titles XIII-XV of the National Defense Authorization Act for Fiscal Year 1997, (PL. 104-201);

! **National Defense Authorization Act for Fiscal Year 1996,** §3131 (Pub.L.No. 104-106), authorizes conduct of programs to improve fissile materials protection, control, and accountability in Russia;

! **National Defense Authorization Act for Fiscal Year 1997,** §1441 (Pub.L.No. 104-201) establishes National Coordinator on Nonproliferation (for weapons of mass destruction) and provides funding for cooperative plutonium disposition activities with Russia;

! **National Defense Authorization Act for Fiscal Year 2000,** §3136 (Pub. L. No. 106-65) (nonproliferation initiatives and activities);

! **United States Enrichment Corporation Privatization Act,** §3112 (Pub.L.No. 104-134) establishes terms and conditions governing the disposition of surplus highly enriched uranium;

Treaties:

- **Treaty on the Nonproliferation of Nuclear Weapons (NPT)**;
- **The Threshold Test Ban Treaty (TTBT)** (verification of compliance with treaty provisions by the parties);
- **Agreement for Cooperation between the United States of America and the International Atomic Energy Agency**;
- **Agreement with the International Atomic Energy Agency for the Application of Safeguards in the United States of America with Protocol (U.S. - IAEA) Treaty for Safeguards in the U.S.** (Voluntary Offer);

Objective NS5

Provide the U.S. Navy with safe, militarily effective nuclear propulsion plants, and ensure their continued safe and reliable operation.

Statutes:

- **Atomic Energy Act of 1954**
  - §25 (42 U.S.C. 2035) (establishes the Division of Military Application);
  - Chapter 4 (42 U.S.C. 2061-2064) (R&D in the theory and production of atomic energy, including application for military purposes);
  - Chapter 9 (42 U.S.C. 2121-2123) (military applicatiion of atomic energy);
- **Energy Reorganization Act of 1974,** §104 (42 U.S.C. 5814) (Naval Reactors);
- **Department of Energy Organization Act,** §309 (42 U.S.C. 7158) (Naval Reactors);
- **Department of Defense Authorization Act, 1985,** §1634 (freezes E.O. 12344 on Naval Reactors in place unless changed by law) (42 U.S.C. 7158 note);
- **Energy Policy Act of 1992,** §§2121-2124 (42 U.S.C. 13491-13494) (advanced nuclear reactors R&D);
- **National Defense Authorization Act for Fiscal Year 2000**
  - §§3201-3299, National Nuclear Security Administration Act (50 U.S.C. 2401 note, 50 U.S.C. 2401-2484, 42 U.S.C. 7144-7144c) (relocates the Office of Naval Reactors from the Office of Nuclear Energy, Science, and Technology to the NNSA and reaffirms the assignments and responsibilities assigned by E.O. 12344;

Executive Order:

- **Executive Order 12344** (jurisdiction of DOE and DOD over the Naval Nuclear Propulsion Program);

Objective NS6

Ensure the effective security policy, implementation, and oversight for the Department's nuclear materials, facilities, and information assets.

Statutes:

- **Atomic Energy Act of 1954**
  - Chapter 12 (42 U.S.C. 2161-2169) (control of Restricted Data and establishment of personnel security program);
  - Chapter 18 (42 U.S.C. 2271-2284) (criminal provisions relating to security functions);
  - §161 (42 U.S.C. 2201) (protection of nuclear materials and Restricted Data);

- **Atomic Weapons and Special Nuclear Materials Rewards Act**, §§2-7 (50 U.S.C. 47a-47f) (rewards for information on illegal possession of atomic weapons or special nuclear material);
- **Defense Production Act of 1950** (50 U.S.C. App. 2061 et seq.) (conversion of civilian materials to military use);
- **Economic Espionage Act of 1996** (Pub.L. No. 104-294) (prevention of economic espionage);
- **National Defense Authorization Act for Fiscal Year 1993,** §§3161 and 3163 (42 U.S.C. 7274h, 7274j) (DOE defense nuclear facilities workforce restructuring plan);
- **National Defense Authorization Act for Fiscal Year 1998,** §3161 (42 U.S.C. 7251 note) (creation of a DOE Security Management Board);
- **Strom Thurmond National Defense Authorization Act for Fiscal Year 1999,** §3161 (50 U.S.C. 435 note) (plan prepared by DOE and U.S. Archives to prevent inadvertent release of Restricted and Formerly Restricted Data);
- **National Defense Authorization Act for Fiscal Year 2000;**
  - §§3141-3156, Department of Energy Facilities Safeguards, Security, and Counterintelligence Enhancement Act of 1999 (42 U.S.C. 7383 note) (new security procedures at DOE facilities);
  - §§3201-3299, National Nuclear Security Administration Act (50 U.S.C. 2401 note, 50 U.S.C. 2401-2484, 42 U.S.C. 7144-7144c) (established the National Nuclear Security Administration);

Executive Orders:

- **Executive Order 10450** (security requirements for Government employment);
- **Executive Order 10865** (safeguarding classified information within industry);
- **Executive Order 11057** (communication of Restricted Data);
- **Executive Order 12958** (procedures for classification of national security information);
- **Executive Order 12968** (procedures for access to classified information);
- **Executive Order 12938** (national emergency in regards to weapons of mass destruction);

Emergency Planning and Operations:

- **Executive Order 10480** (Defense Production Act priority contracting and allocation authority);
- **Executive Order 11912** (DPA priority contracting and allocation authority to maximize domestic energy supplies);
- **Executive Order 11953 and 12656** (emergency preparedness);
- **Executive Order 12742** (national security industrial responsiveness);

Intelligence:

- **Executive Order 12333** (functions and responsibilities of U.S. intelligence community);
- **Executive Order 12334** (President's Intelligence Oversight Board);
- **Executive Order 12356** (special access programs for intelligence information);

Treaty:

- **Open Skies Treaty;**

Environmental Quality

Generally Applicable Statutes:

- **Department of Energy Organization Act**, §102(11), (13), and (15) (42 U.S.C. 7112(11), (13), and (15)) and §203(a)(3) and (8) (42 U.S.C. 7133(a)(3) and (8));
- **Atomic Energy Act of 1954**, §161 b. and I. (42 U.S.C. 2201(b) and (I));
- **Comprehensive Environmental Response, Compensation, and Liability Act of 1980,** (42 U.S.C. 9601 et seq.);
- **Solid Waste Disposal Act (RCRA)** (42 U.S.C. 6901 et seq.);
- **National Environmental Policy Act of 1969** (42 U.S.C. 4321 et seq.);
- **Clean Air Act** (42 U.S.C. 7401 et seq.);
- **Federal Water Pollution Control Act (Clean Water Act)** (33 U.S.C. 1251 et seq.);
- **Safe Drinking Water Act** (42 U.S.C. 300f et seq.);
- **Toxic Substances Control Act** (15 U.S.C. 2601 et seq.);
- **Hazardous Materials Transportation Act** (49 U.S.C. 5101 et seq.);

Objective EQ1

Safely and expeditiously clean up sites across the country that supported nuclear weapons research, production, and testing, and conducted DOE-funded nuclear energy and basic science research in the United States. After completion of cleanup, continue stewardship activities to ensure that human health and the environment are protected.

Statutes:

- **Comprehensive Environmental Response, Compensation, and Liability Act of 1980** (42 U.S.C. 9601 et seq.) (cleanup of contaminated sites);
- **Solid Waste Disposal Act** (42 U.S.C. 6901 et seq.) (minimization of generation of hazardous waste, hazardous waste management, and cleanup of past contamination at currently active sites);
- **National Defense Authorization Act for Fiscal Years 1990 and 1991,** §3141 (42 U.S.C. 7274a) (defense waste cleanup technology program);
- **National Defense Authorization Act for Fiscal Years 1992 and 1993,** §3135 (42 U.S.C. 7274g) (environmental restoration and waste management five-year plan and budget reports);
- **National Defense Authorization Act for Fiscal Year 1994,** §3153 (42 U.S.C. 7274k) (baseline environmental management reports);
- **National Defense Authorization Act for Fiscal Year 1995,** §3140 (Pub. L. No. 103-337) hazardous materials management and emergency response training program);
- **National Defense Authorization Act for Fiscal Year 1996,** §3156 (42 U.S.C. 7274k note) (accelerated schedule for environmental restoration and waste management activities);
- **National Defense Authorization Act for Fiscal Year 1997;**
  - §3143 (42 U.S.C. 7274n**)** (program of closure-acceleration projects);
  - §3153 (42 U.S.C. 7274k note) (future use plans for defense nuclear facilities at which environmental restoration and waste management activities are occurring); and

- §§3171-3180 (42 U.S.C. 7274k note) (cost effective management mechanisms, innovative technologies, and performance-based contracting);

! **National Defense Authorization Act for Fiscal Year 1998;**

- §3132 (Pub. L. No. 105-85) (authority to enter into privatization contracts);
- §3159 (Pub. L. No. 105-85) (delegation of certain authorities to site manager of Hanford Reservation);

! **Strom Thurmond National Defense Authorization Act for Fiscal Year 1999,**

- §3139 (Pub. L. No. 105-261) (establishment of Office of River Protection at Hanford);
- §3141 (Pub. L. No. 105-261) (authority to enter into partnership with Federal and non-Federal entities to share the costs of operating the hazardous materials management and hazardous materials emergency response training program);

! **Uranium Mill Tailings Radiation Control Act of 1978** (42 U.S.C. 7901 et seq.) (program to clean up inactive uranium milling sites and other contaminated properties in their vicinity);

! **Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1980,** §213, Pub.L.No. 96-164 (establishes WIPP);

! **Waste Isolation Pilot Plant Land Withdrawal Act** (Pub.L.No. 102-579) (withdraws land for WIPP and establishes procedures for starting its operation);

! **Energy Policy Act of 1992,** §2113 (42 U.S.C. 13473) (plan for developing new technologies for minimizing the volume and toxic lifetime of nuclear waste);

Objective EQ2

Complete the characterization of the Yucca Mountain site and, assuming it is determined suitable as a repository and the President and Congress approve, obtain requisite licenses, construct and, in FY 2010, begin acceptance of spent nuclear fuel and high-level radioactive wastes at the repository.

Statutes:

! **Nuclear Waste Policy Act of 1982** (42 U.S.C. 10101 et seq.) as amended (disposal, interim storage, monitored retrievable storage, and transportation of high-level radioactive waste and spent nuclear fuel);

Objective EQ3

Manage the material and facility legacies associated with the Department's uranium enrichment and civilian nuclear power development activities.

Statutes:

! **Atomic Energy Act of 1954,** §§1801-1805 (42 U.S.C. 2297g—2297g-4) (uranium enrichment plants decontamination and decommissioning);

! **Public Law 105-204** (treating and recycling depleted uranium hexafluoride);

Science

Generally Applicable Statutes:

! **Department of Energy Organization Act (DOE Act)** (42 U.S.C. 7101 et seq.);

! **Atomic Energy Act of 1954** (42 U.S.C. 2011 et seq.);

! **Energy Reorganization Act of 1974** (42 U.S.C. 5801 et seq.);

! **Federal Nonnuclear Energy Research and Development Act of 1974** (42 U.S.C. 5901 et seq.);

Objective SC1

Provide the leadership, foundations, and breakthroughs in the physical sciences that will sustain advancements in our Nation's quest for clean, affordable, and abundant energy.

Statutes:

! **Atomic Energy Act of 1954**;

- §31 (42 U.S.C. 2051) (research and development (R&D) related to: (1) nuclear processes, theory, and production, and (2) use of nuclear and radioactive materials for medical, biological, agricultural, health, and industrial purposes);
- §32 (42 U.S.C. 2052) (conducting energy-related R&D activities in DOE facilities, e.g., National Laboratories);
- §33 (42 U.S.C. 2053) (Energy R&D for non-DOE entities if private facilities inadequate);
- §91 (42 U.S.C. 2121) (R&D in the military applications of atomic weapons and the production of atomic weapons and atomic weapons parts);

! **DOE Act;**

- §102(5) and (6) (42 U.S.C. 7112(5), (6)) (carry out a comprehensive energy R&D program);
- §203(a)(2) and (3) (42 U.S.C. 7133(a)(2), (3)) (R&D in solar, geothermal, recycling, fossil, and nuclear energy and environmental effects of energy technologies);
- §209 (42 U.S.C. 7139) (creates Office of Energy Research to: (1) advise the Secretary on R&D programs, R&D financial assistance, and lab management other than nuclear weapons labs, and (2) supervise DOE R&D activities);
- §301 (42 U.S.C. 7151) (transferred Energy Research and Development Administration functions and Energy Reorganization Act of 1974 functions to DOE);

! **Energy Reorganization Act of 1974,** §103 (42 U.S.C. 5813) (management of R&D programs respecting all energy sources; energy-related environmental, biomedical, and physical science R&D; international R&D cooperation);

! **Federal Nonnuclear Energy Research and Development Act of 1974,** §§4 and 8 (42 U.S.C. 5903, 5907) (energy R&D&D, including coal, oil, natural gas, and other nonnuclear programs);

! **High-Performance Computing Act of 1991**, §203 (15 U.S.C. 5523) (high-performance computing and communications systems R&D);

! **Spark M. Matsunaga Hydrogen Research, Development, and Demonstration Act of 1990** (42 U.S.C. 12401-12408) (RD&D concerning hydrogen as an economic fuel or storage medium);

! **National Defense Authorization Act for Fiscal Year 1991**, §1801 (sections 2901-2904, title 10, United States Code) (environmental R&D to meet DOD and DOE environmental obligations);

! **National Defense Authorization Act for Fiscal Years 1990 and 1991**, §3141 (42 U.S.C. 7274a) (defense waste cleanup technology program);

! **National Superconductivity and Competitiveness Act of 1988**, §4 (15 U.S.C. 5203) (DOE superconductivity research and development activities);

Objective SC2

Develop the scientific foundations to understand and protect our living planet from the adverse impacts of energy supply and use, support long-term environmental cleanup and management at DOE sites, and contribute core competencies to interagency research and national challenges in the biological and environmental sciences.

Statutes:

- **Energy Policy Act of 1992,** §§1601-1609 (42 U.S.C. 13381-13388) (sets forth a global climate change program in DOE);
- **Global Change Research Act of 1990** (15 U.S.C. 2921, et seq.) (interagency program to study and improve the understanding of and response to global change);
- **National Climate Program Act** (15 U.S.C. 2901-2908) (multi-agency program on the effects of climate on energy supply and demand, the natural environment, and other areas);

Objective SC3

Explore matter and energy as elementary building blocks from atoms to life, expanding our knowledge of the most fundamental laws of nature spanning scales from the infinitesimally small to the infinitely large.

Statutes:

- **Atomic Energy Act of 1954;**
  - §31 (42 U.S.C. 2051) (conducting R&D and training activities in nuclear energy and related fields);
  - §32 (42 U.S.C. 2052) (conducting energy-related R&D activities in DOE facilities, including the National Laboratories);
  - §33 (42 U.S.C. 2053) (conducting energy research and development activities for non-DOE entities);
  - §161 g. and j. (42 U.S.C. 2201(g) and (j)) (acquiring and disposing of real and personal property);
- **DOE Act;**
  - §209(b)(3) (42 U.S.C. 7139(b)(3)) (management of non-defense multi-purpose laboratories);
  - §§647-649 (42 U.S.C. 7257-7259) (acquisition, maintenance, construction, and use of laboratories and other facilities);
- **Energy Policy Act of 1992;**
  - §2203 (42 U.S.C. 13503) (construction of user facilities; policy and plans for multi-program energy laboratories);
  - §§2203, 2206 (42 U.S.C. 13503, 13506) (basic energy research);
- **Energy Reorganization Act of 1974,** §107 (42 U.S.C. 5817) (facilities and property);
- **National Defense Authorization Act for Fiscal Year 1991**, §3132 (42 U.S.C. 7257a) (GOCO labs R&D);
- **High-Performance Computing Act of 1991;**
  - §102 (15 U.S.C. 5512) (National Research and Education Network, communication among scientists);
  - §203 (15 U.S.C. 5523) (DOE high-performance computing and communications systems R&D);

- **Federal Nonnuclear Energy Research and Development Act of 1974,** §§4 and 7 (42 U.S.C. 5903, 5906) (energy R&D through contracts and financial assistance, national laboratories, and working with the private sector);
- **National Superconductivity and Competitiveness Act**, §4 (15 U.S.C. 5203) (superconductivity R&D, including the management of property developed or made at the National Laboratories);

Executive Orders:

- **E.O. 12591 and E.O. 12618** (labs assistance to universities and private sector);

Objective SC4

Provide the extraordinary tools, scientific workforce, and multidisciplinary research infrastructure that ensures success of DOE's science mission and supports our Nation's leadership in the physical, biological, environmental, and computational sciences.

Statutes:

- **Atomic Energy Act of 1954;**
  - §31 b. (42 U.S.C. 2051(b)) (grants for education activities in relation to certain fields of nuclear theory and processes);
  - §§151-160 (42 U.S.C. 2181-2190) (patents and inventions relating to nonmilitary utilization; prior art; licenses, royalties, Federally financed research, etc.);
  - §§141-149 (42 U.S.C. 2161-2169) (control of information);
- **Energy Reorganization Act of 1974, §§103, 104, and 107** (42 U.S.C. 5813, 5814, 5817) (energy-related education and training and public dissemination of research results);
- **Department of Energy Organization Act;**
  - §102(5)(D) (42 U.S.C. 7112(5)(D)) (disseminate information resulting from R&D programs);
  - §209(b)(4) (42 U.S.C. 7139(b)(4)) (the Director of Energy Research is responsible for advising the Secretary on education and training to support basic science);
- **Department of Energy Science Education Enhancement Act** (42 U.S.C. 7381 et seq.) (DOE involvement in mathematics, science and engineering education; establishes DOE partnerships with educational institutions);
- **Federal Nonnuclear Research and Development Act of 1974**, §§7 and 8 (42 U.S.C. 5906, 5907) (demonstrations of new energy technology and patent policy);
- **Stevenson-Wydler Technology Innovation Act of 1980** (15 U.S.C. 3701 et seq.) (amended numerous times) (authorizes government-owned, contractor operated (GOCO) labs to enter into cooperative research and development agreements (CRADAs) with non-Federal parties; establishes other aspects of the technology development relationship between GOCO laboratory contractors and DOE, such as title to inventions; requires Offices of Research and Technology Application at major labs to coordinate activities; and requires making Federally-funded R&D more accessible to State and local governments and private industry);
- **National Competitiveness Technology Transfer Act of 1989** (section 3131(d) of the National Defense Authorization Act for Fiscal Years 1990 and 1991) (15 U.S.C. 3710a, note) (technology transfer and CRADAs for GOCO labs);
- **Bayh-Dole Act of 1980** (35 U.S.C. 200 et seq.) (small businesses and nonprofit organizations retain title to inventions made under funding agreements with DOE; Federal agencies grant exclusive licenses);

- **Energy Policy Act of 1992;**
  - §1211 (42 U.S.C. 13316) (renewable energy international technology transfer program with AID);
  - §1332 (42 U.S.C. 13362) (clean coal international technology program with AID);
  - §1608 (42 U.S.C. 13387) (innovative environmental international technology transfer program with AID);
  - §2025 (42 U.S.C. 13435) (R&D on electric motor vehicles and associated equipment);
  - §2203 (42 U.S.C. 13503) (supporting research and technical analysis);
  - §2204 (42 U.S.C. 13504) (math and science education);
  - §§3001-3002 (42 U.S.C. 13541-13542) (procedures and forms of agreement for carrying out RD&D and commercialization activities under EPACT);
  - §§611-616 (42 U.S.C. 13281-86) (electric and hybrid motor vehicle commercial demonstration program);
- **High-Performance Computing Act of 1991;**
  - §102 (15 U.S.C. 5512) (National Research and Education Network);
  - §203 (15 U.S.C. 5523) (DOE R&D and technology transfer on high-performance computing and communications systems);
- **National Cooperative Research and Production Act of 1993** (15 U.S.C. 4301 et seq.) (details exception to anti-trust prohibition against joint ventures in research and related activities by competitors);
- **Steel and Aluminum Energy Conservation and Technology Competitiveness Act of 1988** (15 U.S.C. 5101 et seq.); (R&D program to develop competitive manufacturing technologies and increase energy efficiency in the steel and aluminum industries);
- **Department of Energy Metal Casting Competitiveness Research Act of 1990** (15 U.S.C. 5301 et seq.) (technology development for metals industry);
- **National Defense Authorization Act for Fiscal Years 1988 and 1989**, §§3141-3151 (15 U.S.C. 4621-4631)) (DOE semi-conductor technology research excellence initiative);
- **Strom Thurmond National Defense Authorization Act for Fiscal Year 1999,** §3137 (42 U.S.C. 7259a) (research and activities on behalf of non-DOE persons and entities);
- **Global Change Research Act of 1990** (15 U.S.C. 2921 et seq.), (interagency program to study and improve the understanding of and response to global change);
- **National Climate Program Act** (15 U.S.C. 2901-2908) (multi-agency program on the effects of climate on energy supply and demand, the natural environment, and other areas);
- **Solar Energy Research, Development, and Demonstration Act of 1974** (42 U.S.C. 5551-5566) (research and development in solar technology);
- **Renewable Energy and Energy Efficiency Technology Competitiveness Act of 1989** (42 U.S.C. 12001-12007) (demonstration and deployment of renewable energy and energy efficiency technologies for buildings and transportation);
- **Albert Einstein Distinguished Educator Fellowship Act of 1994** (42 U.S.C. 7382-7382f) (establishes within DOE a national fellowship program for elementary and secondary school mathematics and science teachers);

Executive Orders:

- **E.O. 12591 and E.O. 12618** (April 10 and December 22, 1987) Federal Technology Transfer Act implementation; labs assistance to universities and private sector; consultation on CRADAs and licensing agreements with foreign persons or organizations);

Corporate Management

Generally Applicable Statutes:

- **Department of Energy Organization Act (DOE Act)** (42 U.S.C. 7101 et seq.);
- **Atomic Energy Act of 1954** (42 U.S.C. 2011 et seq.);
- **Numerous statutes of Government-wide application, such as Federal Property and Administrative Services Act of 1949; chapters 11-91 of title 5, United States Code; Freedom of Information Act; Government Performance and Results Act of 1993; Chief Financial Officer Act of 1990; National Environmental Policy Act of 1969; Administrative Dispute Resolutions Act; and Information Technology Management Reform Act of 1996;**

Objective CM1

Ensure the safety and health of the DOE workforce and members of the public, and the protection of the environment in all Departmental activities.

Statutes:

- **Atomic Energy Act of 1954,** §161 b. and I. (42 U.S.C. 2201(b) and (I)) (protect health and safety);
- **DOE Act,** §102(13) (42 U.S.C. 7112(15)) (assure incorporation of national environmental protection goals in formulation and implementation of energy programs);
- **National Defense Authorization Act for Fiscal Year 1993**, §§3162-3163 (42 U.S.C. 7274i-7274j) (medical evaluation of current and former DOE employees);

Objective CM2

Manage human resources and diversity initiatives and implement practices to improve the delivery of products and services.

Statutes:

- **DOE Act**
  - §211 (42 U.S.C. 7141) (establishes Office of Minority Economic Impact);
  - §621 (42 U.S.C. 7231) (authority of Secretary to appoint and fix the compensation of officers and employees);
  - §§641–662 (42 U.S.C. 7251—7270b) (general administrative authority);
- **Energy Policy Act of 1992,** §3021 (42 U.S.C. 13556) (disadvantaged business enterprises);
- **National Defense Authorization Act for Fiscal Year 1998**, §3138 (42 U.S.C. 7256 note) (pilot program relating to use of proceeds of disposal of certain Department of Energy assets);

Objective CM3

Manage financial resources and physical assets to ensure public.

Statutes:

- **DOE Act,** §102(11) and (15) (42 U.S.C. 7112(11), (15)) (provision for DOE cooperation with State and local governments and for public participation in the development of national energy programs);

- **National Defense Authorization Act for Fiscal Year 1997,** §3153 and §3173(b)(3) (42 U.S.C. 7274k note) (citizen advisory board for each facility at which environmental restoration and waste management activities are occurring and consultation with the advisory board and the State before making certain decisions);
- **Atomic Energy Act of 1954,** §§141-148 (42 U.S.C. 2161-2168) (control, classification, and declassification of information);
- **Electronic Freedom of Information Act Amendments of 1996** (Pub. L. No. 104-231) (5 U.S.C. 552) (facilitates electronic transfer of information to and from Federal agencies and the public);

Executive Order:

- **Executive Order 12862** (September 11, 1993) (setting customer service standards for Federal agencies);

Objective CM4

Manage information technology systems and infrastructure to improve the Department's efficiency and effectiveness.

Statutes:

- **DOE Act,** §647 (42 U.S.C. 7257) (authority to acquire and maintain property);
- **High-Performance Computing Act of 1991;**
  - §102 (15 U.S.C. 5512) (National Research and Education Network);
  - §203 (15 U.S.C. 5523) (DOE R&D and technology transfer on high-performance computing and communications systems);

Objective CM5

Use appropriate oversight systems to promote the efficient, effective, and economical operation of the Department of Energy.

Statutes:

- **DOE Act**
  - §102(2) and (3) (42 U.S.C. 7112(2), (3)) (provision for effective management of energy functions of the Federal Government and for a mechanism for coordinating national energy policy;
  - §643 (42 U.S.C. 7253) (authority to organize and reorganize offices within DOE);
  - §646 (42 U.S.C. 7256) (contracting authority);
  - §650 (42 U.S.C. 7260) (authority to establish and alter field offices);
  - §653 (42 U.S.C. 7263) (working capital fund);
- **Energy Policy Act of 1992,** §2304 (42 U.S.C. 13523) (management plan for the conduct of research, development, demonstration, and commercial application of energy technologies);
- **Atomic Energy Act of 1954** (42 U.S.C. 2011 et seq.) (contracting authority);
- **Government Performance and Results Act of 1993** (§306 of title 5, United States Code, and §§1105(a)(29), 1115-1119, and 9703 of title 31, United States Code);
- **National Defense Authorization Act of 1993,** §3161 (42 U.S.C. 7274h) (assisting communities near DOE sites and released DOE workers);
- **Clinger-Cohen Act of 1996** (40 U.S.C. 1401 et seq.) (Information Technology Management).

APPENDIX D: Glossary Term / Description

ABM
Anti-Ballistic Missile Treaty Agreement

Acoustic Resonant Ultrasound Spectroscopy Technology
Application of this technology has generated a new NDE (non-destructive evaluation) method known as Resonant Ultrasound Spectroscopy (RUS) that has been found useful for characterizing components and structures of many diverse shapes and sizes.

Annual Accountability Report
Required by the GPRA of 1993 to review the success of achieving the performance goals/ targets of the past fiscal year. An explanation is required in those cases where the goals have not been met. OMB circular A-11 refers to this report as an Annual Program Performance Report. DOE calls this report the Annual Accountability Report. It is due no later than March 31st, six months after the close of the fiscal year.

Annual Performance Plan
Required by the GPRA of 1993 to set out measurable goals that define what will be accomplished during the budget year. The goals should reflect a level of accomplishment commensurate with the resources requested and subsequently funded. The final plan reflects budget, policy, and programmatic decisions, and is consistent with and transmitted with the President's Budget Request.

ATF
Bureau of Alcohol, Tobacco, and Firearms

Bio-energy
Fuels derived from plant materials, for example, the production of ethanol fuels.

BMIS
Business Management Information System

Buckeyballs
C_{60}, Buckminsterfullerene—a chemical structure of 60 carbon atoms.

CFO
Chief Financial Officer

CFR
U.S. Code of Federal Regulations

Chips
Electronic microchips

CHRIS
Corporate Human Resources Information System

CIA
Central Intelligence Agency

CIO
Chief Information Officer

Class 7 trucks
4 or more axles, single trailer

CNES
Comprehensive National Energy Strategy

COSEPUP
The Committee on Science, Engineering, and Public Policy of the National Academy of Science, National Academy of Engineering, and Institute of Medicine.

Cosmic background radiation
The universe is filled with the remnant heat from the Big Bang called the "cosmic microwave background radiation." Today, this radiation is very cold: only 2.728 degrees above absolute zero. It fills the universe.

COTS
Commercial off-the-shelf

CTBT
Comprehensive Test Ban Treaty

CVNX
New class of Navy nuclear-powered aircraft carrier

Cyber Security
Computer security

DARHT
Dual-Axis Radiographic Hydrodynamic Test Facility

Decision Unit
Decision Units represent the major program elements of the approved budget structure, which is used for formulation and decision-making purposes. A Decision Unit is usually a subset of an organization.

Depleted uranium
Uranium from which most of the uranium-235 has been removed.

DNA
Dioxyribonucleic Acid

DNFSB
Defense Nuclear Facilities Safety Board

DoD
Department of Defense

DOE
Department of Energy

DOELAP
DOE Laboratory Accreditation Program

DSW
Directed Stockpile Work

EIA
Energy Information Administration

EIS
Environmental Impact Statement

Electrochemical Sciences
Studies the use of electrical energy to bring about a chemical reaction or the generation of electrical energy by means of chemical action.

Electrolyte
A chemical compound (salt, acid, or base) that dissociates into electrically charged ions when dissolved in a solvent. The resulting electrolyte (or electrolytic) solution is an ionic conductor of electricity. Very often, the so formed solution itself is simply called an "electrolyte."

EMAB
Environmental Management Advisory Board

Environmental Restoration
The assessment, cleanup, and restoration of sites contaminated with radioactive or hazardous substances during past production or disposal activities.

EPA
Environmental Protection Agency

EPAct
Energy Policy Act of 1992

ER
Energy Resources

Ethanol
Ethyl Alcohol

Facilities Decommissioning
The process of removing a facility from operation, followed by decontamination, entombment, dismantlement, or conversion to another use.

FBI
Federal Bureau of Investigation

FEMA
Federal Emergency Management Agency

FEMP
Federal Energy Management Program

FEOSH
Federal Employees Occupational Safety and Health program

FFMIA
Federal Financial Management Improvement Act of 1996

FFRDCs
Federally-Funded Research and Development Centers

FMCT
Fissile Materials Cutoff Treaty

FMFIA
Federal Manager's Financial Integrity Act

FSU
Former Soviet Union

Fusion
The fusion of lightweight atomic nuclei

G-7 countries
Italy, France, Canada, Germany, United States, Japan, United Kingdom

GAO
U.S. General Accounting Office

GDP
Gross Domestic Product

General Goal
Included in a Strategic Plan, this goal defines how an agency will carry out its Mission over a period of time. The Goal is expressed in a manner, which allows a future assessment to be made of whether the Goal was or is being achieved. The goal may be of a programmatic, policy, or managerial nature. General Goals are predominately outcome-type goals.

Genome
One complete haploid set of chromosomes of an organism

Gigawatt
One billion watts

Global Climate Change
Climate change refers to the trends that persist for decades or even centuries, over and above natural seasonal and annual changes. Climate changes are influenced, among other things, by a natural "greenhouse" effect that maintains a warm and inhabitable Earth.

GMRA
Government Management and Reform Act of 1994

GPRA
Government Performance and Results Act of 1993

GW
Gigawatt, 1 billion watts

HEU
Highly enriched uranium. Uranium that contains the isotope uranium-235 in concentration of 20 percent or more. Naturally occurring uranium has a uranium-235 content of about 0.7 percent.

Higgs Boson or Bosons
Any subatomic particle, including photons and mesons, that does not obey the Pauli exclusion principle (the principle that no two electrons, protons, etc. in a given system can have the same set of quantum numbers and thus, cannot occupy the same space at the same time).

IAEA
International Atomic Energy Agency

Ion
An electrically charged chemical particle (atom, molecule, or molecule fragment). Anions are negatively charged, and cations are positively charged.

IPP
The Initiatives for Proliferation Prevention program is designed to prevent "brain drain" from Russia and other former Soviet states by creating civilian employment for former weapons scientists and workers.

ISM
Integrated Safety Management

IT
Information Technology

ºK
Kelvin, one degree Kelvin equals one degree Celsius

Km
Kilometer

LEU
Low enriched uranium. Uranium that contains the isotope uranium-235 in a concentration of less than 20 percent and greater than 0.7 percent. Most commercial reactor fuel is enriched to 5 percent or less uranium-235.

LLW
Low-level radioactive waste. Waste that contains radioactivity but is not classified as high-level waste, transuranic waste, spent nuclear fuel, or by-product material as defined by U.S. Department of Energy Order 5820.2A. Low-level waste is typically disposed of using shallow land burial.

Mixed oxide (MOX) fuel
MOX fuel is a blend of uranium dioxide [UO_2] and plutonium dioxide [PuO_2], which is fabricated into assemblies suitable for use in nuclear reactors. Commercial nuclear reactors in the United States use a low enriched uranium fuel.

MLLW or LLMW
Mixed low-level radioactive waste contains both hazardous waste under the Resource Conservation and Recovery Act and radioactive material, including sources, special nuclear, or by-product material subject to the Atomic Energy Act of 1954. Such waste has to be handled, processed, and disposed of in a manner that considers its chemical as well as its radioactive components.

MPC&A
Material protection, control, and accounting

mpg
Miles per gallon

MT
Metric tons

Muon Collider
A positively or negatively charged lepton with a mass 207 times that of an electron.

NEPA
National Environmental Policy Act

NERC
North American Electric Reliability Council

neutrino
Either of two leptons having a mass approaching zero and no charge.

NIF
National Ignition Facility

NIS
Newly Independent States

NNSA
National Nuclear Security Administration

NNSBL
National Nuclear Security Business Line

Nonproliferation Activities
DOE activities to reduce the threat of proliferation of weapons of mass destruction to the United States.

NRC
Nuclear Regulatory Commission

Nuclear Cities Initiative
The Nuclear Cities Initiative is designed to prevent "brain drain" from Russia and other former Soviet states by creating civilian employment for former weapons scientists and workers.

Nuclear Materials Safeguards
The DOE Nuclear Safeguards and Security programs provide for the protection of DOE's nuclear weapons, nuclear materials, classified information, and facilities.

Nuclear Materials Stabilization
DOE's activities that stabilize excess nuclear materials to achieve safe states for interim and long-term storage, pending disposition.

NWPA
Nuclear Waste Policy Act

NWSP
Nuclear Weapons Stockpile Plan

NWTRB
Nuclear Waste Technical Review Board

Objective
Included in a Strategic Plan. The objective(s) support a General Goal, and can be used to help assess whether a General Goal was or is being achieved. An Objective usually describes a more specific level of achievement than a General Goal.

OIG
Office of Inspector General

OMB
Office of Management and Budget

OSHA
Occupational Safety and Health Administration

P&F
Program and Financing schedules in the President's Budget Appendix.

PBSs
Project Baseline Summaries

PCAST
President's Committee of Advisors on Science and Technology

PEIS
Programmatic Environmental Impact Statement. A type of EIS that deals with broad strategies and decisions, such as those that are regional or national in scope.

Pentaflop
1,000 teraop or 1,000 trillion floating point operations per second.

Performance Indicator
A particular value or characteristic used to measure output or outcome. Performance Indicators are associated with Performance Goals in the Annual Performance Plan.

Performance Measure
A performance goal or performance indicator

Performance-Based Budgeting
The concept of Performance Budgeting is to link various budget levels with the desired results, so that for a given increase or decrease in budget, the impact on the outcome of the program can be determined.

Person-rem
The summation of individual radiation doses received by all those exposed to the source or event being considered is referred to as a collective dose. The collective radiation dose received by a population group is usually measured in units of person-rem. (A rem would be equivalent to one roentgen of X-ray or gamma-ray radiation.)

Plasmas
A high temperature, ionized gas composed of electrons and positively charged particles in such relative numbers that the gaseous medium is essentially electrically neutral.

PNGV
Partnership for a New Generation of Vehicles

Program Evaluation
An assessment, through objective measurement and systematic analysis, of the manner and extent to which Federal programs achieve intended objectives.

Pu
Plutonium. A heavy, radioactive, metallic element with the atomic number 94. Plutonium is produced artificially in a reactor by bombardment of uranium with neutrons and is used primarily in the production of nuclear weapons.

Quads
Quadrillion (1 with 15 zeros) British Thermal Units (BTU's)

Quasars
Any of the star like celestial objects that emit immense quantities of light and radio waves.

R&D
Research and Development

Radionuclides
A radioactive nuclide

RERF
Radiation Effects Research Foundation

SBA
Small Business Administration

Secretary of Energy Advisory Board (SEAB)
The Secretary of Energy Advisory Board (SEAB) was chartered in January 1990, to provide the Secretary with timely, balanced, external advice on issues of importance to the Secretary. SEAB replaced the Energy Research Advisory Board (ERAB) which had been in operation since 1978 as the principal scientific advisory committee to the Department of Energy. The mission of the Secretary of Energy Advisory Board is to provide advice, information, and recommendations to the Secretary of Energy on the Department's basic and applied research activities, economic and national security policy, educational issues, laboratory management, and on any other activities and operations of the Department of Energy as the Secretary may direct.

SIM
Strategic Information Management

SLEP
Stockpile Life Extension Program

SOLOMON
A DOE management information system that tracks actual performance against planned performance.

SPR
Strategic Petroleum Reserve

Stakeholders
Any person or organization interested in or potentially affected by activities and decisions of the U.S. Department of Energy.

START I
Strategic Arms Reduction Talks I

START II
Strategic Arms Reduction Talks II

START III
Strategic Arms Reduction Talks III

Strategic Plan
The Strategic Plan is required to be transmitted to

Congress every three years by the GPRA of 1993. The Strategic Plan covers a period of not less than five years forward from the fiscal year in which it is submitted.

SUV's
Sport utility vehicles

TEDE
Total effective dose equivalent

TEF
Tritium Extraction Facility

Teraop
1 trillion operations per second

Tesla
The international unit of measure of magnetic flux density, equal to one weber per square meter. One weber equals 108 maxwells. One maxwell is equal to the flux through one square centimeter normal to a magnetic field with intensity of one gauss. One gauss is equal to one line of magnetic flux per square centimeter.

Top Quark
A sub-atomic particle, the last undiscovered quark of the six predicted by current scientific theory, discovered at DOE's Fermi National Accelerator Laboratory.

Tritium
A radioactive isotope of hydrogen

UF_6
Uranium hexafluoride

USAID
U.S. Agency for International Development

USEC, Inc.
United States Enrichment Corporation

UV
Ultra-violet

VPP
Voluntary Protection Program

Waste Minimization
An action that economically avoids or reduces the generation of waste by source reduction, reducing the toxicity of hazardous waste, improving energy usage, or recycling.

WMD
Weapons of mass destruction

Workforce 21
In November 1998, shortly following his appointment as DOE Secretary, Bill Richardson launched a new initiative designed to build a talented and diverse workforce to carry out the Department's critical missions in the new millennium. His "Workforce for the 21st Century Initiative" focuses on strengthening the Department's technical and management capability through targeted hiring, career development, and workforce planning.

APPENDIX E: Contributors

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The Department of Energy would like to thank the many members of the DOE complex, other Federal agencies, Congressional staffers, stakeholders, and members of the public that have contributed to the development of this Strategic Plan.

Our Core Values

1. **We are public servants and customer-oriented.**
   - DOE is an agency of public servants.
   - Public service focuses our efforts on constituents.
   - Public service creates an esprit de corps within DOE.
   - Public service is an antidote to bureaucracy.
   - Our decisions and actions are responsive to our customer's needs.
   - We foster a participatory government in which the opinions and input of diverse stakeholders are sought and considered prior to making decisions.
   - We develop policies to address major challenges in a proactive, collaborative way with our customers and stakeholders.
   - We are open and honest and want to be trusted by our customers and stakeholders.

2. **We value public safety and respect the environment.**
   - We place a high priority on the protection of public health and safety in all of our operations.
   - We are committed to the restoration of the environment through cleanup of contamination caused by past operations.
   - We recognize the seriousness of the environmental impacts of our operations, and we develop and employ processes and technologies to reduce or eliminate waste production and pollution in these operations.
   - We will be a leader in improving the quality of the environment for future generations.

3. **We believe people are our most important resource and that they should be treated with fairness, respect, and dignity.**
   - We are committed to providing a safe and healthy workplace for all our employees and contractors.
   - We value the needs of individuals.
   - We reward employees based on performance.
   - We are committed to improving the knowledge, skills, and abilities of our employees.
   - We are committed to diversity.
   - We share credit with all contributors.
   - We value listening as an essential tool in learning from others.
   - Our employees are forthright in sharing their experiences so we can learn from each other.

4. **We value creativity and innovation.**
   - We are committed to a flexible operating environment that facilitates the pursuit of new technologies, processes, programmatic approaches, and ideas that challenge the status quo.
   - We seek out, nurture, and reward innovation in daily activities, ranging from the routine to the complex.
   - Our employees are empowered to pursue creative solutions.
   - We recognize and highly regard resourcefulness, efficiency, and effectiveness.
   - We consider adaptable, entrepreneurial approaches that can respond quickly to the rapidly changing world business and political environment to be essential.

5. **We are committed to excellence.**
   - We consider quality and continuous improvement essential to our success.
   - We are committed to excellence in everything we do.

6. **We work as a team and advocate teamwork.**
   - We reinforce the notion of a common or greater Departmental good and encourage interdepartmental teamwork to achieve this goal.
   - We value teamwork, participation, and the pursuit of win/win solutions as essential elements of our operating style.
   - We work as a team with other Federal agencies, government organizations, and external stakeholders in pursuing broader national objectives.
   - We recognize the needs of others for information, and we communicate knowledge and information in an open and candid manner.

7. **We recognize that leadership, empowerment, and accountability are essential.**
   - We are visionary in our everyday activities.
   - Our leaders trust and support individuals to make informed decisions about the processes they own.
   - We are effective stewards of the taxpayer's interests.
   - Our actions are result-oriented.

8. **We pursue the highest standards of ethical behavior.**
   - We maintain a personal commitment to professionalism and integrity.
   - We assure conformance with applicable laws, regulations, and responsible business practices.
   - We keep our commitments.
   - We are objective and fair.