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Before the
House Committee on Appropriations
Subcommittee on Energy and Water Development

FY 2004 Appropriations Hearing
March 17, 2004

Mr. Chairman and Members of the Committee, I am pleased to appear before you today to discuss the President's FY 2005 budget request for the Department of Energy, in particular activities in the area of energy and science.

As Secretary Abraham highlighted last week, we are requesting $24.3 billion in gross budget authority. Of the $24.3 billion, a total $4.2 billion is requested for programs in renewable energy, nuclear energy, science, and electricity transmission and distribution, which I will be discussing with you today. The FY 2005 budget request for these specific programs build on a number of successes achieved over the past three years. I applaud the accomplishments of the Department in terms of fulfilling the President's management vision for DOE and also what has been achieved for the national, energy, and economic security of the American people. I repeat Secretary Abraham's gratitude for the support and guidance the Members of this Committee have provided the Department.

As you now know, the Office of Management and Budget last month announced that DOE has made the most progress among cabinet-level agencies in the implementation of the President's Management Agenda. The Department, I am proud to say, was recognized as the cabinet-level agency "leading the pack with regard to management improvement," in the areas of human capital, competitive sourcing, financial management, e-government, and budget/performance integration.

In addition to the Department's successful implementation of the President's Management Agenda, I am also proud to mention the progress we've made thus far in our energy and science portfolio. For example, we have made tremendous progress in ensuring that nuclear power remains part of the Nation's fuel mix and continue to make great stride in advanced nuclear research. In addition to nuclear energy, we are pursuing other new technologies to meet future energy and environmental challenges. These are transformative technologies that will change the way we think about how we use and produce energy. We are pursuing a path toward a "hydrogen economy" -- with affordable zero emission fuel cell vehicles, abundant production sources, and safe storage and transportation of hydrogen.

We have also aggressively pursued international cooperation in order to advance our initiatives. In a variety of areas, especially those related to climate change, we have been able to create partnerships with other countries to develop the Department's cutting-edge science and technology. Our continued pursuit of fusion energy power through our participation in the

International Thermonuclear Experimental Reactor (ITER) project could hold great promise of helping meet our future energy demand. To ensure the reliability of our energy future, the Department will also be helping to modernize and facilitating expansion of our national electricity transmission grid to help prevent any future energy disruptions from reoccurring.

With that brief summary, I would now like to discuss in more detail the following Energy and Science programs:

THE OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

OVERVIEW

Research, development and deployment of advanced clean energy technologies are making a difference in the daily lives of Americans today and will make an even larger difference tomorrow. Advanced energy efficient technologies and practices that use less energy, as well as renewable energy technologies that produce power and heat more cleanly than conventional sources, are well on their way to becoming today's answers to tomorrow's energy and environmental challenges.

The overall EERE budget request for FY 2005 is a robust $1.25 billion, an increase of $15.3 million over the comparable FY 2004 appropriation. For the renewable energy programs funded through the Energy and Water Development appropriation, the FY 2005 request totals $374.8 million, a $17.3 million increase over the FY 2004 appropriation and 30 percent of the total EERE Budget.[1]

The renewable energy programs included in the Energy Supply account and funded solely within the Energy and Water Development appropriations include Hydrogen Technology, Solar Energy Technology, Wind and Hydropower Technologies, and Geothermal Technology. Activities in the Biomass Program and Intergovernmental programs are funded through both the Energy and Water Development and Interior and Related Agencies appropriations.

HYDROGEN TECHNOLOGY

The FY 2005 budget request for Hydrogen Technology is $95.3 million, a $13.3 million increase over the FY 2004 appropriation. Much of the proposed increase is for hydrogen safety research. This includes safety testing and analysis on bulk storage systems, fuel dispensing equipment, and piping to support new codes and standards specific to hydrogen. The Department has worked with the Department of Transportation and other agencies to coordinate our efforts on hydrogen

[1] Activities focused on energy conservation are funded through the Interior and Related Agencies appropriations bill.

codes and standards. Under this activity, we will also develop system safety requirements for producing hydrogen and sensors to detect hydrogen leaks.

Research undertaken in the Hydrogen Technology Program is also targeted to reduce the cost of distributed hydrogen production from electrolysis and natural gas reformation. An enhanced focus on electrolysis, as recommended by the National Research Council, may lead to production of hydrogen from renewable energy at $2.25 per gallon of gasoline equivalent by 2015. Considering the higher efficiency of hydrogen fuel cells compared with internal combustion engines that use gasoline, we believe that this price target will enable hydrogen fuel to be cost competitive.

Our hydrogen work is well integrated with the fuel cell and vehicle work funded through the Interior Appropriations bill. Taken together, these programs represent the majority of the Federal efforts comprising the Hydrogen Fuel Initiative announced by President Bush during his 2003 State of the Union Address. We have published very specific, measurable technical goals against which to measure our progress. If we achieve our technical objectives, the automotive and energy industries will be in a position to consider commercialization by 2015, with mass market availability of both vehicles and refueling infrastructure by 2020.

SOLAR ENERGY TECHNOLOGY

The Solar Energy Technology program focuses research on advanced solar devices that can provide the nation with a widely available domestic energy resource to help meet electricity needs and reduce the stress on our critical electricity infrastructure. Efforts are directed in the interrelated areas of Photovoltaics, Solar Heating and Lighting, and Concentrating Solar Power. The FY 2005 budget request for Solar Technology is $80.3 million. This is roughly equivalent to the FY 2004 appropriation of $83.4 million, which included $3.6 million earmarked to specific recipients.

Photovoltaic research and development seeks to reduce the manufacturing cost of highly reliable photovoltaic modules from $2.10/watt in 2003 to $1.85/watt by FY 2005, roughly equivalent to about 20 cents per kilowatt-hour (kWh). This price will enable expanded deployment of the technology in niche markets such as remote locations and areas where peak demand prices are high. Ultimately, we aim to reduce the cost to about 6 cents/kWh in order to be competitive in most markets. The program is focused on next-generation technologies such as thin-film photovoltaic cells and leap-frog technologies such as polymers and nanostructures. Systems engineering efforts seek to increase system durability and develop technologies to improve interconnections with the electric grid. The FY 2005 request of $75.4 million for photovoltaics includes: $30 million for critical fundamental research, including $2.1 million to equip a new Science and Technology Facility at the National Renewable Energy Laboratory; $29 million for advanced materials, including thin films and next generation materials with potential for dramatic cost reductions; and $16.4 million for technology development efforts to improve reliability of the entire system, including testing, verification, and deployment activities for grid-connected applications and analysis of private sector commercialization options.

WIND AND HYDROPOWER TECHNOLOGIES

Wind and Hydropower research and development supports the Nation's fastest growing and most widely used renewable energy resources. These technologies emit no air pollution or greenhouse gases**,** and they produce significant amounts of bulk power to help meet America's growing need for clean, domestic sources of electricity.

Since 2000, installed wind turbine capacity in the United States has more than doubled, driven in large part by the tremendous reductions in cost that have resulted from wind energy research. Our research contributed to reducing the cost of electricity generation by a factor of 20 since 1982, to four cents or less per kilowatt-hour in areas with excellent wind resources.

The FY 2005 budget request for Wind Energy is $41.6 million, $0.3 million more than the FY 2004 appropriation, which included $1.4 million in funds that were earmarked to specific recipients. The $12 million request for Low Wind Speed Technology research and development will support multiple large wind system technology pathways to achieve the goal of three cents per kilowatt-hour for onshore systems. It also supports new work in off-shore systems to help achieve a cost goal of five cents or less per kilowatt-hour. FY 2005 activities will include field testing of the first full-scale low wind speed technology prototype turbine and fabrication and testing of advanced drivetrains, power converter and blades for future low wind speed turbines. The $17 million request for supporting research and testing will engage the capabilities of the national labs, universities and private sector for technical support including both facility and field tests of newly developed components and systems to ensure design and performance compliance.

Hydropower is the most widely used form of renewable energy in the world today and accounts for about seven percent of total electricity generation in the United States and over 75 percent of domestic renewable electricity generation. The FY 2005 budget request for Hydropower Technologies is $6.0 million, a $1.1 million or 22 percent increase over the FY 2004 appropriation. The Department's research approach involves a unique combination of computer modeling, instrumentation, lab testing, and field-testing that is improving the design and operation of the next generation of hydropower technology. This request will support development of technologies that will enable hydropower operators at existing plants to generate more electricity with less environmental impact.

GEOTHERMAL TECHNOLOGY

The FY 2005 budget request for Geothermal Technologies is $25.8 million, a $0.3 million increase from the FY 2004 appropriation of $25.5 million. Geothermal energy generates electricity and provides heat for applications such as aquaculture, crop drying, and district heating, and for use in heat pumps to heat and cool buildings. The program focuses on developing technology that optimizes the use of geothermal energy through improved

exploration, drilling, reservoir engineering, and energy conversion. These technology improvements lead to cost-effective energy production at new geothermal fields and expanded production at existing fields.

BIOMASS AND BIOREFINERY SYSTEMS R&D

Biomass and Biorefinery Systems Research and Development focuses on advanced technologies to transform the Nation's domestic biomass resources into high value chemicals, fuels, and power. With the U.S. Department of Agriculture, the DOE biomass program leads the multi-agency Biomass R&D Initiative that coordinates all federal bioenergy research and development in accordance with the Biomass Research and Development Act of 2000.

In FY 2005, the Department is requesting $72.6 million for biomass program activities in the Energy and Water Appropriation, $13.9 million less than the FY 2004 appropriation. However, it is important to note that the FY 2004 appropriation required the use of $13 million in prior year balances, and most available balances were in the Biomass program. After accounting for the use of prior year balances, the actual new budget authority provided to the Biomass program in FY 2004 was $75.0 million, just slightly more than our FY 2005 request. Moreover, the FY 2004 appropriation included nearly $41 million, nearly half of the biomass budget, targeted to specific projects not identified in program plans.

Biomass activities funded through the Energy and Water appropriation focus on advanced biorefinery technologies to produce low cost sugars, syngas and pyrolysis oils. In FY 2005, the thermochemical program will test the continuous production, cleanup and conditioning of biomass syngas and pyrolysis oils suitable for conversion to fuels, chemicals or hydrogen, and examine the production of hydrogen from biomass via synthesis gas. Work will continue with industry on improved process integration capabilities for industrial biorefineries, and the program will evaluate existing partnerships for more productive and lower-cost cellulase enzyme systems. Additional partnerships may further improve the procession operations leading to cheaper biomass-based sugars. Projects to test and evaluate the performance and costs of converting corn fiber to fuels and co-products will also continue.

NATIONAL CLIMATE CHANGE TECHNOLOGY INITIATIVE COMPETITIVE SOLICITATION PROGRAM

This is the third year we have sought funding for the Competitive Solicitation Program as part of the President's National Climate Change Technology Initiative. The competitive solicitation process will seek to explore innovative, novel, high-impact climate change technology options that can complement and enrich, not duplicate, the existing portfolio of climate change-related research and applied technology. By stimulating research in these areas, the program hopes to broaden and strengthen the Federal portfolio and inspire private sector interest and international cooperation in a collaborative program of research investment aimed at accelerating technology

development and advancing the Administration's climate change goals. The Department is requesting $3 million in FY 2005 for this initiative.

THE OFFICE OF ELECTRIC TRANSMISSION AND DISTRIBUTION

OVERVIEW

The mission of the newly created Office of Electric Transmission and Distribution (OETD) is to lead a national effort to modernize and expand America's electricity delivery system to ensure a more reliable and robust electricity supply, as well as economic and national security. This is vital to the Department's strategic goal to protect our national and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy.

The August 14, 2003 blackout demonstrated the vulnerability of electric grid and thus its strategic importance to our Nation. President George Bush stated in September 2003: "…it's clear that the power grid needs an overhaul. It needs to be modernized. As we go into an exciting new period of American history, we want the most modern electricity grid for our people… we need more investment; we need research and development…"

We request $90.9 million for OETD in FY 2005 to increase reliability, a 12.5 percent increase over the FY 2004 comparable appropriation. This effort includes research, development, demonstration, technology transfer, and education and outreach activities in partnership with industry, businesses, utilities, States, other Federal programs and agencies, universities, national laboratories, and other stakeholders.

Neither government nor industry alone can satisfy the Nation's electric infrastructure needs. The *National Delivery Technologies Roadmap* provides a framework for all of the electric industry stakeholders to work together to achieve common aims. The call for grid modernization is coming from all levels of leadership. The President's 2004 State of the Union Address asking Congress to "modernize our electricity system" reiterated the Administration's objectives first outlined in the *National Energy Policy [May 2001]* and reinforced, in more detail, in the *National Transmission Grid Study (NTGS) [May 2002]*.

Modernizing the grid will involve time, resources, and unprecedented levels of cooperation. The nation's aging electric infrastructure, and the increasing requirements placed on it, have contributed to market inefficiencies and electricity congestion in several regions. These conditions could lead to more outages, more power quality disturbances, higher prices, and the less efficient use of resources. We must act now or risk even greater problems in the future.

THE GRIDWISE AND GRIDWORKS INITIATIVES

OETD's FY 2005 budget request, reflecting the Administration's efforts to modernize and expand the electric grid, includes $10.5 million for the new GridWorks Initiative and the existing GridWise Initiative, which are aimed at reducing the likelihood and impact of reliability events, such as blackouts.

GridWise denotes a modernized electric infrastructure framework where open, but secure, communication and information technologies, and associated standards, are used throughout the electric grid to enhance reliability and robustness, promote economic efficiencies, and provide value and choices to electricity consumers. The GridWise program activity (software-centric) comprises the intelligence – or brains – behind a modern electric grid that incorporates GridWorks (hardware-centric) technology.

GridWorks is focused on advanced equipment applications, taking an integrated approach to the entire electric system. It bridges the gap between the laboratory prototypes of the base programs and the application needs of the electric industry. GridWorks uses the facilities at DOE's national laboratories to accelerate the development and testing of advanced conductors, which can increase much needed transmission line capacity. It complements GridWise's architectural software development by developing and demonstrating associated hardware, such as sensors. GridWorks pursues advanced power electronic breakthroughs to provide faster means of limiting transmission problems before they propagate through the electric system.

HIGH TEMPERATURE SUPERCONDUCTIVITY.

OETD's FY 2005 budget request includes $45 million, a $10.9 million increase for High Temperature Superconductivity R&D to develop second generation wire usable in cables, generators, transformers, and motors – equipment that crosscuts the entire electric power value chain.

High temperature superconductors are a good example of advanced materials that have the potential to revolutionize electric power delivery in America. The prospect of transmitting large amounts of power through compact underground corridors, with minimal electrical losses and voltage drop over long distances, could significantly enhance the overall energy efficiency and reliability of the electric system, while reducing fuel use, air emissions, and any physical footprint. Also, breakthroughs in basic science are rapidly applied in the area of high temperature superconductivity. For instance, benefits from nanoscience research are accelerating progress in superconductivity wire development.

THE OFFICE OF NUCLEAR ENERGY, SCIENCE AND TECHNOLOGY

OVERVIEW

The FY 2005 budget request continues the Department's commitment to refining the benefits of nuclear power as a clean, reliable and affordable source of energy for this nation. The proposed $410 million investment in the Department's nuclear energy program includes funding to establish a new laboratory for nuclear energy research, development, demonstration and education; preconceptual design work for the Next Generation Nuclear Plant; continued work with utilities to pave the way for an industry order for a new nuclear power plant in the near future; and continued work with other countries to develop new reactor and fuel cycle technologies.

This budget request supports the President's priorities to fortify U.S. energy independence and security while making significant improvements in environmental quality through the deployment of non-emitting generation capacity by the end of the decade. It also strengthens our nation's nuclear education infrastructure, and recommends increased support for the Nuclear Hydrogen Initiative, which will take high temperature nuclear energy systems for clean hydrogen production from concept to reality. Finally, this request supports funds for the Advanced Fuel Cycle Initiative, which is aimed at developing proliferation-resistant fuel cycle technologies to reduce the volume and toxicity of commercial spent nuclear fuel and maximize energy from nuclear fuel.

I would like to explain in more detail how this budget proposal continues to advance the Department's nuclear energy initiatives.

DEVELOPMENT OF THE IDAHO NATIONAL LABORATORY

This budget supports the Secretary's realignment of the mission at the current Idaho National Engineering and Environmental Laboratory to focus on nuclear energy research and development. The Department is in the process of establishing the Idaho National Laboratory, which will combine the resources of the INEEL and the Argonne-West site. As the Department's leading center of nuclear research and development, a core mission of this laboratory is advanced nuclear reactor and fuel cycle technologies, including the development of space nuclear power and propulsion technologies. The new Idaho National Laboratory will play a vital role in the research and development of enabling technologies for the Next Generation Nuclear Plant, which will support the Department's long-term vision of a zero-emissions future, free of reliance on imported energy.

The Department's nuclear energy program involves the collective talents of universities, the private sector, international partners and many of our other national laboratories – Argonne, Los Alamos, Sandia and Oak Ridge among them. The rebuilding of the Department's nuclear power research and development program, however, will be centered at INL. While environmental

cleanup remains an important focus at the Idaho site, real progress is being made that will aid in the expansion of nuclear research and development. Within the 2005 budget, an additional $40.1 million is requested to manage laboratory infrastructure and security.

GENERATION IV NUCLEAR ENERGY SYSTEMS

The Generation IV program continues to support the Department's work to develop advanced reactor technologies for commercial deployment in the 2015 to 2030 timeframe. These advanced reactor concepts offer significant improvements in sustainability, proliferation resistance, physical protection, safety and economics. Generation IV nuclear energy systems will not only be safe, economic and secure, but also include energy conversion systems that produce valuable commodities such as hydrogen, desalinated water and process heat. These features make Generation IV reactors ideal for meeting the President's energy and environmental objectives.

The development of these reactors is being led by the Generation IV International Forum, a group of 10 leading nuclear nations (Argentina, Brazil, Canada, France, Japan, the Republic of Korea, the Republic of South Africa, Switzerland, the United Kingdom and the United States), plus Euratom. The forum has selected six promising technologies for next-generation nuclear energy systems. While the Department is supporting research on several reactor concepts, this budget proposal places priority on the Next Generation Nuclear Plant (NGNP), a Very-High Temperature Reactor. This emphasis reflects the NGNP's potential to economically and safely produce electricity and hydrogen without emitting greenhouse gases. FY 2005 NGNP activities will be focused on the research and development of fuels and structural materials for high-temperature, high-radiation environments, and continuing the preconceptual design activities initiated in FY 2004. Research and development for the other Generation IV systems will focus on establishing technical and economic viability and the resulting core and fuel designs and materials requirements.

NUCLEAR HYDROGEN INITIATIVES

Hydrogen offers significant promise as a future energy technology, particularly for the transportation sector. The use of hydrogen in transportation will reduce U.S. dependence on foreign sources of petroleum. Significant progress in hydrogen combustion engines and fuel cells is making transportation by hydrogen a reality. The goal of the Nuclear Hydrogen Initiative is to demonstrate the economic, commercial-scale production of hydrogen using nuclear energy. If successful, this research could lead to a large-scale, emission-free domestic hydrogen production capability to fuel a future hydrogen economy.

The Nuclear Hydrogen Initiative will focus primarily on hydrogen production technologies that utilize high-temperature nuclear reactors to produce hydrogen, which then could supplant fossil fuels in our transportation system. With funding of $9 million in FY 2005, the Nuclear Hydrogen Initiative will move toward demonstrating nuclear-based hydrogen producing

technologies in the laboratory, study potential hydrogen production schemes, and develop deployment alternatives to meet growing hydrogen demand.

As previously noted, the Generation IV program priority is on the Next Generation Nuclear Plant, which utilizes a Very-High-Temperature Reactor for advanced hydrogen production and electricity generation. Investigating and demonstrating the Generation IV nuclear energy systems will require advances in materials and systems technology, including development of high temperature and corrosion-resistant materials, and advanced chemical systems analysis. NE is working in close cooperation with the Department's Office of Science, through the Future Energy Advanced Materials Initiative, to evaluate common areas of research to develop advanced materials for use in nuclear hydrogen systems, as well as Generation IV Nuclear Energy Systems.

ADVANCED FUEL CYCLE INITIATIVE

Of all the challenges affecting the expansion of nuclear energy in the U.S. and worldwide, none is more important or more difficult than dealing effectively with spent nuclear fuel. After a long and difficult process, the country is moving forward with licensing a geologic repository for spent nuclear fuel. This is an absolute necessity, even as the Department develops advanced forms of spent nuclear fuel treatment. The Department plans to submit a license application for the repository to the Nuclear Regulatory Commission by the end of 2004.

Research on improving ways to treat and utilize materials from spent nuclear fuel will allow the Department to optimize the first repository, and delay – and perhaps even eliminate – the need for future repositories. The Advanced Fuel Cycle Initiative, with an investment of $46 million for FY 2005, will continue the progress made in the development of proliferation-resistant treatment and transmutation technologies that can reduce both the volume and toxicity of spent nuclear fuel. These technologies would support both national security and energy independence by reducing inventories of commercially-generated plutonium while recovering residual energy value from spent nuclear fuel.

The Department is proposing a research program leading to a demonstration of proliferation-resistant fuel treatment technology to reduce the volume of high-level waste, and the development of advanced fuels that could allow the consumption of plutonium using existing light water reactors, or advanced gas reactors. Under the President's request, the Department will continue work toward demonstration of proliferation-resistant fuel treatment technology and continue design and testing of transmutation fuels for future use with current reactor technologies.

For the Advanced Fuel Cycle Initiative to be successful, advanced fuel treatment and transmutation research and development must be integrated with the development of Generation IV nuclear energy systems, particularly with those reactor technologies that can produce very high neutron levels that would be needed to transmute a wide variety of toxic radioactive species.

To support this goal, the Advanced Fuel Cycle Initiative will develop the advanced proliferation resistant fuels and fuel cycle systems for Generation IV reactors.

NUCLEAR POWER 2010

The President's Budget supports continuation of Nuclear Power 2010 in FY 2005 to demonstrate, in cost-shared cooperation with industry, key regulatory processes associated with licensing new nuclear plants in the U.S. The requested funds of $10 million would support the activities associated with achieving NRC approval of early site permits and development of Combined Construction and Operating License applications.

UNIVERSITY REACTOR INFRASTRUCTURE AND EDUCATION INITIATIVE

For years, the Energy Department has sponsored an initiative that supports nuclear science and technology educational infrastructure through our University Reactor Infrastructure and Education Initiative. This program is essential to the continued operation of the nation's university research and training reactors, which play a vital role in supporting nuclear education and training.

The growth of nuclear energy in the United States is dependent on the preservation of the education and training infrastructure at universities. Research conducted using these reactors is critical to many national priorities. Currently there are 27 operating university research reactors at 26 campuses in 20 states. These reactors are providing support for research in nuclear engineering and other fields dependent upon nuclear science, including medical isotopes, human health, life sciences, environmental protection, advanced materials, lasers, energy conversion and food irradiation.

Beyond technology and equipment, DOE's university program supports the personnel required for a strong nuclear energy future. The demand for trained and qualified nuclear scientists currently exceeds supply. The FY 2005 budget request includes $21 million for fellowships, scholarships, nuclear engineering research, and for critical support to university research reactors – all of which will help address the shortage of well-trained nuclear scientists.

THE OFFICE OF SCIENCE

OVERVIEW

The FY 2005 budget request for the Office of Science is $3.432 billion, a $68.5 million decrease from the FY 2004 appropriation levels. When $140.8 million for FY 2004 Congressionally-directed projects is set aside, there is an increase of $72.3 million in FY 2005. When compared to

the FY 2004 comparable President's Request, the FY 2005 request increases $104.9 million or 3.2 percent. This request allows us to increase support for high priority scientific research, increase operations at our key scientific user facilities, keep existing construction projects on schedule, and support new initiatives. This request, coming at a time of tight overall Federal budgets, is also a demonstration of the Administration's support for basic research and the role that fundamental science plays in keeping our Nation strong and secure.

The Office of Science plays four key roles in the U.S. research effort. *We provide solutions to our Nation's energy challenges*, contributing essential scientific foundations to the energy, national, and economic security missions of the U.S. Department of Energy (DOE). *We are the Nation's leading supporter of the physical sciences*, investing in research at over 280 universities, 15 national laboratories, and many international research institutions. *We deliver the premier tools of science to our Nation's science enterprise*, building and operating major research facilities for open access by the science community. *We help keep the U.S. at the forefront of intellectual leadership*, supporting the core capabilities, theories, experiments, and simulations to advance science.

This FY 2005 budget request will set us on the path toward addressing the challenges that face our nation in the 21st Century. The Office of Science has recently released *Facilities for the Future of Science: A Twenty-Year Outlook* which sets an ambitious agenda for scientific discovery over the next two decades. The priorities established in this plan—which is not a budget document—reflect national priorities set by the President and the Congress, our commitment to the missions of the Department of Energy, and the views of the U.S. scientific community. Pursuing these priorities will be challenging, but they hold enormous promise for the overall well-being of all of our citizens. In February 2004 we released an updated *Office of Science Strategic Plan* that is fully integrated with the Facilities Plan, the Department's new Strategic Plan, and the President's Management Agenda – including the R&D Investment Criteria and OMB's Program Assessment Rating Tool. The FY 2005 budget request begins to implement these plans.

DOE's Office of Science leads the world in the conception, design, construction, and operation of these large-scale devices. These machines have enabled U.S. researchers to make some of the most important scientific discoveries of the past 70 years, with spin-off technological advances leading to entirely new industries. More than 19,000 researchers and their students from universities, other government agencies (including the National Science Foundation and the National Institutes of Health), private industry, and those from abroad use DOE facilities each year. These users are both growing in number and diversity.

We credit our outstanding track record in construction to a highly effective management and review process. We have been so successful that our process is now considered a "best practice" across the U.S. government by OMB and OSTP, and we are being consulted by CERN, Europe's premier particle physics laboratory, on construction of their Large Hadron Collider, a facility to which the United States (through a partnership between the Office of Science and the National Science Foundation) is contributing $531 million.

Because of the extraordinarily wide range of scientific disciplines required to support facility users at national laboratories, and the diversity of mission-driven research supported by the Office of Science, we have developed an interdisciplinary capability that is extremely valuable to some of the most important scientific initiatives of the 21st Century. There is also a symbiotic relationship between research and research tools. Research efforts advance the capabilities of the facilities and tools that in turn enable new avenues of research.

The Office of Science funds research at DOE's national laboratories and at 280 colleges and universities located across the country. Excluding funds used to construct or operate our facilities, approximately half of our base research funding goes to support research at universities and institutes. Academic scientists and their students are funded through peer-reviewed grants, and SC's funding of university research has made it an important source of support for graduate students and postdoctoral researchers in the physical sciences during their early careers.

Office of Science research programs are managed in seven major areas, including an enhanced effort in Workforce Development for Teachers and Scientists.

ADVANCED SCIENTIFIC COMPUTING RESEARCH (ASCR)

ASCR significantly advances scientific simulation and computation, applying new approaches, algorithms, and software and hardware combinations to address the critical science challenges of the future, and provides access to world-class, scientific computation and networking facilities to the Nation's scientific community to support advancements in practically every field of science and industry. The ASCR budget also supports the *Scientific Discovery through Advanced Computing (SciDAC)* program — a set of coordinated investments across all Office of Science mission areas with the goal of achieving breakthrough scientific advances via computer simulation that were impossible using theoretical or laboratory studies alone.

The FY 2005 budget includes $204 million for ASCR to advance U.S. leadership in high performance supercomputing, networking and software development to continue to advance the transformation of scientific simulation and computation into the third pillar of scientific discovery. The request includes $38 million for the *Next Generation Computer Architecture (NGA)* to acquire additional advanced computing capability for existing users, and for longer-term research and development on new architectures for scientific computers. Enhancements are supported for ASCR facilities – the Energy Sciences Network (ESnet) and the National Energy Research Scientific Computing Center (NERSC). The request also includes $8.5 million for the new *Atomic to Macroscopic Mathematics* research effort to provide the research support in applied mathematics needed to break through the current barriers in our understanding of complex physical processes.

BASIC ENERGY SCIENCES (BES)

The BES program is a principal sponsor of fundamental research for the Nation in the areas of materials sciences and engineering, chemistry, geosciences, and bioscience as it relates to energy. This research underpins the DOE missions in energy, environment, and national security; advances energy-related basic science on a broad front; and provides unique user facilities for the scientific community and industry.

For FY 2005, the Department requests $1.064 billion for BES including $209 million to continue to advance nanoscale science through atomic- and molecular-level studies in materials sciences and engineering, chemistry, geosciences, and energy biosciences. This supports Project Engineering Design (PED) and construction on four Nanoscale Science Research Centers (NSRCs) and a Major Item of Equipment for the fifth and final NSRC. NSRCs are user facilities for the synthesis, processing, fabrication, and analysis of materials at the nanoscale. The request also includes $80.5 million for construction and $33.1 million for operation of the Spallation Neutron Source and $50 million for design and long lead procurement of the Linac Coherent Light Source, a revolutionary x-ray laser light source. With these tools, we will be able to understand how the compositions of materials affect their properties, watch proteins fold, see chemical reactions, and design matter for desired outcomes.

The FY 2005 budget request also includes $29 million for activities that support the President's Hydrogen Fuel Initiative. This research program is based on the BES workshop report *"Basic Research Needs for the Hydrogen Economy",* which highlights the enormous gap between our present capabilities and those required for a competitive hydrogen economy.

BIOLOGICAL AND ENVIRONMENTAL RESEARCH (BER)

BER advances energy-related biological and environmental research in genomics and our understanding of complete biological systems, such as microbes that produce hydrogen; in climate change, including the development of models to predict climate over decades to centuries; developing science-based methods for cleaning up environmental contaminants; in radiation biology, providing regulators with a stronger scientific basis for developing future radiation protection standards; and in the medical sciences, by developing new diagnostic and therapeutic tools, technology for disease diagnosis and treatment, non-invasive medical imaging, and biomedical engineering such as an artificial retina that will restore sight to the blind. For FY 2005, the Department requests $502 million for BER which does not include continued support for the $141 million in Congressional earmarks from FY 2004.

Research on microbes through the *Genomics: GTL* program, addressing DOE energy and environmental needs, continues to expand from $63.4 million in FY 2004 to $67.5 million in FY 2005. The request also supports initiation of Project Engineering Design (PED) activities for the GTL Facility for the Production and Characterization of Protein and Molecular Tags, a facility that will help move the excitement of the *Genomics: GTL* systems biology research program to a

new level by greatly increasing the rate and cost-effectiveness with which experiments can be done. DOE, through the *Genomics: GTL* program, will attempt to use genetic techniques to harness microbes to consume pollution, create hydrogen, and absorb carbon dioxide.

FUSION ENERGY SCIENCES (FES)

The FES program advances the theoretical and experimental understanding of plasma and fusion science, including a close collaboration with international partners in identifying and exploring plasma and fusion physics issues through specialized facilities. This includes: 1) exploring basic issues in plasma science; 2) developing the scientific basis and computational tools to predict the behavior of magnetically confined plasmas; 3) using the advances in tokomak research to enable the initiation of the burning plasma physics phase of the Fusion Energy Sciences program; 4) exploring innovative confinement options that offer the potential of more attractive fusion energy sources in the long term; 5) focusing on the scientific issues of nonneutral plasma physics and High Energy Density Physics; 6) developing the cutting edge technologies that enable fusion facilities to achieve their scientific goals; and 7) advancing the science base for innovative materials to establish the economic feasibility and environmental quality of fusion energy.

When the President announced that the U.S. would join in the International Thermonuclear Experimental Reactor (ITER) project he noted that "the results of ITER will advance the effort to produce clean, safe, renewable, and commercially available fusion energy by the middle of this century." To this end, the Department continues its commitment to the future of Fusion Energy Science research with a FY 2005 request of $264.1 million, slightly above the FY 2004 level. Within that amount, DOE's funding in preparation for ITER in FY 2005 is $38 million, $30 million more than last year. Of this $38 million, $7 million is for engineers who support the International Team and for the qualification of vendors for superconducting cable. The other $31 million is for experiments on our tokamak facilities and for component R&D in our laboratories and universities that is closely related to our ongoing program but which is focused on ITER's specific needs. It is important for me to stress that this means that some U.S. scientists and engineers will be doing different, not less, research under the President's request.

Fabrication of the National Compact Stellarator Experiment (NCSX) will continue with a target of FY 2008 for the initial operation of this innovative new confinement system that is the product of advances in physics understanding and computer modeling. In addition, work will be initiated on the *Fusion Simulation Project* to provide an integrated simulation and modeling capability for magnetic fusion energy confinement systems over a 15-year development period. The Inertial Fusion Energy research program will be redirected toward high energy density physics research based on recommendations of the recently established Interagency Task Force on High Energy Density Physics.

HIGH ENERGY PHYSICS (HEP)

HEP advances understanding of dark energy and dark matter, the striking imbalance of matter and antimatter in the current universe, the basic constituents of matter, and the possible existence of other dimensions, collectively revealing the key secrets of the birth, evolution, and final destiny of the universe. HEP expands the energy frontier with particle accelerators to study fundamental interactions at the highest possible energies, which may reveal the rest of the universe: new particles, new forces or undiscovered dimensions of space and time; explain how everything came to have mass; and illuminate the pathway to the underlying simplicity of the universe.

For FY 2005, the Department requests $737 million for the HEP program, about the same as in FY 2004. Highest priority in HEP is the operations, upgrades and infrastructure for the two major HEP user facilities at the Fermi National Accelerator Laboratory (Fermilab) and the Stanford Linear Accelerator Center (SLAC), to maximize the scientific data generated.

In FY 2005, the Neutrinos at the Main Injector (NuMI) facility will be completed and the beam line will be commissioned. The FY 2005 budget request also supports engineering design activities for a new Major Item of Equipment, the BTeV ("B Physics at the TeVatron") experiment at Fermilab to extend current investigations that use modern detector technology to increase our data rate by more than two orders of magnitude. Research, development and design funding continues in FY 2005 on the proposed Supernova Acceleration Probe (SNAP) experiment for the DOE/NASA Joint Dark Energy Mission (JDEM).

NUCLEAR PHYSICS (NP)

NP supports innovative, peer reviewed scientific research to advance knowledge and provide insights into the nature of energy and matter, and in particular, to investigate the fundamental forces which hold the nucleus together, and determine the detailed structure and behavior of the atomic nuclei. Nuclear science plays a vital role in studies of astrophysical phenomena and conditions of the early universe. At stake is a fundamental grasp of how the universe has evolved, an understanding of the origin of the elements, and the mechanisms of supernovae core collapse. The program builds and supports world-leading scientific facilities and state-of-the-art instruments necessary to carry out its basic research agenda. Scientific discoveries at the frontiers of Nuclear Physics further the nation's energy-related research capacity, which in turn provides for the nation's security, economic growth and opportunities, and improved quality of life.

The FY 2005 budget request of $401 million gives highest priority to exploiting the unique discovery potentials of the facilities at the Relativistic Heavy Ion Collider (RHIC) and Continuous Electron Beam Accelerator Facility (CEBAF) by increasing operating time by 26% compared with FY 2004. R&D funding is provided for the proposed Rare Isotope Accelerator (RIA) and 12 GeV upgrade of CEBAF at Thomas Jefferson National Accelerator Facility.

Operations of the MIT/Bates facility will be terminated as planned, following three months of operations in FY 2005 to complete its research program. This facility closure follows the transitioning of operations of the Lawrence Berkeley National Laboratory 88-Inch Cyclotron in FY 2004 from a user facility to a dedicated facility for the testing of electronic circuit components for use in space (using funds from other agencies) and a small in-house research program. These resources have been redirected to better utilize and increase science productivity of the remaining user facilities and provide for new opportunities in the low-energy subprogram.

WORKFORCE DEVELOPMENT FOR TEACHERS AND SCIENTISTS

The mission of the Workforce Development for Teachers and Scientists program is to continue the Office of Science's long-standing role of training young scientists, engineers, and technicians in the scientifically and technically advanced environments of our National Laboratories.

The FY 2005 budget request of $7.66 million provides $1.5 million for a *Laboratory Science Teacher Professional Development* activity. About 90 participating teachers will gain experience and enhance their skills at five or more DOE laboratories in response to the national need for science teachers who have strong content knowledge in the classes they teach. A new $0.5 million *Faculty Sabbatical Fellowship* activity will provide sabbatical opportunities for 12 faculty from minority serving institutions (MSIs). This proposed activity is an extension of the successful *Faculty and Student Teams* (FaST) program where teams of faculty members and two or three undergraduate students, from colleges and universities with limited prior research capabilities, work with mentor scientists at a national laboratory to complete a research project that is formally documented in a paper or presentation.

CLOSING

The Department's FY 2005 request reflects the accomplishments of the last three years, the successes and the many changes. It charts a focused course of investment for the nation's future -- one guided by a cohesive mission and targeted performance metrics. Making all of this work are the extremely talented men and women of the Department of Energy which include the world's top engineers and scientists. It is a privilege to work alongside them on a common mission. It is an honor to serve a President who has provided this vision of what this Department can – and will – accomplish in FY 2005 and beyond.

Thank you. This concludes my formal statement. I would be pleased to answer any questions you may have at this time.