Department of Energy

Annual Implementation Plan for FY 2002

January 1, 2002

Contents

Executive Summary

The central steam-heating distribution system at DOE's Grand Junction Project Office was replaced with individual water boilers resulting in a 37% reduction in annual gas costs.

The Department of Energy (DOE) has led other Federal agencies in the reduction of energy use since 1985. During this time, DOE has reduced its energy use in buildings by 43 percent, already achieving the Executive Order 13123 (EO) goal of a 35 percent reduction by 2010. This energy reduction was achieved through energy retrofit projects, changes in mission and other operational changes in facilities and is saving DOE over $100 million annually.

In FY 2002, DOE will continue to champion the cause of continuous improvement in energy efficiency. In addition to this leadership role DOE will review existing operating and administrative processes and conservation programs and identify and implement ways to further reduce energy use in accordance with the Presidential Directive of May 3, 2001, "Energy Conservation at Federal Facilities." We will negotiate performance agreements with the DOE Field Offices and sites in accordance with our new performance based DOE Order "Departmental Energy and Utilities Management." These Energy and Utility Management Performance Agreements will be negotiated by Headquarters with the DOE Field Offices. The DOE Field Offices will then have the lead in negotiating energy conservation performance objectives, measures and annual expectations with their Management and Operating Contractors who operate many of the DOE sites.

DOE intends to accomplish the following objectives during FY2002:

- **Perform Energy and Water Audits at 3 sites.**
- **Review or finalize proposals for Energy Savings Performance Contracts (ESPCs) at six sites, with a total investment of over $30 million.**
- **Establish Utility Energy Services Contracts (UESCs) at two sites at an investment cost of $10 million.**
- **Evaluate DOE office buildings with metered data for Energy Star labels, and develop metering plans for additional DOE office buildings.**
- **Obtain the Energy Star Buildings label for at least one office building.**
- **Emphasize sustainable building design practices at DOE sites.**
- **Encourage energy efficiency provisions in building leases.**
- **Invite Energy Service Companies (ESCOs) and Utilities to propose efficiency improvements for industrial processes at DOE sites.**
- **Encourage DOE sites using ESPC to bundle renewable energy technologies with other energy conservation technologies.**
- **Require all sites to develop Water Management plans and to use Best Management Practices.**
- **Re-commission buildings on at least two DOE sites.**
- **Fund 5 energy management retrofit projects.**
- **Accomplish energy savings in two DOE surplus facilities.**
- **Update existing curtailment plans for electricity load reduction in accordance with the Federal Directive Plan of Action.**

Background

DOE Facilities

DOE owns or leases over 12,000 buildings at over 50 sites throughout the United States. Currently occupied buildings comprise 96.2 million gross square feet, which is divided into laboratory space (23%), production space (34%), office space (14%) and other activities such as storage and service space (29%). The buildings are under the stewardship of major DOE Operations and Field Offices (Figure1).

In 2000, in the standard buildings category, DOE facilities used approximately 250,000 Btu per gross square foot, compared to approximately 450,000 Btu per gross square foot in 1985. DOE has reduced its energy use in buildings by 43 percent since 1985. Energy costs in the standard buildings category in 2000 were $162 million. The remainder of DOE's energy costs occurred in energy-intensive industrial, laboratory, and research facilities that fluctuate directly with mission support activities. These facilities consume approximately 580,000 Btus per gross square foot, compared to approximately 1,350,000 Btu per gross square foot in 1985.

Figure 1: Major DOE Field Offices

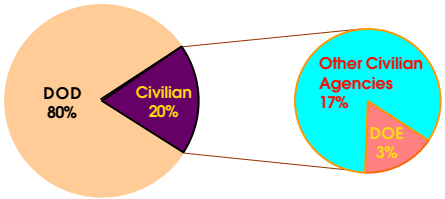
About 2,000 (17%) of DOE's buildings were originally designed and constructed to support Cold War objectives and are no longer needed. These excess buildings constitute 17.1 million gross square feet and use about 6.7 trillion Btu annually, at a cost of about $52 million. DOE is currently pursuing the use of Energy Savings Performance Contracts as a method of funding the decommissioning and deactivation of surplus buildings.

The U.S. Department of Energy has accomplished an ESPC for its lighting systems at its headquarters building in Washington, DC, and is exploring other cost effecive improvements.

DOE Progress toward Energy Reduction Goals

DOE has the second largest energy consumption of all civilian agencies (Figure 2). Through an active utility management program, DOE has the lowest average unit cost for electricity in the Federal government. DOE has led other Federal agencies in reducing its energy consumption and accounting for over $100 million in annual avoided costs.

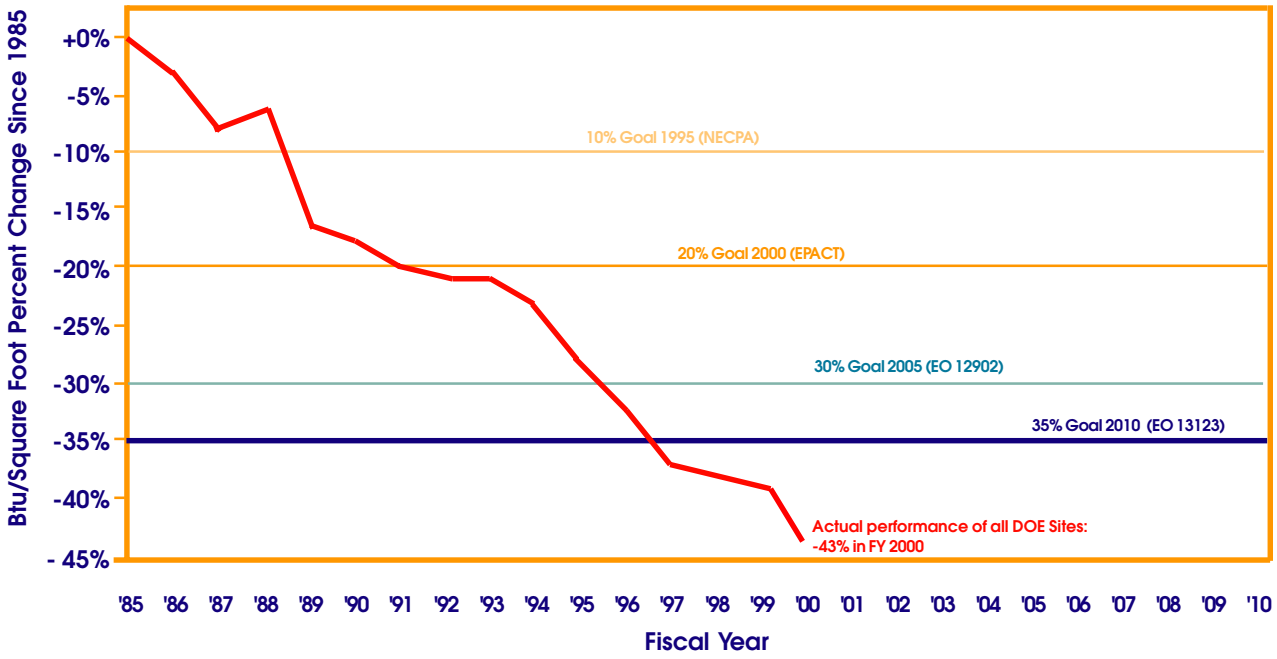
Figure 2: DOE Share of Federal Government Energy Consumption



In FY 2000, DOE exceeded all Federal energy reduction requirements by reducing energy consumption in its buildings by more than 43 percent in Btu per gross square foot compared to FY 1985 (Figure 3). DOE achieved greater than an 8 percent reduction in energy use per square foot in buildings in FY 2000 over the previous year (from 272,000 to 250,000 Btu per gross square foot), and a savings in utility costs for all facilities of approximately $25 million. Reductions in DOE's consumption in FY 2000 are partially due to mission-related activities and overall downsizing of operations and facilities. These reductions in energy consumption also reduced emissions of greenhouse gases by 22.4 percent from FY 1990 levels, or 1.3 million tons-

equivalent to removing over 900,000 cars from the road. In addition to energy consumption reductions, emissions reductions were accomplished by switching from fuel oil and coal to less greenhouse gas-intensive fuels. Coal and fuel oil use from FY 1990 levels was reduced 70 percent and 56 percent, respectively. The savings to the tax payers in fuel oil and coal costs alone during FY 2000 as compared to FY 1990 was almost $7 million.

Figure 3: DOE Performance Toward Energy Reduction Goals for Buildings



Federal Facilities Report

Energy Management Infrastructure

The Senior Official

The Assistant Secretary for Energy Efficiency and Renewable Energy, Mr. David Garman, is the Senior Agency Official responsible for advocating policy, programs, and new initiatives to take appropriate actions to conserve energy at DOE facilities to the maximum extent consistent with the effective discharge of public responsibilities. The head of this organization is ideally suited to the role of the Senior Agency Official, since the organization is responsible for conducting research in energy conservation and renewable energy technologies and for accomplishing energy conservation actions at DOE facilities through the Federal Energy Management Program. The Director of the Federal Energy Management Program (FEMP), Ms. Beth Shearer, will be the Agency Official responsible for implementing the policies, programs, and new initiatives of the Assistant Secretary at DOE facilities and for accomplishing the requirements of the Presidential Directive of May 3, 2001, "Energy Conservation at Federal Facilities."

The Agency Energy Team

The Agency Energy Team at headquarters is The Energy Management Steering Committee (EMSC) which is comprised of senior level representatives from each of the major DOE

The National Renewable Energy Laboratory's Thermal Testing Facility is being used to show how sustainable design strategies can be integrated into a variety of commercial buildings, offices, warehouses, and institutional facilities. Each innovative "air tree" shown above provides ventilation for six offices.

programs responsible for implementation of DOE's mission at the sites. The EMSC is chaired and reports its progress through Victor Petrolati of the FEMP's Departmental Utilities and Energy Management Team. The EMSC reviews proposed implementation policy and plans to ensure compatibility with mission requirements and to facilitate implementation within their programs and at the sites. The major DOE program offices and their program representatives are:

National Nuclear Security Administration – John Ordaz;
Office of Environmental Management – Susan Weber;
Office of Science – Arnold Edelman;
Office of Energy Efficiency and Renewable Energy – Marv Gorelick;
Office of Fossil Energy – Craig Zamuda;
Office of Nuclear Energy, Science, and Technology – Rajendra Sharma;
Office of Environment, Safety, and Health – Ted Koss;
Office of Management and Administration – Doug Bielan and Thomas Brown;
Office of General Counsel – Lawrence Oliver and Francine Pinto;
Office of Chief Financial Officer – Joann Luczak and James Cayce.

In addition to the energy team at headquarters, DOE also has a team of energy management professionals from headquarters, DOE Field Offices and sites called the Energy Efficiency Working Group (EEWG) which is sponsored by FEMP. This group has a goal of promoting excellence in energy management through the active exchange of timely management and technical information. Working meetings are conducted 2-3 times a year. The chair is Mike Holda of Lawrence Berkeley National Laboratory.

The Departmental Utilities and Energy Management Team

The Departmental Utilities and Energy Management Team is the expert staff within the Federal Energy Management Program who advocate energy efficiency and the cost effective acquisition of energy supplies and services for DOE facilities. The team provides support to the EMSC, EEWG, and Senior Agency Official by drafting plans and policy, budgets, and reports for DOE's energy and utility management efforts. They also draft the Energy and Utilities Management Performance Agreements which are negotiated with the DOE Operations and Field Offices.

DOE Energy Coordinators and Utility Coordinators

The DOE Energy Coordinators and Utility Coordinators are designated persons at DOE Operation Offices and Field Offices responsible for acquiring utility services and for coordinating energy conservation actions and other energy initiatives at the sites. Implementation is carried out primarily through Management and Operating Contractors since the majority of DOE sites are managed and operated by the private sector or not-for-profit divisions of universities.

Site Energy Coordinators

Site energy coordinators are individuals designated by their site management as responsible for advocating energy efficiency at the site. These individuals prepare plans and reports, often initiating projects and support activities and other DOE energy management projects at their sites.

Awards

DOE uses employee incentive programs to recognize outstanding contributions toward energy and dollar savings at DOE facilities and field organizations. Each year, DOE holds its Annual Departmental Energy Management Awards ceremony, which was established in 1979. The awards are held at DOE's Washington, DC headquarters in October to coincide with Energy Awareness Month.

DOE's Solar Energy Research Facility uses state-of-the-art solar and renewable energy technologies.

During FY 2002, DOE will honor DOE and contractor employees for implementing projects that have contributed significantly toward achieving energy management goals.

Performance Evaluations

Facility managers and energy managers will be judged on their performance and progress toward meeting the goals of Executive Order 13123. Evaluations for these staff members will consist partly of self-assessments based on the Performance Objectives agreed to in the prior year Performance Agreements. In addition, the Departmental Utilities and Energy Management Team will conduct field-office level evaluations based on the same Performance Objectives.

A comparison then will be made between the self-assessments and the annual reports provided by the sites and field elements. Discrepancies will be reconciled. The evaluations will be provided to the appropriate Program Office and the Senior Energy Official for review, with potential recommendations for improvement.

Training and Education

During FY 2002, DOE is expecting to provide formal energy management training to over 300 DOE employees. DOE will continue to offer training to energy and utility coordinators in the areas of life-cycle costing, basic energy management, acquisition of energy supplies, and acquisition of energy- efficient products. DOE Energy Coordinators along with other Federal participants will receive training at the Energy 2002 Conference. In addition, at least one new energy coordinator at a DOE field office will receive one-on-one training by a member of DOE's Energy and Utilities Management Team.

Showcase Facilities

Several high-profile DOE areas and buildings have received the Federal Energy Saver Showcase label. In FY 2001, the Fermi National Accelerator Laboratory received a designation from FEMP as a Federal Energy Saver Showcase facility. Showcase facilities represent some of the best examples of energy efficiency and renewable energy technologies in the Federal sector. DOE hopes to continue receiving this recognition in FY 2002.

Implementation Strategies

In FY 2002, in accordance with the Presidential Directive of May 3, 2001, "Energy Conservation at Federal Facilities," DOE will continue to review its existing operating and administrative processes and conservation programs and identify and implement ways to reduce energy use through the following strategies:

1. Expanding the use or initiating new energy savings performance contracts (ESPCs) and utility energy service contracts (UESCs);
2. Auditing of DOE facilities to identify future energy retrofit projects and to accelerate the replacement of inefficient equipment;
3. Auditing DOE facilities for water savings opportunities or implementing FEMP's best management water practices;
4. Evaluating DOE office buildings with metered energy use data for Energy Star labels, developing metering plans for evaluating buildings that do not currently have metered data or improving the energy efficiency of buildings that do not qualify for Energy Star labels;
5. Evaluating methods for reducing energy consumption in surplus facilities;
6. Evaluating high efficiency energy systems including combined cooling, heat, and power systems, bioenergy systems, and geothermal systems, when life-cycle cost-effective;
7. Assisting in the design of sustainable buildings with emphasis on acquiring Leadership in Energy and Environmental Design Building Certification through the U.S. Green Building Council;
8. Reducing greenhouse gas emissions by evaluating life-cycle cost-effective measures for reducing petroleum use by switching to natural gas or renewable energy sources, or other effective means;
9. Evaluating energy efficiency and best practice opportunities in industrial facilities for steam systems, boiler operations, motor and pump systems, air compressor systems, industrial processes, and fuel switching;
10. Evaluating energy efficiency and best practice opportunities in laboratory facilities for clean rooms, computer facilities, and other energy intensive operations;
11. Evaluating the use of off-grid generation systems (i.e. fuel cells, microturbines, wind energy systems, photovoltaic systems, etc.) where such systems are life-cycle cost effective and offer benefits including energy efficiency, pollution prevention, and source energy reductions;
12. Evaluating the replacement of chillers that use Class I ozone depleting substances with chillers that are more efficient and are integrated with other energy conservation measures to allow downsizing of the system;
13. Developing a model program for the procurement of Energy Star products or other energy efficient products that are in the upper 25 percent of energy efficiency;
14. Developing building commissioning or re-commissioning programs to identify and correct operational inefficiencies, verify energy use and improve design and construction practices; and
15. Transferring information from model programs that have already been developed to other sites, so that these programs can be replicated.

The primary DOE tools for implementing these high priority strategies are through the Congressional funding that DOE receives under the Departmental Energy Management Program, and through finalizing a new performance based DOE order "Departmental Energy and Utilities Management." Performance agreements will be negotiated with DOE Field Offices and sites under this Order. These Energy and Utility Management Performance Agreements will be negotiated by Headquarters with the DOE Field Offices. The DOE Field Offices will then have the lead in negotiating energy conservation performance objectives, measures and annual expectations with their Management and Operating Contractors who operate many of the DOE sites.

Life-Cycle Cost Analysis

DOE has always based investment decisions regarding energy efficiency and renewable projects on life-cycle cost effectiveness and will continue to do so. When funds are appropriated specifically for energy management projects, DOE ranks projects according to their savings to investment ratio (SIR). The funds are then allocated, until exhausted, to projects with the highest SIRs. DOE expects to fund approximately $1 million in energy retrofit projects in FY 2002, and expects to cost share some of these projects between FEMP, the DOE site and/or the DOE Program Office.

Facility Energy Audits

DOE has completed comprehensive audits for many sites. At sites where major energy efficiency improvements have been installed, DOE does not anticipate repeating audits for five years. DOE is concentrating its auditing efforts at locations that have not received comprehensive audits or at locations where audits would lead to installation of specific technologies based on unique local circumstances. Funding priority of comprehensive audits are ranked according to their potential for success in achieving energy conservation. Factors for ranking include energy unit cost, total energy consumed at the facility, and energy consumed per gross square foot. During FY 2002, DOE has set-aside a minimum of $75,000 in funding for energy and water efficiency audits at DOE sites. The first priority for these funds is to collect information and establish baselines for ESPCs and UESCs.

DOE will continue to emphasize the use of ESPCs and UESCs to accomplish energy efficiency projects. The second priority of audits is to support other specific strategies such as establishing benchmarks to qualify office buildings for the Energy Star Building label. The third priority is to perform comprehensive audits of 10 percent of facilities each year.

New energy conservation activities that are being conducted in FY 2002 and are being identified for this Implementation Plan include:

The Fermi National Laboratory (FERMI) will be identifying cost effective energy efficiency lighting systems, and heating, ventilating and air-conditioning (HVAC) systems and their control systems. In addition, FERMI will be investigating upgrading their Supervisory Control and Data Acquisition (SCADA) System to allow for better control of electricity once it reaches the laboratory. FERMI will also initiate a Site-wide Computerized Management Program to replace the labor intensive activities used to control energy using systems.

The Idaho National Engineering and Environmental Laboratory (INEEL) will conduct facility audits to identify energy efficiency retrofit projects to reduce the cost of their energy purchases. Energy rates at the INEEL increased 53 percent on May 1, 2001, in part due to increased demand for electricity from California. Low water levels in hydroelectric dams due to prolonged drought conditions also contributed significantly to the rate increase.

Financing Mechanisms

In FY 2001, DOE received $2 million under the Departmental Energy Management Program budget request. In FY 2002, DOE received $1.5 million under the Departmental Energy Management Program budget request. This funding will be leveraged with additional funding from the DOE sites to support both energy retrofit projects and to implement strategies to accomplish the requirements of the Presidential Directive "Energy Conservation at Federal Facilities."

The new retrofit projects that DOE has funded and are being identified for this Implementation Plan report include:

- **Klystron Energy Reduction through the use of Variable Voltage Cathode power Supply LED Modulating Anode Project** at the Thomas Jefferson National Accelerator Facility (TJNAF) costing $323,600. TJNAF will retrofit 43 klystron power supplies to allow adjustment of the input AC voltage. Klystron power supplies convert the incoming electricity to microwaves. The project will save 8,600,000 kilowatt-hours (kWh) and $270,000 annually when completed.

- **Install Variable Frequency Drives with Direct Digital Control Project** at the Princeton Plasma Physics Laboratory (PPPL) costing

$55,000. This project will allow for more efficient energy use through better matching of power needs with the loads on the fans through direct digital control of fan speed. The project will save 203,000 kWh and 2,400 million British thermal units (MBtu) of natural gas and $18,000 annually when completed.

⊙ **Upgrade of the Energy Management System and Lighting Systems Project** of the Engineering Research Office Building at the Idaho National Engineering and Environmental Laboratory (INEEL) costing $23,600 in anticipation of applying for the Energy Star Building label. INEEL will install occupancy sensors and light sensors to automatically turn off lights that are not needed. The project will save 80,000 kWh and $5,000 annually when completed

This rooftop gas-fired desiccant unit is one example of a system that will eliminate the need for CFC-chillers to dehumidify ventilation air.

⊙ **LED Replacement for Safety Locator Lighting Project** at the Brookhaven National Laboratory (BNL) costing $46,000. BNL will replace existing incandescent lamps and fluorescent lamps with a lifetime light emitting diode (LED) bulb, resulting in both energy and maintenance savings. The project will save 63,860 kWh and $7,000 annually when completed.

⊙ **VendingMiser Retrofits Project** at the Lawrence Livermore National Laboratory (LLNL) costing $26,400. LLNL will install VendingMiser® controllers on selected vending machines to reduce their power requirements when not in use. The project will save 110,460 kWh and $4,000 annually when completed.

⊙ **Lighting Control - Building 041, Second Floor Project** at the Stanford Linear Accelerator Center (SLAC) costing $23,400. SLAC will install light switches and occupancy sensors. The project will save 89,000 kWh and $3,500 when completed.

⊙ **Micro-turbine Demonstration Project** at the Brookhaven National Laboratory (BNL) costing $112,000. KeySpan Energy, the local natural gas supplier will cost-share the project and will install the micro-turbine. BNL expects the project to save 185,000 kWh and 1,230 MBtu of oil and $6,300 per year. The micro-turbine will require 2,520 MBtu of natural gas per year to operate.

⊙ **Replace Central Chilled Water Plant Project** at the Princeton Plasma Physics Laboratory (PPPL) costing $300,000. PPPL will install new high efficiency chillers and related equipment with this cost shared project. When completed, the project will save 1.2 million kilowatt hours (kWh) of electricity annually with annual cost savings of $90,000.

⊙ **Install Ultra Low Flow Toilets, Urinals and Automatic Faucets Project** at the PPPL costing $115,000. This project will save 150,000 kWh of electricity and 8 million gallons of water annually with total annual cost savings of $36,000.

⊙ **Energy Management and Control System (EMCS) Optimization - Phase II Project** at the BNL costing $289,000. The project will optimize operation of heating, ventilating and air-conditioning (HVAC) systems, saving 1.5 million kWh of electricity and 7,100 million British thermal units (MBtu) of fuel oil with total annual cost savings of $112,000.

⊙ **Install Four High Seasonal Energy Efficiency Ratio HVAC Units Project** at the PPPL costing $65,000. These more efficient, non-ozone depleting units, will save 53,000 kWh of electricity and 128 MBtu of natural gas annually with total annual cost savings of $21,000.

⊙ **B241 HVAC Direct Digital Control (DDC) System Retrofit Project** at the LLNL costing $221,000. The controls will provide efficient operation of HVAC systems, saving 1 million kWh of electricity and 9,700 MBtu of natural gas annually, with total annual cost savings of $38,000.

⊙ **Elimination of Once-Through Cooling in 902 Project** at the BNL costing $369,000. BNL will install an air cooled electric chiller to replace one pass water used for cooling. The project will save 43 million gallons of potable water and $72,000 annually.

Example of a Trombe Wall designed to utilize passive solar energy in new DOE laboratory

⊙ **Install Closed Loop Dry Cooler for Air Compressor C-701Project** at the PPPL costing $38,000. This project will replace a one pass cooling water system with a closed loop system, saving 4 million gallons of water and $10,000 annually.

⊙ **CPP-630 Heat Recovery System Project** at the INEEL costing $294,000. The INEEL will install a heat recovery system to preheat makeup air, saving 17,000 kWh of electricity and 5,500 MBtu of fuel oil annually with total annual cost savings of $51,000.

⊙ **Lighting Retrofits for 318, 320, and 350 Project** at the Pacific Northwest National Laboratory (PNNL) costing $227,000. PNNL will retrofit 1,500 fluorescent fixtures with more efficient electronic ballasts and lamps, saving 550,000 kWh and $42,000 annually.

When completed, these direct funded projects will annually save 13,828,000 kWh of electricity, 23,738 MBtus of oil or natural gas and 55 million gallons of water. The energy and water savings will also represent approximately $800,000 in utility cost savings to the Government.

Although these direct funded projects provide significant energy savings, they will not account for the majority of energy savings that will be achieved at DOE sites. Private sector financing will continue to be the primary method for funding energy conservation projects and achieving reductions in energy consumption. DOE has instituted guidelines for the ESPC Review Board that will include representatives from the appropriate offices to facilitate the use of Energy Savings Performance Contracts. The review board meets to provide recommendations for improvement of initial proposals from Energy Services Companies regarding DOE sites. The review board will also meet to provide final concurrence for negotiated contracts.

During FY 2002, DOE expects to receive initial proposals or final proposals for ESPCs at the following six sites: Pantex Plant, Argonne National Laboratory-East, Y-12 Plant, Idaho National Engineering/Environmental Laboratory, Savannah River Site and Oak Ridge National Laboratory. The total investment is expected to be over $30 million.

Energy conservation activities through ESPC that will be accomplished in FY 2002 and are being identified for this Implementation Plan include:

At the Hanford Site, DOE's Richland Operation Office will investigate the feasibility of using energy savings performance contract (ESPC) delivery order under the SuperESPC, or a utility contract to accomplish energy conservation opportunities in facilities designated as surplus (excess). There are many facilities at Hanford designated as excess that continue to use energy (primarily electricity) to support fire protection and environmental surveillance systems. Reducing energy consumption in surplus facilities can provide significant cost savings since the Bonneville Power Authority has already provided notice to the Richland Operations Office of a rate increase as of October 1, 2001. Due to this rate increase the Richland Operations Office is planning for an increase of $2,000,000 in FY 2002's utility bills. The increased demand for electricity for California and western drought conditions are cited as the reason for the increase.

The Idaho National Engineering and Environmental Laboratory (INEEL) is also evaluating

New DOE Laboratory incorporates daylighting

ESPC for energy efficiency retrofit projects to reduce the cost of maintaining excess facilities. Energy rates at the INEEL increased 53 percent on May 1, 2001, in part due to increased demand for electricity from California. Low water in hydroelectric dams due to prolonged drought conditions also contributed significantly to the rate increase.

DOE's Savannah River Site (SRS) will investigate the technical, financial and contractual support for their third task order under their ESPC. Previous task orders included replacing inefficient lighting and air-conditioning equipment that directly contributed to high summer peak electricity demand at SRS. The third task order will investigate additional opportunities to reduce demand.

DOE is also pursuing UESCs. These contracts depend on local conditions with deregulation and competition for customers being the primary drivers. During FY 2002, DOE expects to have at least two UESCs in place at its Chicago sites at an investment cost of over $10 million. Energy conservation activities through UESCs that will be accomplished in FY 2002 and are being identified for this Implementation Plan include:

The Fermi National Accelerator Laboratory (FERMI) will be identifying energy conservation opportunities in partnership with its electricity and natural gas suppliers. FERMI has already identified millions of dollars of investment opportunities and fully expects to identify even more opportunities.

The Idaho National Engineering and Environmental Laboratory (INEEL) will be issuing guidance for the use of UESC at the site. In addition the INEEL will be initiating discussion with its utility providers to explore investment opportunities to accomplish energy conservation projects.

Energy Star™ compliant lamps are available for virtually all DOE lighting applications

Energy Star™ and Other Energy-Efficient Products

DOE issued an acquisition letter to all of its contracting officers alerting them to purchase DOE/EPA Energy Star™ products and other energy-efficient products. DOE has included purchases of energy-efficient goods as a priority Performance Objective in all Performance Agreements over the last several years. Most sites have already incorporated energy-efficient goods in their purchasing systems and will continue to purchase these goods when they are life-cycle cost effective and compatible with mission requirements. The National Renewable Energy Laboratory (NREL) will be developing an Energy Star™ procurement program as an example of new energy conservation activities being accomplished in FY 2002 that are being identified for this Implementation Plan.

Energy Star™ Buildings

All DOE sites with office buildings and metered data are evaluating their buildings for Energy Star labels. Sites with buildings that do not currently qualify are encouraged to establish a goal for obtaining Energy Star™ Buildings labels. To date, two office buildings at the Nevada Operations Office, one at the Oak Ridge National Laboratory and one at the Oakland Operations Office have acquired Energy Star™ labels.

Testing of wind turbine aerodynamics at DOE's National Renewable Energy Laboratory.

Completed surveys suggest that DOE does not have many buildings that fit the EPA Energy Star™ profile. Most DOE buildings are not used purely as office buildings, but are mixed use and include laboratory, intense computing space, and control rooms. Other DOE buildings designated as office space are actually of modular construction and considered temporary.

Where office buildings that are considered good candidates fall short of the benchmark test, they will be audited for life-cycle cost-effective energy efficiency retrofits. If retrofit projects can be undertaken, DOE will encourage ESCOs to propose such projects and apply for the label.

New energy conservation activities are being accomplished in FY 2002 in conjunction with obtaining the Energy Star™ Building label and identified for this Presidential report include:

The Oak Ridge National Laboratory (ORNL) has identified 11 office buildings that would be good candidates for the Energy Star™ label. ORNL will begin metering those buildings so that it can apply for the label.

The Idaho National Engineering and Environmental Laboratory (INEEL) will identify facilities that would benefit from accurate meters and develop plans to meter all cost effective significant applications. INEEL will also identify facilities applicable to the Energy Star™ buildings program; install meters and collect meter data for at least two of the best candidates for the Energy Star™; and apply for the Energy Star™ label.

Also as shown earlier under the Financing section, the INEEL has been provided with funding to upgrade the energy management system and lighting systems of its Engineering Research Office Building in anticipation of applying for the Energy Star™ Building label.

Sustainable Building Design

During FY 2002, DOE will emphasize sustainable building design practices at five DOE sites. To help introduce sustainable design as a standard operating practice, DOE is encouraging several of its sites to become partners in the DOE/EPA Labs for the 21st Century initiative. DOE expects at least two of its laboratories to become a partner in FY 2002. The partner receives design assistance and preferential project funding consideration as a benefit.

New energy conservation activities being accomplished in FY 2002 in conjunction with sustainable design and being identified for this Presidential report include:

The Sandia National Laboratory – New Mexico (SNL-NM) is reviewing and revising its standard construction specifications and Design Manual to incorporate sustainable design. SNL-NM is also training its design professionals and will be providing lessons learned to other DOE sites.

The Idaho National Engineering and Environmental Laboratory (INEEL) will be providing sustainable design recommendations for the conceptual design of the Subsurface Geosciences Laboratory. As part of that effort the INEEL is preparing a life cycle cost assessment showing the building design is cost effective to construct and will evaluate the design using the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) software analysis package.

The Pacific Northwest National Laboratory (PNNL) will implement working standards for sustainable design of its capital and expense facility projects. The PNNL effort will include the development of working standards and economic calculations for use by other DOE sites.

PNNL will post recommendations and calculations on the Internet.

The National Renewable Energy Laboratory (NREL) will be working to accredit LEED evaluators and certifying their planned Science and Technology Facility. NREL will also be expanding its sustainable website.

The Oak Ridge National Laboratory (ORNL) will incorporate sustainable design principles into three new buildings. ORNL will also develop criteria for selecting private sector building developers, and transfer lessons learned to DOE's Laboratory Facility Revitalization Initiative.

Energy Efficiency in Lease Provisions

Most DOE space is federally owned and energy intensive. In spaces leased by DOE, energy efficiency has been a matter of policy for years. For example, DOE's Oakland Operations Office has occupied leased space in an Energy Star™ Building since 1998. However, most DOE facilities are in remote locations, where much of the leased space is in the form of modular offices and trailers that are considered temporary structures. When leased space in a certified Energy Star™ building becomes available and lease space is needed, then DOE gives such space priority consideration. Leased space in Energy Star™ Buildings is selected when it is the most life-cycle cost-effective alternative and meets mission requirements. In FY 2002, DOE will encourage energy efficiency provisions in new building leases.

Industrial Facility Efficiency Improvements

Reliability of the energy supply is an important issue in energy-intensive facilities. Thus, DOE is targeting these facilities as opportunities for distributed energy resources. Some of the technologies that may be investigated include cogeneration facilities, micro-turbines and fuel cells that will increase electricity reliability. In FY 2002, Energy Services Companies and Utilities will be invited to propose efficiency improvements for industrial processes in at least two DOE sites.

Energy conservation activities to be accomplished in FY 2002 in conjunction with industrial facility efficiency improvements and being identified for this Implementation Plan include:

The Thomas Jefferson National Accelerator Facility (TJNAF) will evaluate new klystron designs for energy efficiency and develop engineering and economic parameters for the final design of a new klystron. Klystrons are the devices that convert dc power into microwave power which energizes the accelerator used for high energy physics research. The goal is to increase the efficiency of the conversion process from 35 percent to over 60 percent.

The Material and Molecular Research Lab at Lawrence Berkeley National Laboratory was the first DOE project that used private sector financing through a shared energy savings contract to improve its energy efficiency, resulting in a $60,000 a year reduction in the utility bill

The Fermi National Accelerator Laboratory (FERMI) will evaluate and identify cost effective solutions to improve humidity control in the fixed target areas of its accelerator. FERMI has identified excessive energy costs, as well excessive maintenance costs and environmental disposal costs in these areas.

In addition, as listed within the Financing section, TJNAF, has received funding to improve the energy efficiency of its existing klystron systems. The Idaho National Engineering and Environmental Laboratory (INEEL) will be receiving funding for a heat recovery system for a building within its Chemical Processing Plant.

Highly Efficient Systems

In FY 2002, DOE will audit its facilities to determine if more highly efficient systems can be installed cost effectively.

In FY 2002, DOE will also target geothermal technologies for inclusion into new building designs as part of the sustainable design process.

NREL's 10,000 square foot Thermal Test Facility cuts energy cost by two-thirds at no extra upfront cost.

Off-Grid Generation

DOE is actively promoting the use of solar and renewable energy. Off-grid generation systems are encouraged when they are life-cycle cost effective and offer benefits such as energy efficiency, pollution prevention, source energy reductions, avoided infrastructure costs, or expedited service.

In FY 2002, DOE will also encourage ESCOs to bundle renewable energy technologies with other more cost effective energy efficiency technologies in order to increase the installation of renewable energy technologies.

In addition to the solar and renewable projects, DOE has funded micro-turbine projects at its Brookhaven National Laboratory and Sandia National Laboratory.

Natural gas-fired microturbine cogenerators, such as these, can be used by DOE labs to reduce peak electricity grid loads.

Sensors as shown above will be installed at faucets, urinals and water closets.

Water Conservation

DOE recognizes a tremendous potential to save money and precious natural resources through water conservation. Water conservation is a high priority objective in the DOE Order "Departmental Energy and Utilities Management." In FY 2002, DOE Field Offices and sites will be developing Water Management Plans for inclusion in their energy and facility management plans. DOE Field Offices/sites will be implementing Best Management Practices (BMPs) for efficient water use, and prioritizing funding for projects based on life-cycle cost effectiveness.

Energy conservation activities being accomplished in FY 2002 in conjunction with water conservation and being identified for this Implementation Plan include:

The Idaho National Engineering and Environmental Laboratory (INEEL) is preparing a comprehensive Water Management Plan that includes pumps, distribution piping and fixtures inside the buildings. INEEL will audit at least 10 percent of its water using facilities using the Federal Energy Management Programs' Best Management Practices as a guide.

The Fermi National Accelerator Laboratory (FERMI) is evaluating modifications to its site-wide low conductivity water (LCW) system to improve the performance. FERMI will be evaluating the pumps and the speed at which the LCW is flowing through the system in support of experimental high energy physics equipment. In addition as listed in the Financing section, the Princeton Plasma Physic Laboratory will be installing automatic ultra low flow toilets, urinals and automatic faucets.

Acquisition of Green Power

DOE has established targets of 3 percent of purchases from non-hydro-renewable power by FY 2005 and 7.5 percent of power purchases by 2010. In FY 2002, DOE expects to purchase at least 1 megawatt of power either from non-hydro renewable power or from hydro-power that has been certified as environmentally friendly.

Reduction of Ozone-Depleting Substances

In FY 2002, DOE expects to replace chillers that are currently using ozone depleting substances with more efficient chillers using environmentally friendly refrigerants.
The retrofit project that will be accomplished at Princeton Plasma Physics Laboratory "Replace Central Chilled Water Plant," will eliminate three chillers that currently use Class I ozone depleting substances.

Energy-Efficient Operation and Maintenance of Buildings

Even with modern control systems, the energy systems of buildings gain inefficiencies over time due to sensor "drift" and aging of equipment. In FY 2002, DOE will re-commission buildings in at least one site and identify the resultant energy efficiency opportunities.

New energy conservation activities being accomplished in FY 2002 in conjunction with energy efficient operation and maintenance being identified for this Implementation Plan include:

An example of on-site Diesel engine-driven electricity generators that can be used to shift electrical load off the grid during peak demand periods.

The Pacific Northwest National Laboratory (PNNL) will audit one of its major laboratories. In addition, PNNL will improve measurement and verification tools for recommissioning, and develop a recommissioning checklist and economic calculations for use by other DOE sites. PNNL will post the results of the audit, tools and reports on the Internet.

Electrical Load Reduction Activity at California Sites

Peak demand at DOE's major energy using sites in California has been reduced significantly through implementation of energy conservation measures. These measures, which include the upgrading of lighting, central chiller and pumping systems, have not only reduced annual energy consumption but also peak electrical load demand. All of DOE's major energy using sites in California have participated in the California Energy Commission's Emergency Load Reduction Test to demonstrate their peak load reduction capabilities. The largest DOE energy-using site in California, the Lawrence Livermore National Laboratory (LLNL), has reduced energy use by 27% from its 1990 baseline.

As of April 3, 2001, the California Public Utilities Commission ordered electricity service providers to include transmission-level customers, such as all the DOE sites in California, to participate in the rotating outage process. All sites have therefore developed electricity usage curtailment plans that address the actions required at each of the 3 electrical emergency stages. The major sites affected by the rotating outages are Lawrence Berkeley National Laboratory (LBNL), Lawrence Livermore National Laboratory (LLNL), Stanford Linear Accelerator Center (SLAC) and Sandia National Laboratory-California Site (SNL-CA), all of which receive power from and are notified of impending electrical emergency alerts from the Western Area Power Administration (WAPA). Stage 1 alert is declared when predicted load versus generating capacity margin is less than 7%, Stage 2 and Stage 3 alerts are declared when the margins are less than 5% and less than 1.5% respectively.

⊙ LBNL's Response to Electrical Emergency Alerts:
LBNL notifies all staff of alerts by e-mail within 10 minutes of receiving notification from WAPA. At the Stage 1 level, staff turn off all non-essential experimental equipment, lights, computer monitors and other office equipment. At the Stage 2 level, staff turn off all non-critical experimental equipment and the same lights and

equipment turned off during a Stage 1 alert. At the Stage 3 level, staff turn off all non-critical equipment and all office air conditioning. LBNL has also developed preliminary plans to address 5, 10 and 15% power curtailments.

LBNL estimates that rotating outages could cost the lab over $21 million over the next 2 years if subjected to the predicted 15 outages per year. Installation of a power generator on-site to meet the power shortage (during curtailments) is estimated to cost $1.5 million and appears to be an attractive option.

LBNL has participated with the Assessment of Load and Energy Reduction Techniques (ALERT) teams' identification of additional demand reduction measures. Four cost effective measures were identified that could save LBNL about one million kWh annually and reduce their peak demand by 80 kW. These measures will cost about $160,000 to implement and will annually save over $25,000.

Power transmission lines in California.

⊙ LLNL's Response to Electrical Emergency Alerts:

LLNL notifies all staff of alerts by e-mail through its Public Relations Department. Staff actions in response to each alert level are similar to those described for LBNL above.

LLNL has participated with the ALERT teams' identification of additional demand reduction measures at its site. Six cost effective measures were identified that could save LLNL over 11 million kWh annually and reduce their peak demand by over 4,000 kW. These measures will cost over $1.2 million to implement and will annually save over $360,000.

⊙ SLAC's Response to Electrical Emergency Alerts:

Since SLAC has an interruptible rate contract with WAPA, it is required upon request by WAPA to reduce its load from 50-65 MW down to no greater than 21 MW during a power shortage. SLAC has identified accelerator subsystems that can be curtailed, while still maintaining the capacity to resume full operations quickly following the restoration of power. During Stage 3 alerts, and at other times requested by WAPA dispatchers, SLAC has reduced its electrical load by deferring activities that involve the development and testing of klystrons. SLAC has conducted a preliminary review of the possible impacts of a catastrophic failure. To mitigate the impact of such a failure SLAC installed a new emergency backup generator at its Main Control Center and has initiated a project to provide emergency backup for its critical computer and communications systems.

⊙ Sandia-CA's Response to Electrical Emergency Alerts:

Sandia-CA updated a site-wide bulletin explaining the Presidential Directive with an appeal to continue conservation efforts. In addition to implementing their established load curtailment plan, Sandia-CA will implement e-mail notifications to employees during Stage 2 and Stage 3 alerts to conserve further. During the alerts, maintenance staff will be stepping up

conservation activities such as re-setting thermostats and setting back chillers. During previous alerts in February 2001, electrical consumption decreased by 6 percent.

DOE-Wide Emergency Electrical Load Reduction

DOE's major energy-using sites are required to have emergency conservation plans for 10, 15 and 20 percent reductions from the previous fiscal year in gasoline, other oil-based fuels, natural gas, or electricity, for periods up to 12 months. These plans are designed to achieve the desired level of energy use reductions with the least impact on the site's mission and operating costs. While other energy sources are addressed in these plans, the need for emergency electrical load reduction plans has been underscored by recent events in California.

West side of DOE's low-energy design Solar Energy Research Facility in Golden, CO. showing placement of photovoltaic modules

Most major DOE sites have emergency electric load reduction plans in place.

Notable accomplishments include:

- The DOE headquarters facilities participate in Potomac Electric Power Company's (PEPCO's) load curtailment program by operating diesel generators at the Germantown complex, shutting down escalators and selected elevators at the Forrestal building, and alerting employees to reduce electric loads under their control (lights, personal computers, and appliances). Peak demand has been reduced by about 20 percent since 1990 through energy efficiency improvements in these facilities.
- The Argonne National Laboratory has participated in Commonwealth Edison's load reduction program since 1992. In response to requests from the utility the lab reduces end use electrical load, combined with operation of emergency generators, saving over $850,000 through 2001.
- The Brookhaven National Laboratory meets regularly with their utility to discuss electric loads and future requirements and set monthly demand targets. Past demand reduction programs have saved over $1.5 million. The lab pledged demand reductions of 12 megawatts (MW) for summer 2001, the largest reduction in the utility's service area.
- The Princeton Plasma Physics Laboratory reduces electric loads by up to 4.5 megawatts, with 30 minutes notice from the utility, saving $11 million since 1986.
- The Los Alamos National Laboratory load shedding plan reduces electric demand in four stages up to 50 percent of total load.
- The Rocky Flats Environmental Technology Site power curtailment plan reduces electric demand in three phases by 35 percent of total load.
- The Savannah River Site initiated its "Peak Alert" program in 1992, to achieve reductions in site electric demand. "Peak Alerts" are issued in response to requests from the utility to reduce electric demand, as well as to control electric demand (and hence cost).

Glossary

ALERT ..... Assessment of Load and Energy Reduction Techniques
BMP ..... Best Management Practice
BNL ..... Brookhaven National Laboratory
BPA ..... Bonneville Power Administration
Btu ..... British Thermal Unit
DDC ..... Direct Digital Control
DOE ..... The Department of Energy
EEWG ..... Energy Efficiency Working Group
EMCS ..... Energy Management and Control System
EO ..... Executive Order 13123
EMSC ..... Energy Management Steering Committee
ESCO ..... Energy Services Company
ESPC ..... Energy Savings Performance Contract
FEMP ..... Federal Energy Management Program
FERMI ..... Fermi National Accelerator Laboratory
FY ..... Fiscal Year
INEEL ..... Idaho National Environmental Engoneering Laboratory
LBNL ..... Lawrence Berkeley National Laboratory
LEED ..... Leadership in Energy and Environmental Design
LLNL ..... Lawrence Livermore National Laboratory
M&O ..... Management and Operating (Contractor)
NETL ..... National Energy Technology Laboratory
NREL ..... National Renewable Energy Laboratory
ORNL ..... Oak Ridge National Laboratory
PA ..... Energy and Utility Management Performance Agreement
PPPL ..... Princeton Plasma Physics Laboratory
SCADA ..... Supervisory Control and Data Acquisition System
SIR ..... Savings to Investment Ratio
SLAC ..... Stanford Linear Accelerator Center
SNL ..... Sandia National Laboratory
SRS ..... Savannah River Site
TJNAF ..... Thomas Jefferson National Accelerator Facility
UESC ..... Utility Energy Services Contract

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For The Assistant Secretary, Energy Efficiency and Renewable Energy
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, DC 20585

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