

Greening Project Status Report: DOE Headquarters



**Prepared for the
Federal Energy Management Program
U.S. Department of Energy**

February 2001

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The Greening of DOE Headquarters: Status Report and Accomplishments

1. Introduction

Over the past several years, a number of energy efficiency and sustainability projects have been conducted at the U.S. Department of Energy's (DOE's) Headquarters buildings in Washington, D.C. (the Forrestal Building), and Germantown, Maryland. These projects are undertaken to:

- Demonstrate and showcase best practices in energy use and resource management
- Invest in cost-effective improvements
- Increase the productivity, comfort, and health of employees and other building occupants
- Make use of opportunities for innovative financing and partnering with the private sector
- Facilitate interagency cooperation to achieve the best possible results
- Work with facilities management staff to improve overall operations and procedures

The General Services Administration (GSA) remains the “landlord” of the two buildings, and the agency provides operating funds to DOE in an amount equal to the money GSA would spend to operate the buildings. The GSA is responsible for concessions and food services, and it funds major projects.



The Forrestal Building in Washington, D.C., was constructed between 1966 and 1969. It encompasses 1.75 million gross square feet of space, usually counted as five buildings. Steam and chilled water are purchased from the central GSA plant. The building was planned for open office space; this has created problems in ventilation and lighting as space has been divided into separate offices. A large relighting project was completed in 1993, but no other major remodeling work is scheduled.

The U.S. DOE Forrestal Building in Washington, D.C.

The Germantown facility is on 98.6 acres and includes eight buildings that total 567,272 gross square feet. The main building has 375,000 square feet of occupied space. The buildings were constructed between 1955 and 1958; new wings and buildings were added in 1970, 1973, and 1991. The complex has its own boilers and chillers.

2. Context of the Project

DOE strives to demonstrate leadership in energy efficiency and the use of new energy technologies and strategies. Implementation is sometimes constrained by budgets, however.

3. Design and Decision Process

The DOE Federal Energy Management Program (FEMP) led the Headquarters greening effort. FEMP assembled a team of experts to participate in the process. Participants first identified critical issues for a greening workshop that was held in January 1996 at Forrestal. National experts and DOE staff worked in four teams to identify potential strategies for making improvements in energy efficiency; air, water, and landscaping; resource management; and human factors. Workshop participants submitted more than 100 recommendations for decreasing energy and resource consumption, increasing productivity, and saving taxpayer dollars.



The Forrestal Building now has lower energy and water utility costs.

The Greening of DOE Headquarters, An Action Plan for Success was published in 1996. It contains more than 80 of the workshop recommendations that DOE and GSA determined to merit further consideration. This report also noted the importance of integrating these individual actions and looking for linkages with other actions to increase their impact and cost-effectiveness. In September 1996, a comprehensive audit of the Forrestal Building was completed to develop the initiatives in the action plan and to identify other energy and water conservation opportunities.

In April 1998, a status report was issued titled, *The Greening of the U.S. Department of Energy Headquarters, Washington, DC, Second-Year Status Report*.

4. Highlights of Environmental Strategies and Accomplishments

The 1996 audit estimated the costs and savings associated with energy-related recommendations. Some recommendations were not pursued because their cost-effectiveness was doubtful. However, in just the first two years of DOE Headquarters' greening initiative, 60% of the recommendations in the action plan had been addressed or accomplished, 22% were in progress, and 18% were scheduled for action. Even more has been accomplished since then. The following sections list numerous improvements and accomplishments in energy use; air, water, and landscaping; resource management; and other strategies. See also the table at the end of this report for the status of many Headquarters greening activities.

Energy

Executive Order 13123, June 1999, requires each agency to reduce energy consumption per gross square foot of facilities by 30% by 2005 and 35% by 2010, relative to 1985 levels. Cost-effective, energy-efficient retrofit projects at the Forrestal and Germantown facilities achieved a 26% reduction in energy use at the end of FY 2000. Overall savings associated with this reduction totalled \$8.65 million. DOE also continued work on Super Energy Savings Performance Contracts

(Super ESPCs) for both the Forrestal and Germantown facilities. A list of many energy-related greening actions and projects follows.

At Forrestal:

- Conducted surveys and studies of building systems and equipment operation and design; studied energy conservation opportunities with GSA, through GEOMET Engineers
- Installed a new, insulated roof
- Added a solar film to exterior windows
- Installed a building-wide energy management and control system
- Constructed a child development center that incorporates energy-efficient concepts
- Began an energy conservation awareness program for employees
- Completed a shared energy savings project to retrofit all 36,000 lighting fixtures
- Specified and procured energy-efficient appliances, equipment, and products
- Coordinated, procured, and installed energy consumption measuring and monitoring devices
- Improved the operation and maintenance of facility systems and equipment
- Replaced aluminum feeders with copper ones for building-wide electrical power in five transformer vaults
- Coordinated the installation of fusion lights over the main entrance
- Installed occupancy sensors to turn off lights in bathrooms and 10% of offices
- Replaced emergency exit signs with more energy-efficient fixtures
- Participated in demand-side management service through load curtailment program with local utility, PEPCO (ongoing)
- Replaced 114 fluorescent fixtures with ten 250-watt mercury vapor lamps on two garage entrance ramps
- Installed direct digital controls for the reheat system to achieve enhanced control of the office environment
- Continued consolidation of local area network rooms into central computer areas; allocated 7520 square feet of the EIA computer center in South Building basement to allow UPS protection and air-conditioning to be more efficient
- Reduced number of copiers; replaced some old ones with more efficient copiers
- Through GSA, completed design for domestic house water system replacement with energy-efficient pumps and motors and water pressure booster system
- Modified energy management and control system (EMCS), within budget constraints
- Installed variable-speed-drive motors and other equipment for cooling towers; replaced some chilled-water pumps with high-efficiency units
- Replaced electrical panels in electric closets to eliminate overloaded circuits and old circuit breakers and to provide additional capacity for future



DOE saves thousands of dollars each year with energy-efficient lighting.



This solar electric system produces power at Forrestal.

- Installed updated, supplemental air-conditioning system
- Installed photovoltaic (PV) system on south side of South Building; building now has three of the four DOE Headquarters solar arrays
- Disaggregated load for Cellular One from the rest of the building's electric load and arranged for carriers to prepay electricity costs associated with lease agreement
- Conducted more than 5,230 hours of preventive maintenance on mechanical equipment, including air-conditioning, chillers, cooling towers, reheat coils, and fan coil units; motor control units and motors; plumbing systems; and doors

- Upgraded three electronic stand-alone cabinets for EMCS
- Caulked windows in North Building to prevent infiltration of water
- Replaced cracked, broken, or vandalized windows
- Repaired or replaced drip pans and ductwork around expansion joints
- Removed Simplex master clock system, which operated electrically 24 hours per day
- Replaced three large hot water pumps and three smaller heating and chilled-water pumps with energy-efficient units
- Installed a high-efficiency chiller with efficient pumps and variable-speed drives
- Completed West Building HVAC study
- Replaced old 40-ton chiller
- Refurbished a cooling tower
- Repaired cracks in walls
- Provided assistance for EE's Solar Wall Design Competition for the South wall

At Germantown:

- Conducted surveys of buildings, systems, and equipment
- Installed a building-wide EMCS
- Installed highly insulating new roof
- Installed small, "summer use" boiler
- Replaced three emergency electrical generators
- Retrofitted 1,784 single-pane windows with efficient low-e windows (argon-gas-filled, double-pane, tinted windows with thermal-break frames)
- Retrofitted fluorescent lights with energy-efficient electronic ballasts and T8 lamps and added additional efficient fixtures
- Retrofitted boiler burners for dual-fuel (oil and gas) capability
- Participated in demand-side management service through load curtailment program with PEPCO (ongoing)



Nearly 1,800 energy-efficient windows were installed at the Germantown complex.

contained ozone-depleting CFCs in refrigerant; brought new chiller plant online five years ahead of schedule

- Improved energy-efficient operation and maintenance of building
- Coordinated, procured, and installed energy consumption measuring and monitoring devices
- Specified and procured energy-efficient appliances, equipment, and products
- Began an energy conservation awareness program for employees
- Replaced emergency exit signs with energy-efficient luminaries
- Through GSA, completed design/build chiller replacement specifications that included whole-building modeling and analysis to size new chillers; partnered with GSA to obtain a new, centralized, high-efficiency chiller plant with automated controls; removed old chillers that contained ozone-depleting CFCs in refrigerant; brought new chiller plant online five years ahead of schedule
- Provided about \$500,000 for new cooling towers for chiller project
- Completed exterior wall repairs
- Retrofitted the lighting in the child development center with electronic ballasts and T8 lamps
- Retrofitted exterior canopy and vestibule lighting with energy-efficient, compact fluorescent fixtures
- Replaced toilet exhaust motors with energy-efficient motors
- Replaced high-voltage switchgear
- Completed auditorium lighting upgrade design, through GSA
- Completed transformer replacements and motor control center replacement designs, through GSA
- Awarded a contract to replace dry-type transformers with energy-efficient transformers meeting NEMA TP-1 standards
- Completed retrofits and replacements of inefficient lighting in lobbies, stairwells, and restrooms; received PEPCO rebate
- Partnered with GSA to improve energy efficiency of new chiller plant design by adding new cooling towers and relocating new condenser water pumps
- Replaced domestic hot water tanks
- Completed upgrade of the hot water system, including making entire system more energy-efficient with a dedicated, small, high-temperature tank for facility's dishwasher
- Replaced four direct-expansion air-conditioning units with chilled-water units
- Made existing chilled-water piping system more energy-efficient with two-way bypass valves on eight main air-handler systems
- Installed controller on passenger elevator to increase energy efficiency
- Replaced single-wall fuel oil tank with double-wall, fluid containment tank

Air, Water, Landscaping

To improve indoor air quality, DOE designated both the Forrestal and Germantown buildings as smoke-free facilities. In addition, carpet tiles and paints with low levels of volatile organic compounds (VOCs), or without VOCs, are being used in renovations. The following improvements in water use and landscaping were also made:

At Forrestal:

- Conducted stormwater management project at the Forrestal building, which included replacing the plaza deck, adding drains, and covering 30% of the deck area with plant material instead of impervious surface; deck project also increased the R-value of the building envelope
- Installed new chilled water meter to monitor consumption
- Installed steam pressure-reducing station at main steam station
- Through GSA, completed design and construction of domestic hot water tank replacement
- Upgraded the domestic water system
- Installed new chilled water flow meter
- Partnered with GSA to bring small chiller on line and install new steam flow meter
- Continued steam maintenance program, including as-needed replacements of traps
- Repaired several steam leaks

At Germantown:

- Completed study of standpipe and sprinkler systems
- Replaced steam and condensate lines
- Naturalized a two-acre site at complex with native meadow species, to reduce or eliminate the use of energy, water, pesticides, and fertilizers in the area
- Added 170 native trees

Resource Management

Several improvements were made in the areas of recycling at both facilities:

At Forrestal:

- Began purchasing paper with higher post-consumer recycled content
- Added plastic, magazines, and envelopes to recycled materials program
- Used recycled materials in playground at child development center

At Germantown:

- Enhanced recycling program by replacing old containers with plastic ones
- Significantly improved the quantity of recycled materials and resulting earnings

Other Strategies

In other strategies, DOE expanded video teleconferencing capabilities considerably, which has led to increased use of both desktop and studio systems. The agency also began using computer screen messages to provide employees with information on how to cut their energy, water, and resource use.

5. Acknowledgments

The contributions of Michael Shincovich, DOE Headquarters, to this report are gratefully acknowledged, as well as those of ENSAR Group, Inc., and Scientific Consulting Group, Inc.

6. References

The Greening of DOE Headquarters, An Action Plan for Success, DOE/EE-0097, Washington, DC: U.S. Department of Energy, April 22, 1996.

The Greening of DOE Headquarters, Second Year Status Report, Washington, DC: U.S. Department of Energy, April 22, 1999.

Status of Greening Strategies

Energy Efficiency	
<u>Actions Implemented</u>	<u>Comments</u>
Improve productivity by increased use of electronic document management	Completed
Increase office equipment savings through power management, improved purchase criteria, startup commissioning, user training, shared equipment, and ink jet technology	Completed; most computers are ENERGY STAR® rated; staff are encouraged to turn off computers after work
Save paper and energy with state-of-the-art copiers	Copiers are being replaced by smaller, more efficient machines and staff are encouraged to make fewer copies
Implement computer-based “paperless” faxing	Completed
Improve efficiency of vending machines	In progress; GSA concessions management requires vendors to use most energy-efficient machines
Relocate LAN equipment in “LAN parks”	In progress; the LAN park has been expanded in stages and the air-conditioning was replaced
Improve lighting controls	In progress; at Forrestal, 287 occupancy sensors were installed (15% of fixtures); more will be installed as part of future tenant alterations
Install sulphur lamps in courtyards	In progress
Improve daylighting contribution and optimize artificial lighting effectiveness	To be pursued; energy-saving film on windows reduces daylight
Implement fuel cell demonstration	To be pursued; DOE is considering demonstrations at Forrestal and Germantown
Install temperature controls for a corridor	Completed; incorporated into energy management control system
Review recommendations of building engineering report by Peck, Peck, and Associates	Completed; many recommendations have been implemented
Retrofit lighting transformers with dry-type (Forrestal)	In progress
Change out windows (Germantown)	Completed; low-e windows installed
Use off-peak power	
Install point-of-use hot water heaters in selected restrooms	In progress
Retrofit or replace windows (Forrestal)	To be pursued

Install ground-source heat pumps (Germantown)	To be pursued
Use DOE as a demonstration site for energy efficiency and renewables	In April 1998, DOE activated PV panels in Earth Day park next to the Forrestal building; these panels displace 63% of the park's night lighting load
Install transpired solar collector (solar wall) on south wall to preheat ventilation air (Forrestal)	In progress
<u>Actions Not Implemented</u>	<u>Comments</u>
Insulate behind the induction units and the vertical duct risers to reduce energy waste (Germantown)	To be pursued; not currently cost-effective
Return cost savings to energy managers	Not pursued; savings will be donated to help operate child development center
Back pressure turbine generators	Not pursued; not cost-effective
Recommission entire building following workshop and every 10 years thereafter	Not pursued because of resource limitations
Use solar-driven desiccant dehumidification and cooling (Forrestal)	Not pursued because of estimated 13-year payback
Install an atrium covering open interior section of South building (Forrestal)	Not pursued because of estimated 11-year payback
Set up a variable-air-volume damper system at each major duct branch (Forrestal)	Not pursued
Install 150 to 260 kW of grid-connected advanced photovoltaic technology on south wall (Forrestal)	Smaller PV project undertaken
Air, Water, and Landscape	
<u>Actions Implemented</u>	<u>Comments</u>
Allow employees to work at remote telecommuting centers or out of their homes	In progress
Increase metro subsidies	Completed
Replace CFC refrigerant in icemakers in cafeteria	Completed; R-12 refrigerants replaced by R-134a
Implement pilot demonstration of water-efficient restroom fixtures	Completed; installed water-saving sink fixtures in Forrestal; waterless urinals not yet cost-effective
Use sensor-operated flush valves, faucets, and hand dryers in restrooms	Pilot completed; most Germantown fixtures have been modified with sensor-operated flush valves

Retrofit restrooms with water-efficient fixtures	Pilot completed; waterless urinals not yet cost-effective
Monitor Forrestal water consumption	Completed; management takes daily meter readings and uses them as diagnostic tool
Negotiate energy and water savings in cafeteria contract	To be pursued
Improve chilled drinking water quality	Completed; filters installed, chillers replaced, more efficient dishwasher installed
Integrated landscape actions	Some completed; some in progress
Landscape courtyards for shade and accessibility (Germantown)	Completed; small trees and shrubs planted in areas between buildings
Improve stormwater management	New roof deck at Forrestal incorporates stormwater management
Use electric or alternative-fuel grounds maintenance equipment	Completed; DOE acquired electric trucks from PEPCO
Ban use of toxic de-icing agents	Completed; DOE now uses potassium chloride
Conduct outreach on grounds and landscape improvements	Outreach connected with earth day
Naturalize landscape (Germantown)	Pilot under way
Introduce compressed natural gas shuttle vans into Forrestal to Germantown transportation	DOE has added nine sedans and one van that use CNG
<u>Actions Not Implemented</u>	<u>Comments</u>
Restore tree cover for parking lots and roads (Germantown) and increase plantings (Forrestal)	
Create “adopt a planting” program	Not pursued because of insufficient resources
Conduct a study of economically and environmentally beneficial landscaping practices	
Install plants along connector walkways (Forrestal)	
Enhance pond habitat (Germantown)	
Provide employee garden space	Not pursued because of insufficient resources
Compost yard waste, use non-chemical fertilizers, use native plants, reduce turf grass, use plants for passive cooling (Germantown)	

Resource Management	
<u>Actions Implemented</u>	<u>Comments</u>
Change the building carpet program	Completed; only low-VOC carpet tiles used in renovations
Use no-VOC and low-VOC paints	Completed
Implement an integrated pest management program	Completed
Form a recycling committee	Completed; formed within facility management
Don't separate the trash – use off-site separation	Completed
Begin an “all paper recycling program”	Completed
Place recycling containers near points of sale	Completed; containers placed outside Forrestal building
Implement a polystyrene recycling program	Pilot completed; machine used required excessive maintenance and failed to produce the melted gel from the cups
Develop green construction contracts	Completed
Develop a recycling revenue policy	Completed
Consolidate solid waste management contracts	To be pursued by GSA
Move toward a “paperless office” policy	In progress
Evaluate copier and printer paper alternatives	In progress
Increase procurement of recycled content items designated by EPA	In progress
Purchase recycled content items through the GSA	In progress
<u>Actions Not Implemented</u>	<u>Comments</u>
Begin a coffee mug program	Not pursued
Human Factors	
<u>Actions Implemented</u>	<u>Comments</u>
Issue affirmative procurement policy memorandum for recycled content products	To be pursued
Develop a green system architecture for information management systems	In progress
Support implementation of FEMP energy-efficient purchasing recommendations	In progress
Issue memo directing staff to make energy efficiency an integral part of purchasing and contracting activities	To be pursued
Develop and use a systematic process to simplify business and work processes and make them more efficient	In progress

Expand televideo conference capabilities	Completed
Increase public awareness of DOE greening activities	Completed
Instill a green work ethic among DOE employees	In progress; extensive outreach to employees through the LAN – “You Have the Power” campaign
Implement recommendations of 1993 energy and indoor air quality survey (Forrestal)	To be pursued
Improve indoor air quality for improved employee comfort, health, and productivity	Completed
<u>Actions Not Implemented</u>	<u>Comments</u>
Conduct productivity study based on energy and indoor air quality	
Increase outside air intake with heat recovery (Forrestal)	Not pursued
Establish model “intelligent retrofit” demonstrations (Forrestal)	Not pursued
Establish “employee productivity center” or demonstration to meet demands for shared spaces and contract/part-time workers (Forrestal)	Not pursued
Coordinate work space infrastructure and furnishings on the same module for ease of reconfiguration	Not pursued
Provide individual controls of environmental services for each workstation (Forrestal)	Not pursued

Prepared for the U.S. Department of Energy
Federal Energy Management Program
And the National Renewable Energy Laboratory
By ENSAR Group, Inc., in cooperation with
Scientific Consulting Group, Inc.
Under NREL Subcontract No. AAR-0-29469-01
May 2000