FISCAL YEAR 1998

ANNUAL REPORT

ON

U.S. ENVIRONMENTAL PROTECTION AGENCY'S

ENERGY MANAGEMENT AND CONSERVATION PROGRAMS

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FY 1998 Annual Report to Congress
EPA Energy Management and Conservation Program

Introduction

The Environmental Protection Agency (EPA) is submitting this Fiscal Year (FY) 1998 Energy Conservation report to the Department of Energy (DOE), documenting its energy conservation achievements during the past year, and plans for meeting future energy conservation goals.

1. EPA's Energy Consumption History

EPA is currently responsible for the energy consumption for 16 facilities. All of EPA's facilities are laboratories, used for environmental research, testing, and experimenting. Laboratories have an inherently high energy consumption rate, due to energy intensive equipment, strict temperature and humidity levels, and a one-pass air ventilation requirement. Therefore significant energy reduction is a challenge which must take into account occupant comfort, safety and health, and environmental issues. Although EPA could have responded to DOE reporting requirements by excluding laboratory space, EPA chose to rise to the challenge of energy conservation as a method of preventing pollution by reducing greenhouse gas emissions. The Agency has spent the past two years developing an approach to achieving the required energy reduction in its laboratory facilities.

In 1985, EPA was responsible for the energy bills of 12 facilities, and the Agency's annual energy consumption was 399,992 Btu per square foot.

In 1992 EPA joined the Green Lights program, and performed energy efficient lighting upgrades in its facilities. Green Lights upgrades were completed by 1995, ahead of the scheduled agreement. By 1995, several of EPA's facilities had achieved 20% or more reductions in energy consumption, allowing the agency to reach the first energy conservation milestone of a 10% energy reduction from the 1985 baseline. The major activities which created this reduction were implementation of lighting upgrades and operational improvements. EPA added four facilities, Houston, Texas and Newport, Oregon in 1991; Montgomery, Alabama in 1993; and Richmond, California in 1994. As is shown in Exhibit 1, the overall Agency energy consumption in FY95 was 11% below the 1985 baseline.

In 1995, EPA's Facilities Management and Services Division (FMSD) performed an energy analysis of Agency facilities and determined that approximately 70% of the energy consumption is used for heating, ventilation, and air conditioning (HVAC). In response to this situation, the Agency developed a strategy to pursue comprehensive energy systems upgrades which will allow EPA to more correctly balance energy-consuming system components. The strategy will focus on 'right-sizing' of the central plant, meeting building requirements without unnecessary over-sizing of equipment.

Since 1995, EPA has implemented several energy conservation projects that will Assist EPA in achieving the 20% reduction goal. EPA has targeted energy savings measures such as heat recovery, daylighting, and control strategies such as night setback and chiller optimization. By the end of FY 1997, the EPA overall energy consumption was 354,903 Btu/sq ft, 11% below the baseline.

During FY 1998, several independent energy conservation projects contributed to a further reduction in Agency energy consumption. More importantly, during FY98 the Agency chose a strategy of using energy savings performance contracts (ESPC) to achieve the 20% and 30% energy reduction goals. In August 1998, EPA awarded its first ESPC, which will guarantee a 53% energy reduction at its Ann Arbor, Michigan laboratory. EPA will use the success of this ESPC to upgrade seven other facilities using ESPCs.

Exhibit 1 below shows each of the 16 facilities that EPA is including in its energy consumption reporting. The table shows baseline energy consumption, FY 1995 energy consumption, FY 1997 energy consumption and the most recent energy consumption data for FY 1998.

Exhibit 1. EPA Facilities Energy Consumption History

Location	Gross Area Ft^2	Baseline* Btu/ft^2	FY95 Btu/ft^2	FY95 Diff.	FY97 Btu/ft^2	FY97 Diff.	FY98 Btu/ft^2	FY98 Diff.
Athens, GA	87,437	339,756	255,387	*-25%*	302,097	*-11%*		
Ann Arbor, MI	158,507	713,864	569,409	*-20%*	496,721	*-30%*		
Duluth, MN	129,946	257,368	316,286	*+23%*	295,169	*+15%*		
Ada, OK	71,441	379,587	310,105	*-18%*	272,743	*-28%*		
Research Triangle Park (RTP), NC	913,236	459,305	492,011	*+7%*	529,129	*+15%*		
Las Vegas, NV	84,195	278,634	287,793	*+3%*	264,242	*-5%*		
Gulf Breeze, FL	78,687	307,643	255,435	*-17%*	213,464	*-31%*		
Corvalis, OR	115,702	293,938	273,549	*-7%*	266,022	*-9%*		
Edison, NJ	407,860	145,087	58,359	*-60%*	74,588	*-49%*		
Cincinnati, OH	510,726	401,312	370,019	*-8%*	302,741	*-25%*		
Narragansett, RI	69,182	436,867	396,457	*-9%*	494,392	*+13%*		
Manchester, WA	49,881	370,630	261,018	*-30%*	286,857	*-23%*		
Houston, TX	42,600	572,433*	540,606	*-6%*	524,775	*-8%*		
Newport, OR	46,040	174,433*	194,688	*+12%*	180,666	*+4%*		
Montgomery, AL	54,590	287,811*	257,947	*-10%*	278,182	*-3%*		
Richmond, CA	30,100	660,518*	633,874	*-4%*	534,061	*-19%*		
Total	2,850,130	**399,992**	**357,712**	***-11%***	**354,903**	***-11%***		

** Baseline year is 1985 except for Houston (1991), Newport (1991), Montgomery (1993), and Richmond (1994)*

2. Interagency Initiatives

EPA has taken advantage of interagency programs and initiatives to further the goals of energy conservation within the Agency and for the good of the government and private sectors.

2.2 Energy Star Buildings MOU

In 1997, EPA signed the Energy Star Buildings Memorandum of Understanding (MOU) and became a Federal buildings Partner. The Ann Arbor laboratory was chosen by EPA to be its Energy Star Showcase facility in accordance with the agreement. On October 6, 1998, FMSD and the Energy Star Buildings program held a signing ceremony at the Ann Arbor laboratory to kick off the ESPC upgrade. The FMSD is now working with the Energy Star Buildings program to develop a benchmark and performance criteria for laboratory buildings. The FMSD will use this criteria to upgrade its remaining laboratory space to meet Energy Star standards.

In addition, FMSD plans to develop all new office space to meet Energy Star criteria. EPA plans to obtain energy consumption information from the General Services Administration (GSA) for office spaces that EPA is leasing from GSA. EPA will evaluate these office spaces to determine whether they qualify for the Energy Star label. For leased office spaces which do not qualify for a label, EPA will work with GSA and the building owners to provide the necessary upgrades.

2.2 Laboratories for the 21st Century

EPA has developed an annual forum for the public and private sectors to convene and exchange ideas on reducing energy consumption in laboratories. EPA and DOE partnered on this program due to the energy-intensive nature of laboratories, the need to provide sound, energy-efficient technology alternatives for laboratory applications, and to create a forum for federal laboratories to obtain up-to-date information and support for implementing energy conservation programs.

The first conference was held at the American Institute of Architects headquarters in Washington, DC, in September 1997 and was well attended with representatives from a wide variety of agencies, including the National Institutes of Health, the Center for Disease Control, Sandia National Laboratory, and Princeton Plasma Research Laboratory. The conference is organized into two sessions, a formal training component and an informal open discussion. The training is provided by a host of speakers from EPA, DOE, LBL, NREL, and academia, who present views and technical information on subjects as varied as utility deregulation and passive solar design and the related impacts and considerations for laboratory design, construction, and operation. The informal sessions enabled attendees to present their agency's current issues and projects and have their federal peers join in an exchange of views and experiences.

The second conference was held at the University of Southern California (USC) in May, 1998, and the third conference is being planned for 1999.

3. EPA Energy Conservation Strategy

EPA's current energy conservation strategy includes a combination of large-scale internally funded projects to reduce current consumption, ESPC projects, and renewable energy sources to achieve significant reductions in the long term. As a result of this strategy, the Agency energy consumption rate is not expected to drop substantially in the next year to two years, but when ESPC projects are implemented between FY2000 and FY2005, the Agency should meet the 20% reduction goal, and meet and exceed the 30% reduction goal.

3.1 FY95 to FY97 Projects

Since 1995, EPA has implemented several energy conservation projects that will Assist EPA in achieving the 20% reduction goal. EPA has targeted energy savings measures such as heat recovery, daylighting, and control strategies such as night setback and chiller optimization. Some examples are shown below.

EPA's National Vehicle Fuel Emissions Laboratory in Ann Arbor Michigan (NVFEL) installed a photovoltaic energized active daylighting system to provide natural lighting in a hi-bay area. The project uses light from existing roof-mounted skylight devices to replace fluorescent lighting when adequate daylight is present. Motorized reflectors, powered by photovoltaic cells, track the sun's path and direct sunlight into the diffusers.

EPA's Environmental Research Center (ERC) at Research Triangle Park (RTP), NC installed energy efficient lights, chillers, air compressors, and vacuum pumps.

EPA's MED in Duluth, MN incorporated Green Lights, and designed energy-efficient windows. In 1995 EPA installed a geothermal pumping system to bring water from Lake Superior to the facility to supplement mechanical cooling.

EPA's Cincinnati laboratory incorporated a night setback strategy to reduce air flow to the building during nighttime unoccupied hours by 50%, utilizing the energy management system (EMS) already in place.

In 1996, EPA's Gulf Breeze Laboratory in Pensacola Florida installed a heat pipe dehumidification system on one of the air conditioning systems to reduce cooling and dehumidification energy.

3.2 FY98 Projects

Throughout the past fiscal year, EPA has worked towards the 20% reduction goal by supporting ongoing projects, incorporating new innovative technologies, and planning for future energy upgrades at all of it's facilities. Summaries of current activities for each facility are given below

Duluth, MN. EPA has installed an energy and environmental management system to minimize energy waste through improved equipment controls. In addition, EPA will be replacing two large boilers with ten small boilers to improve part load efficiency of the heating system. EPA is in the process of determining the energy baseline of the Duluth facility

Gulf Breeze, FL. EPA has recently installed timers on approximately 20 electric water heaters, which are expected to save a significant amount of energy. In FY98, EPA will be awarding a contract to install Nodal Direct Digital Controls (NDDC). This project will improve building controls to minimize energy waste and monitor building security, fire protection and indoor environmental quality. Also in FY98 EPA will install a photovoltaic system to generate on-site electricity using solar incidence.

Edison, NJ. A combination desiccant wheel/heat transfer wheel system has been installed as a pilot program at the Edison laboratory to recover energy from fume hood exhausts and to control humidity and conditioning in analytical chemistry laboratory modules. A statement of work (SOW) is in place to install a solar hot water heating system to supplement three existing water heaters.

Houston, TX. The facility conducted air system modifications and upgraded the existing DDC system. EPA is incorporating the use of a night set-back system to control exhaust fans, laboratory fume hoods, and supply air. Also at the Houston laboratory, EPA is evaluating technology and operational options to reduce the large amounts of cooling and reheat that are required to reach temperature set-points.

Cincinnati, OH. In FY98 several energy savings opportunities will be pursued and implemented. Energy-efficient projects will include: a closed loop glycol cooling tower; a high pressure absorption chiller; energy-efficient electric chillers, energy-efficient elevator motors; boiler controls, adding a revolving door to help maintain temperature and building pressure; adding a new HVAC system with improved windows and insulation; installing Green Lights; and installing a new energy-efficient boiler.

Montgomery, AL. EPA developed a protocol for incorporating an NDDC technology system to its Montgomery laboratory to control and monitor laboratory pressures, fume hood exhausts, pH wash-down fluids, scrubber efficiencies, and indoor environmental conditions. Currently in the process of evaluating the program of requirements.

3.3 Energy Savings Performance Contracts

EPA is planning to use ESPCs to finance comprehensive energy upgrades for eight of its facilities. Exhibit 2 shows a timeline for each facility, from award to completion. EPA expects to achieve a 50% reduction from current energy consumption levels for each facility undergoing a comprehensive upgrade paid through an ESPC.

Two tools which have surfaced recently to expediate the process of performing ESPC upgrades are the DOE Super ESPC awards, for which five or six energy service companies in each of four regions (northeast, southeast, mid-west, and west) won the right to bid for ESPC upgrades in federal facilities, and unsolicited ESPCs. EPA's Ada Oklahoma laboratory will be one of the first facilities upgraded under the Midwest Super ESPC, and the Narragansett lab will be one of the first Northeast Super ESPC projects. EPA has been notified of an unsolicited offer to perform an ESPC for the Manchester Washington lab under the Western Super ESPC, and plans to include the Richmond, Houston, and Athens facilities in regional Super ESPCs. The facilities listed below are targeted for upgrades through the Super ESPC program:

Ann Arbor, MI. An ESPC to conduct a complete energy upgrade at the NVFEL has been awarded. The new design will guarantee a reduction in energy consumption of 66% from the baseline, which was the average consumption for the three-year period 1993-1995 (638,675 Btu/ft^2). The planned upgrade will establish NVFEL as an energy and environmental showcase facility by reducing source emissions, energy consumption, and energy costs, and incorporating renewable technologies, while preserving and improving the integrity of the laboratory's mission. Installation of a real-time demand meter has helped the facility reduce and maintain its electrical demand peak. FY97 also saw NVFEL break ground on its new energy-efficient office building, designed using an integrated team approach to ensure that energy efficiency, pollution prevention, and passive solar features were key components of the design process.

Ada, OK. The laboratory in Ada, Oklahoma, will soon undergo a comprehensive energy-efficiency upgrade of their entire facility, including installation of a ground-source heat pump system and an integrated DDC system for energy, fire, and security management, all funded by an ESPC.

Manchester, WA. This facility is in the planning stage to be upgraded with an ESPC project through the western Super ESPC. The contract is expected to be awarded during FY99.

Duluth, MN. This facility is in the planning stage to be upgraded with an ESPC project during FY99. Several energy savings measures will be investigated, including geothermal heat pumps, wind turbines, and photovoltaics.

Gulf Breeze, FL. This facility is in the planning stage to be upgraded with an ESPC project through the southeast Super ESPC. EPA is negotiating and IAG with DOE to provide a no-cost energy audit, which will be used to create the energy baseline model.

Narragansett, RI. The Agency is designing an HVAC system upgrade which will use high-efficiency chillers, geothermal heat pumps, and latent energy recovery technologies. This system is being designed based on the readily available heating and cooling potential of circulated bay water used for salt water aquatic testing in the laboratory. This project will be pursued through DOE's New England Super ESPC, and the request for proposals will require renewables.

Richmond, CA. This facility is in the planning stage to be upgraded with an ESPC project through the western Super ESPC. EPA is working with DOE, the National Renewable Energy Laboratory (NREL), Lawrence Berkeley Laboratories (LBL), and the building owner to establish this project as the first federal leased-facility ESPC.

Athens, GA. This facility is expected to utilize ESPCs for an energy upgrade starting in FY 2000.

3.4 Renewables

EPA recognizes that renewable energy sources and technologies are the most environmentally beneficial method of reducing facility energy consumption. EPA is including a requirement in all ESPC's that renewable technologies be installed as part of the overall upgrade. In addition, EPA is pursuing several independent renewable technology projects.

Ft. Meade, MD. EPA, with DOE and DOD, assembled a public-private partnership to potentially demonstrate the world's first megawatt class solid oxide fuel cell (SOFC) power station at EPA's new Fort Meade Environmental Science Center in Fort Meade, MD. The power station is an innovative compact technology which functions along the same principles as a battery, yet can be fueled by a variety of resources, among them renewable biogas and solar hydrogen. The technology will provide extremely efficient and clean power to the facility at over twice the efficiency of existing conventional power-generating combustion technologies using a combined cycle power generating system.

Athens, GA. A biomass feasibility study for Athens is well underway. A strong partnership between the EPA, DOE, Tennessee Valley Authority, US Department of Agriculture, University of Georgia, and Georgia State Forestry will be the foundation for making this a successful project. Preliminary results of the feasibility study indicated that biofuel could potentially be obtained from the large quantities of cardboard, paper, waste wood, and municipal wood that are currently disposed of in local landfills each month. The next phase of this project will entail determining the size, type, cost, and potential funding options for the plant equipment best suited for the Athens laboratory. In addition, solar hot water was installed at the day care center.

Gulf Breeze, FL. EPA and NREL have jointly funded and awarded a photovoltaic dock lighting project for the Gulf Breeze laboratory.

Edison, NJ. EPA and NREL have jointly funded and will award a solar hot water heating system for the Edison laboratory.

Manchester, WA. EPA and NREL have jointly funded and awarded a photovoltaic demonstration project for the Manchester laboratory. The project will serve as a training exercise for regional, state, and local personnel to learn about the technology's components and installation.

Golden, CO. EPA and NREL are assessing various solar technologies for a newly constructed leased facility in Golden, Colorado. EPA is considering using a new ESPC program for solar technologies.

4. 30% Energy Reduction by 2005

The EPA strategy for reducing energy consumption by 30% from the 1985 baseline includes a heavy dependence on ESPC projects, combined with a few internally-funded large-scale projects. Exhibit 3 shows the baseline and expected consumption rates for each facility, and the method of achieving each reduction (ESPC or funded projects (FP)). The exhibit shows that if all ESPC projects result in a 30% to 50% energy reduction per facility, and funded projects result in a 10% to30% energy reduction per facility, agency energy consumption will be 270,490 Btu/ft^2, a 32% reduction from 1985 levels.

As described in the previous section, EPA plans to utilize ESPCs to upgrade seven owned facilities and one leased facility. Future construction agreements in Edison, New Jersey and Las Vegas, Nevada will include the Leadership in Energy and Environmental Design (LEED) rating system which has been developed by the U.S. Green Building Council (GBC). EPA will be incorporating several renewable technologies into existing laboratories, including biomass boilers, solid oxide fuel cells, photovoltaics, and solar hot water heaters. In another initiative, EPA plans to incorporate Green Power purchasing for several facilities. Each of the following sections describe how EPA plans to use each of these tools to achieve, and bypass, the 30% reduction goals.

4.1 Funded Projects

EPA plans to use FMSD funds to upgrade facilities which are not being considered for ESPC upgrades. These include EPA's Cincinnati laboratory and Research Triangle Park.

4.2 LEED Rating System

EPA plans to incorporate the LEED rating system in new-construction documents being developed for a new laboratory in Edison, and a new facility in Las Vegas, Nevada. The rating system assigns a score for construction proposals which meet specific energy

efficiency and sustainable design criteria.

4.3 Green Power Purchasing

In response to the deregulation of electric utilities, it will be difficult for renewable energy production generators to compete with cheaper, but more polluting, electricity generation sources such as coal and natural gas. The federal government can help accelerate the growth of renewable energy sources by requiring the purchase of Green Power for a percentage of their overall energy consumption. EPA will require Green Power Purchasing for 100% of the energy consumed by the Athens, Georgia laboratory and the Richmond, California laboratory, and 10% of the energy consumption of the Narragansett, Rhode Island laboratory.

Exhibit 3. 2005 Projected EPA Facilities Consumption and Comparison

Location	Baseline Btu/ft2	Project Type	Expected Reduction from 1997 levels		Projected 2005 consumption Btu/ft2	Difference from Baseline
			%	Project year		
Athens, GA	339,756	ESPC	-50%	2002	151,049	-56%
Ann Arbor, MI	713,864	ESPC	-56%	1998	217,149	-70%
Duluth, MN	257,368	ESPC	-30%	1999	206,618	-20%
Ada, OK	379,587	ESPC	-50%	1999	136,371	-64%
RTP, NC	459,305	FP	-10%	2002	476,216	+4%
Las Vegas, NV	278,634	LEED	-25%	2002	198,182	-29%
Gulf Breeze, FL	307,643	ESPC	-50%	1999	106,732	-65%
Corvalis, OR	293,938	FP	-30%	2002	133,011	-55%
Edison, NJ	145,087	LEED	-30%	2004	52,212	-64%
Cincinnati, OH	401,312	FP	-30%	2002	211,919	-47%
Narragansett, RI	436,867	ESPC	-50%	2000	247,196	-43%
Manchester, WA	370,630	ESPC	-50%	1999	143,429	-61%
Houston, TX	572,433				524,775	-8%
Newport, OR	174,433	FP	-30%	2004	126,466	-27%
Montgomery, AL	287,811				278,182	-3%
Richmond, CA	660,518	ESPC	-50%	2000	267,031	-60%
	399,992				270,490	-32%

Two renewable projects in the planning stages could assist the overall Agency fossil fuel energy reduction. A planned installation of a solid oxide fuel cell at the Fort

Meade laboratory could reduce utility electricity consumption at that facility by 60%, and a planned biomass boiler in the Athens facility could reduce utility energy consumption in that facility by 20%. If both of these projects are implemented, the overall Agency energy consumption rate would be 273,920 Btu/ft^2, shown in the table below:

Ft. Meade, MD	556,171	Fuel Cell	-60% (electric)	362,611	-35%
Athens, GA	151,049	Biomass	-20%	120,839	-60%
Total				273,920	-32%

Conclusion

EPA plans to meet and exceed the 30% energy reduction goal by utilizing energy savings performance contracts to upgrade the majority of its owned facilities. EPA also plans to utilize renewable technologies, cutting-edge energy efficient technologies, and Green Power Purchasing to further the goals of pollution prevention through energy conservation. A summary of projects which have been started or completed in the previous two fiscal years (FY97 and FY98), and which are planned for the next fiscal year (FY99) are shown in Exhibit 4, Summary of EPA's FY97 to FY99 Energy Efficiency Improvements.

Exhibit 4. Summary of EPA's FY97 to FY99 Energy Efficiency Improvements

Location	FY97	FY98	FY99
Athens, GA			DDC installed, Biomass boilers designed
Ann Arbor, MI	Photovoltaic lighting	ESPC awarded, and started	ESPC completed
Duluth, MN		Energy efficient windows installed,	ESPC will be awarded
Ada, OK			ESPC will be awarded
RTP, NC			
Las Vegas, NV			
Gulf Breeze, FL	Heat pipe installed	Nodal DDC system designed	NDDC installed, Photovoltaic dock lighting installed
Corvalis, OR			
Edison, NJ		Energy efficient windows installed, Solar hot water heaters designed	Solar hot water heaters installed
Cincinnati, OH		Chiller replacement completed	
Narragansett, RI			ESPC will be awarded
Manchester, WA			
Houston, TX	Energy Management System (EMS) completed		

Newport, OR			ESPC will be awarded
Montgomery, AL	DDC system designed	DDC system constructed	
Richmond, CA			Leased-facility ESPC will be awarded