Army Energy Management Plan

Response to the Energy Policy Act and Executive Order 13123

May 2000

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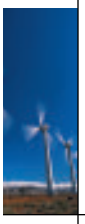
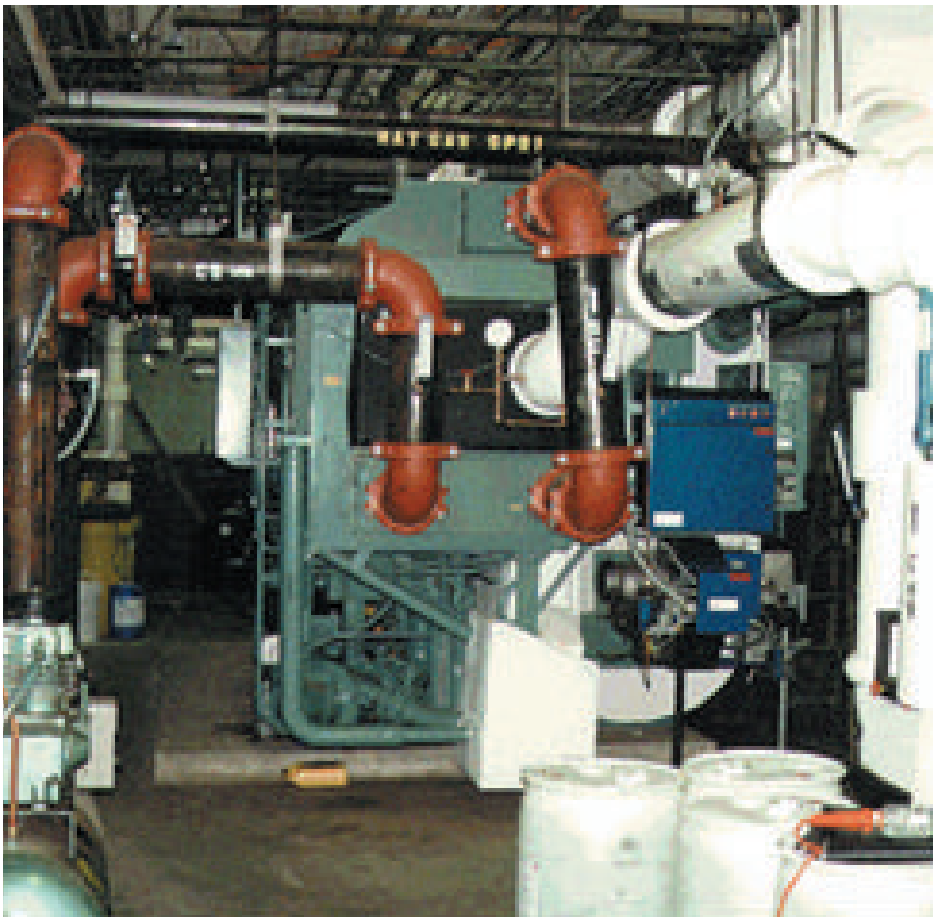


The Army Energy Management Plan implements within the Department of the Army Executive Order (EO) 13123, Greening of the Government through Efficient Energy Management, signed on 3 June 1999 and the Energy Policy Act of 1992 (EPAct), passed into Public Law on 24 October 1992. This document describes the Army's Energy Management Plan and associated policies and programs to meet the goals defined by Executive Order and Law. The Army, to the greatest extent practical, will install all energy and water conservation measures with life-cycle cost effective paybacks of less than 10 years by January 1, 2005. The Army will reduce energy use in its (non-industrial or laboratory) buildings of 30% by 2005 and 35% by 2010 relative to 1985 consumption levels, on a Btu per gross square foot basis. In industrial or laboratory facilities the energy reduction goal per square foot or per production unit is set at 20% by 2005 and 25% by 2010 compared to a 1990 benchmark. All cost-effective water conservation projects will be implemented based on water conservation goals to be established by Department of Energy (DOE) and Environmental Protection Agency (EPA). Also, greenhouse gases attributed to building energy use will be reduced by 30% by 2010 compared to 1990 levels.

Since 1985, the Army has made significant progress towards meeting the 2005 and 2010 goals. The Army has achieved a 22.9% facility energy reduction from fiscal year 1985 through 1999, thereby already meeting the energy reduction requirements of EPAct. The Army is still below the glide path. The Army has already met the 2010 30% greenhouse gas reduction goal for facility energy usage. This was accomplished by implementing a multi-faceted approach that combined awareness, energy saving projects, and new building initiatives. A major investment of approximately $393 million under various direct funding programs such as the Energy Conservation Investment Program (ECIP) and the Federal Energy Management Program (FEMP) is creating major savings. Significant funding has gone into maintenance projects that enhance energy performance while repairing facilities. Through FY99 there has also been a private sector investment of approximately $155 million under Energy Savings Performance Contracts (ESPC).



The energy distribution for the Army changed between FY85 and FY99 in Army facility energy consumption. There is a definite trend toward natural gas and electricity as the dominant energy forms. There have been significant reductions in the use of coal and oil. This is due mainly to conversions to district heat in Europe and conversions from petroleum to natural gas Army-wide.

Energy program initiatives that contributed to the achievement of the progress to date include energy awareness efforts, energy manager training, energy engineering and audit programs, project implementation, use of new construction standards, and demonstration of innovative energy technologies. These along with several new

Table I-1. Energy Program Investment Requirements ($M)

PROJECT TYPE	TOTAL INVESTMENT	TOTAL NET DISCOUNTED SAVINGS	TOTAL ANNUAL SAVINGS	SIMPLE PAYBACK	SIR	TOTAL MBTU SAVINGS
Renewable Energy	$162	$270	$21	7.65	1.66	2,533,602
Water Saving	$89	$357	$33	2.66	4.03	1,137,774
Energy Saving	$192	$817	$71	2.72	4.25	6,881,395
Total for 30%	$443	$1,444	$125	3.54	3.26	10,552,771
Additional Energy Saving for 35%	$383	$934	$84	4.55	2.44	5,769,348
Total for 35%	$826	$2,378	$209	3.95	2.88	16,322,119

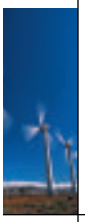
initiatives will ensure that the Army meets the new goals and requirements of EO 13123. New initiatives are enhanced use of private capital, meeting Energy Star building criteria, sustainable design and development, integrated energy planning, source energy considerations when fuel switching, taking maximum advantage of electrical market transformation, and enhanced use of renewable energy.

Implementing the Army Energy Program requires significant resources. The investment strategy to meet the 2005 and 2010 goals of the energy program consists of energy saving projects, renewable energy projects, and water saving projects. Also training and awareness programs must be funded. **Table I-1** shows the total investment required for renewable energy, water savings, and energy saving projects to meet EO 13123.

There has been inconsistent funding support for energy projects and little project funding is expected in the future. ECIP is expected to be funded at about $10 million/year through 2010 and should be reserved for renewable energy projects. Therefore, implementing the above projects will require major use of alternative financing, specifically Energy Savings Performance Contracts (ESPC) and Utility Energy Service Contracts (UESC). It is estimated that about 1,600 task orders will have to be awarded to complete the slate of projects required. The cost of processing a delivery order is approximately $50 thousand. Funding required to execute alternative funding projects is about $2.4 million per year for the next ten years. This does not account for any measurement and verification efforts by the installations.

Since the overwhelming majority of projects will be executed using private capital, there may be little or no monetary savings accruing to the government. Private contractors have much higher discount rates in order to recover the cost of capital, taxes, and profits. Also continued maintenance to ensure efficient operation of the projects must be funded through cost savings. The main benefit to the government is improved facilities and meeting targets and goals for reduced energy and water consumption.

Other funding requirements are $1 million per year for energy program awareness efforts; training energy managers; and program evaluation, management, and support. ■



purpose

This plan implements within the Department of the Army, the Energy Policy Act of 1992 (EPAct), passed into Public Law on 24 October 1992, and Executive Order 13123 - Greening the Government through Efficient Energy Management, signed 3 June 1999. The Army will reduce its energy consumption in fixed facilities worldwide serving the three components: Active, Reserve, and National Guard. This plan describes the following:

- Previous Army Energy Policy and Programs
- Current Energy Policy and Goals
- Past Progress and Initiatives
- Energy Management Program Strategy
- Tracking Progress Towards Goals
- Resource Requirements

BACKGROUND

Introduction

The Department of Defense (DoD) is the largest energy customer in the United States. With an annual facility energy bill around $3 billion dollars, improving the efficiency of defense buildings will reduce federal resource requirements. At the same time, lowering energy consumption will also reduce pollutants and greenhouse gas emissions from heating plants and electrical generating units.

The Army leads the DoD in real estate assets held. With 903 MSF in 171,000 buildings and 1,897 individual installations and sites, the annual facility energy bill exceeds $797 million. Additionally, the Army purchases $188 million worth of mobility fuels, mostly gas, diesel, and jet fuel. Though significant progress has been made in reducing overall energy use, the trend has been one of growing electrical energy use resulting from the explosion in electronic and automation requirements and increased demand for comfort air conditioning systems.

Previous Army Energy Policy and Programs

DoD's energy policy is driven by national energy policy as promulgated through Public Laws, Executive Orders, and Codes of Federal Regulation (CFR). DoD policy and goals are contained in DoD Directives, DoD Instructions (DODI), Defense Energy Program Policy Memoranda (DEPPM), and Defense Reform Initiative Directives (DRID). The Army uses guidance documents and regulations to prescribe policies and implement programs to reduce energy use in buildings. Where necessary, subordinate organizations and installations develop more detailed regulations and standard operating procedures.

Since the mid-1970s, federal policy has emphasized more efficient use of energy resources. The DoD has been assigned increasingly stringent energy reduction targets over the years. The Army has been the only service to consistently meet or exceed these goals.

Federal programs have also focused on emerging technologies, such as renewable energy resources, and provided special funding mechanisms for qualifying energy projects. Here again, the Army has been a leader in the application of these emerging technologies, such as fuel cells and desiccant cooling.

The Energy Policy and Conservation Act (EPCA) of 1975 was the first major piece of legislation to address Federal energy management. The EPCA directed the President to develop a comprehensive energy management plan, including procurement practices, and a 10-year plan for energy conservation in Federal buildings, including mandatory lighting, thermal, and insulation standards. The EPCA included few details, leaving those to the executive branch.

Executive Order 12003, Energy Policy and Conservation, dated July 20, 1977, aggressively expanded the requirements of the EPCA. It required a 20% reduction in energy use in existing buildings, and a 45% reduction in energy use in all new buildings by 1985. It also established the use of life cycle costing methodology. The Army met the 20% reduction goal.

In the National Energy Conservation Policy Act (NECPA) of 1978, Congress took a more active role in defining detailed steps to be followed by the executive agencies. In EO 12003, the President implemented several of the steps included in this legislation. For example, the EPCA directed the President to develop an energy-related procurement policy and the

NECPA specified the use of a "life cycle costing methodology" as the basis of policy. Similarly, where the EPCA directed the President to develop a 10-year building plan, the NECPA included details such as which buildings were subject to energy audits (all those exceeding 1000 square feet). Both of these NECPA provisions were part of EO 12003. Unlike EO 12003, the NECPA set no goal for percentage reduction in energy use, but instead specified the minimum rate at which Federal buildings had to be retrofit with all cost effective measures. All buildings were to have been retrofit by 1990. The NECPA also established the Federal Photovoltaic Program and the Federal Solar Program. The main provisions of the NECPA were codified as the Federal Energy Initiative.

The Comprehensive Omnibus Budget Reconciliation Act (COBRA) of 1985 amended the NECPA to provide Federal agencies an alternative source of funding for energy efficiency investments during a time of great fiscal constraints. Under the COBRA, agencies were encouraged to seek private financing and implementation of energy efficiency projects through "shared energy savings" contracts.

The Federal Energy Management Improvement Act (FEMIA) of 1988, established energy performance goals for Federal buildings, including a 10% reduction in building energy use by 1995. (The Army's goal was set at an 8% reduction since it was the only service to achieve the previous goal of a 20% reduction.) It allowed the Secretary of Energy to set the discount rate used in life cycle cost analyses and removed the requirement that agencies perform all life cycle cost-effective retrofits by 1990. It directed agencies to establish incentives for energy conservation and created the Interagency Energy Management Task Force on Federal energy management.

Executive Order 12759, Federal Energy Management, was signed on April 17, 1991. It extended the FEMIA Federal building reduction goal to 2000, requiring Btu per gross square foot to be reduced 20% from 1985 levels. It also required agencies to prescribe policies for improving energy efficiency of industrial facilities by at least 20% by 2000 compared to 1985 and required procurement of energy-efficient goods and products by Federal agencies based on life cycle costing. This Executive Order provided for Federal agency participation in Demand Side Management services offered by utilities

Executive Order 12902, Energy Efficiency and Water Conservation at Federal Facilities, was signed on March 8, 1994. This EO established an energy reduction goal of 30% by 2005 relative to 1985 consumption levels, on a Btu per gross square foot basis. The industrial energy goal was set at 20% by 2005 compared to a 1990 benchmark. DoD has an interim goal to reduce overall energy use in these buildings by at least 20% between 1990 and 2005. This EO added water conservation to the energy program, requiring implementation of all cost-effective water conservation projects. Each service was required to conduct prioritization surveys of all facilities

within 18 months of the President's signing of the EO. A 10-year plan for obtaining comprehensive facility audits was to be developed from the prioritization survey. Design and construction of new facilities were required to meet or exceed the energy performance standards set forth in 10 CFR 435, local building standards, or other specified limits, whichever resulted in the lowest life cycle cost. Life cycle cost was to be minimized by utilizing energy efficiency, water conservation, or solar and other renewable energy technologies. The use of passive solar design and active solar technologies was required where cost effective over the life of the project. In addition, a facility commissioning program was required to insure that construction of facilities met the outlined requirements before the facility was accepted into the Federal facility inventory. Each Agency was required to designate showcase facilities to highlight energy and water efficiency technology. Agencies were encouraged to utilize innovative financing and contractual mechanisms, including Demand Side Management programs and Energy Savings Performance Contracts to meet the goals and requirements of the EO.

Current Energy Policy and Goals

The DoD's current energy consumption goals are based on EO 13123 and the Energy Policy Act (EPAct) of 1992.

EO 13123, "Greening of the Government through Efficient Energy Management," was signed on 3 June 1999. This EO establishes an energy reduction goal in Federal (non-industrial or laboratory) buildings of 30% by 2005 and 35% by 2010 relative to 1985 consumption levels, on a Btu per gross square foot basis. In industrial or laboratory facilities, the energy reduction goal per square foot or per production unit, is set at 20% by 2005 and 25% by 2010 compared to a 1990 benchmark. The EO requires that all cost-effective water conservation projects be implemented based on water conservation goals to be established. Also, greenhouse gases attributed to building energy use are to be reduced by 30% by 2010 compared to 1990 levels. Source energy and associated carbon emissions are to be reduced. This is to be accomplished even if site energy increases. Additional credit toward meeting of goals will be given for reduction of source energy.

Each service is required to continue to conduct energy and water audits for their facilities through Energy Savings Performance Contracts, utility agreements, or independently.

Design and construction of new facilities are required to meet or exceed the energy performance standards set forth in 10 CFR 435, local building standards, or other specified limits, whichever results in the lowest life cycle cost. Life cycle cost is to be minimized by utilizing energy efficiency, water conservation, or solar and other renewable energy technologies. The use of passive solar design and active solar technologies is required where cost effective over the life of the project. In addition, a facility-commissioning program is required to insure that construction of facilities meet the outlined requirements before the facility is accepted into the Federal facility inventory.

All agencies should adopt sustainable design and development principles. Agencies should consider using Energy Saving Performance Contracts or utility agreements to aid them in constructing sustainable buildings.

Agencies are encouraged to utilize innovative financing and contractual mechanisms, including Demand Side Management programs and Energy Savings Performance Contracting, to meet the goals and requirements of the EPAct and the EO.

Each agency is required to substantially expand the use of renewable energy within its facilities and other activities by implementing renewable energy projects and by purchasing electricity from renewable energy sources. Agencies are required to support the Million Solar Roofs Initiative.

The Energy Policy Act (EPAct) of 1992 was signed on 24 October 1992 and is still in effect. It requires that all energy and water conservation measures with life cycle cost paybacks of less than ten years be installed in all US-owned Federal buildings by January 1, 2005. It gives Agencies new authority to enter into energy performance contracts, and describes methodology of contract implementation. EPAct defines a "trained energy manager" and requires Federal agencies to establish and maintain programs to train energy managers and increase the number of trained energy managers. General Services Administration, DoD, and Defense Logistics Agency are directed to identify energy-efficient products on the Federal supply schedules that offer significant potential for life cycle cost savings. Agencies are directed to establish criteria for improving energy efficiency in Federal facilities operated by contractors and to include such criteria in all cost-plus, award-fee contracts. EPAct establishes ASHRAE/IES Standard 90.1 and subsequent revisions as the basis for mandatory Federal codes for new construction.

The Army has initiated aggressive programs to meet all of these requirements. We have made significant progress toward the 2005 and 2010 goals. A multifaceted approach is crucial and has been effective in addressing the various opportunities to reduce energy consumption and modernized facilities. ■

PAST PROGRESS AND INITIATIVES

Introduction

About 73% of the Army's energy use is in fixed facilities. The Army achieved a 22.9% facility energy reduction from fiscal year 1985 through 1999. The glide path is shown at **Figure III-1**. This has been accomplished by implementing a multi-faceted approach that combined awareness, energy saving projects, and new building initiatives. A major investment of approximately $231 million under various direct funding programs such as the Energy Conservation and Investment Program (ECIP) and the Federal Energy Management Program (FEMP) is creating major savings. Significant funding has gone into maintenance projects that enhanced energy performance while repairing facilities. In addition, there has been a private sector investment of approximately $155 million under Energy Savings Performance Contracts (ESPC). The rule of thumb on investments in energy savings is that it will cost approximately one year's energy bill to reach the 35% reduction goal. The Army has historically paid approximately $1 billion per year for energy so the total range of investment required should be about $1 billion over the 25-year period.

Figure III-2 shows the comparison between FY 85 and FY 99 in Army facility energy consumption. The trend toward the use of natural gas and electricity as the dominant energy forms is evident. Overall consumption was reduced. Additionally, there have been significant reductions in the use of coal and oil. This is due primarily to conversions of coal-fired plants to district heat in Europe and conversions from petroleum to natural gas Army-wide. The intensified use of electricity is a trend that needs attention. Electricity is the Army's most expensive energy form. Although electrical costs are currently decreasing, it is not from reduced consumption, but rather reduced unit costs.

Figure III-1. Army Energy Glide Path and Progress

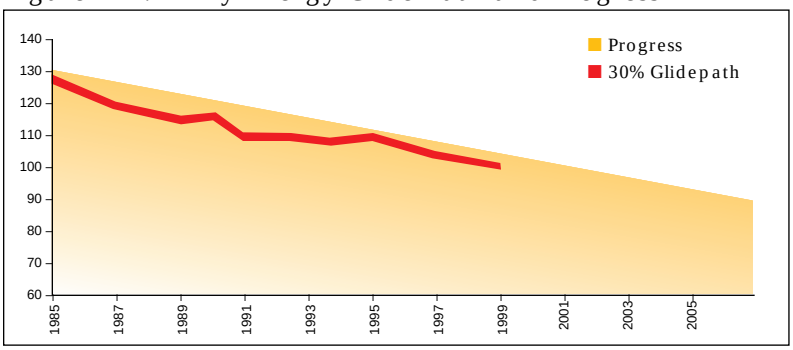


Figure III-2. Army Energy Consumption Trends

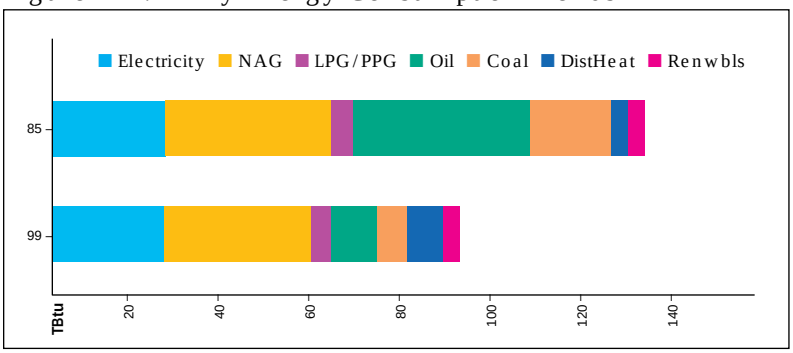
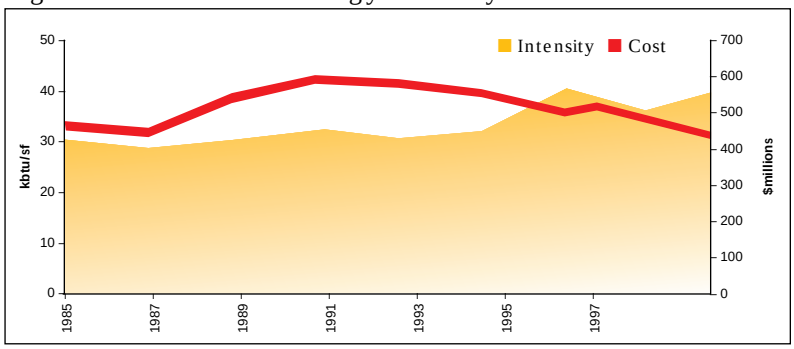


Figure III-3 shows the electrical trend since FY 85. Note how the Army-wide intensity is increased steadily as old buildings were removed from the inventory and less energy intensive facilities in Europe were closed.

Figure III-3. Electrical Energy Intensity and Cost



Energy program initiatives that contributed to the achievement of the progress to date include energy awareness efforts, energy manager training, awards program, energy engineering and audit programs, project implementation, use of new construction standards, and demonstrations of innovative energy technologies.

Energy Awareness Efforts

Awareness and training programs are important in achieving and sustaining energy efficient operations at the installation level. Army Energy Awareness Seminars are conducted at installations by the US Army Logistics Integration Agency (LIA) to provide assistance to the installation staff in meeting their energy goals.

Energy Manager Training

A course in energy management of existing facilities that meets the requirements of the Energy Policy Act of 1992 for training Energy Managers is available through the Army Corps of Engineers, Huntsville Engineering and Support Center (CEHNC). In FY 98, an Army Energy Program Interactive compact disk (CD) was published and is intended to serve as a resource for MACOM and installation level energy coordinators. The CD contains tools, ideas, examples, and information for use in implementing energy projects and other program initiatives. The DoD Energy Manager's Handbook is contained on the Construction Criteria Base CD. An Army Energy Program Home Page is being established by LIA to provide current information and reference materials applicable to the energy program.

Army Energy Awards Program

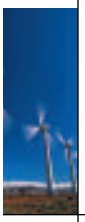
Energy conservation awards are presented to individuals, organizations, and installations in recognition of their energy-savings efforts. In addition to recognition, these awards also provide motivation for continued energy-reduction achievements. The Army participates in two energy awards programs — the Secretary of the Army Energy Conservation Awards and the DOE Federal Energy and Water Conservation Efficiency Awards.

Secretary of the Army Energy Conservation Awards
This program recognizes annual energy conservation achievements of Army installations and provides incentives to further reduce energy consumption. Award categories are: Active Army (1st, 2nd, and 3rd Place), Army National Guard (1st and 2d Place), and Army Reserve (1st Place). MACOMs should nominate installations in accordance with Army Regulation (AR) 11-27, Army Energy Program.

DOE Federal Energy and Water Conservation Efficiency Awards
This program recognizes organizations, small groups, and individuals for outstanding achievements in several energy-related categories within the Federal sector. Categories include energy management, renewable energy, water conservation, ESPC, and beneficial landscaping. Each Service can also recognize one outstanding individual for overall contribution to the program. Nominations are made through the MACOM to USALIA for inclusion into the Army submission to DOE.

Energy Engineering and Audit Programs

Lighting remains a key focus area for potential electrical energy reduction. The energy audit and retrofit program was geared to replacement of lighting systems at Army installations through centrally managed Indefinite Delivery Indefinite Quantity (IDIQ) contracts. Task orders may be awarded through contracts developed by Corps of Engineers with the retrofit work funded by the installation. Based on lessons learned, contracts



now include upgrading fluorescent lighting to T8 lamps, replacement of fixtures, compact fluorescent, LED exit signs, and motion sensors. These contracts offer a cost effective alternative to installations developing their own contracts.

Project Implementation

Centralized Funding

The centralized funding of energy efficient projects has been sporadic and unpredictable. At the peak of the Energy Conservation Investment Program (ECIP) in the 1980s, hundreds of millions of dollars were spent on qualifying projects. The Army supported the centralized development of energy projects through the Energy Engineering Analysis Program (EEAP). Products included an analysis of an installation's energy consumption along with recommended energy projects, complete with DD Form 1391s and life cycle cost analyses (LCCA). Historical funding for ECIP, FEMP, and Operations & Maintenance Army (OMA) is shown in **Figure III-4**.

The Energy Conservation Investment Program (ECIP) for implementing military construction type energy projects over $500,000 is DoD funded. ECIP funds financed $76 million in energy projects from FY91 through FY99. The ECIP program is centrally managed by the Department of the Army's Assistant Chief of Staff for Installation Management (ACSIM). The level of funding varies from year to year. The Army's portion has typically been around $10 million/year. Qualifying projects must achieve a specified simple payback and savings to investment ratio (SIR) as well as compete with other qualifying projects for funding. Guidance for the ECIP program is provided each year from the ACSIM. The Army's ECIP funding is directed toward Military Construction type projects over $500,000 for improving the energy efficiency of existing Army facilities or constructing new, high efficiency energy systems. The Army share of future ECIP funding is expected to remain around $10 million annually.

The Federal Energy Management Program (FEMP) for implementing O&M type energy projects was funded in FY94-96 by DoD. This funding has since been replaced by Operations and Maintenance, Army (OMA) Energy Funding.

OMA funds took over when FEMP funding "ran dry" in FY97. This funding served the same purpose as FEMP funding and financed similar types of projects. The FY97-99 program has been Army funded with $44 million in FY97 and $40 million in FY98-99. In FY00, no OMA funds were centrally programmed for energy conservation measures. Future energy project funding will be through ESPC contracts and Utility Partnerships, or funded as a part of repair or replacement projects.

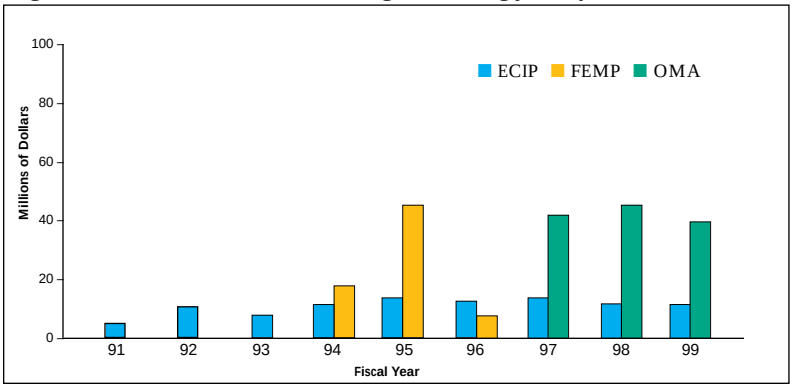
Examples of O&M projects completed in the past include lighting upgrade and replacement with energy efficient lighting; high efficiency motors; and heating, ventilation and air conditioning (HVAC) equipment repair and replacement with energy conserving equipment. All projects require an economic analysis and are ranked by return on investment for funding consideration. Projects funded in the past have had simple paybacks ranging from a few months to 10 years, with an average payback of less than four years. These energy projects are helping installation reduce their energy bills, making facilities more comfortable for the soldiers, civilians, and families while assisting the Army to meet its energy goals as established in EO 13123.

Use of Private Capital

Shared Energy Savings

Partnerships with the private sector through shared-savings type contracts allow installations to improve their infrastructure and to pay for the energy efficiency measures by sharing the monetary savings generated by the project over time with the energy service company providing the services. Several installations have made significant progress

Figure III-4. Historical Funding of Energy Projects



through the use of shared-savings contracts. Examples are Fort Polk and the US Military Academy. At Fort Polk the contractor spent $18.9 million to upgrade 4003 family housing units with ground-source heat pumps, lighting upgrades, water saving showerheads, and hot gas heat recovery water heating. This 20-year contract is expected to save the installation $345 thousand annually. The US Military Academy has a shared savings contract that involves both energy-saving projects and power procurement. These types of contracts are no longer used and have been replaced by Energy Saving Performance Contracts (ESPC).

Energy Savings Performance Contracts

Partnerships with the private sector through ESPC contracts allow installations to improve their infrastructure and to pay for the energy efficiency measures through the savings generated by the project over time. To date, the Army awarded 55 task orders with contractors initial investment of over $184 million and a total life cycle savings in excess of $436 million. Savings generated over time (90%) are returned to the contractor to pay for the improvement measures. In FY 98, the Office of the Secretary of Defense (OSD) funded 22 ESPC task orders for Army installations/activities to initiate installation audits and develop energy conservation retrofit ESPC proposals. Savings generated by ESPCs will help to reduce the energy consumption, but will not reduce the total costs of operation over the economic life of the retrofits. After retrofits are paid for, the Army will be able to obtain cost savings.

Utility Incentives

The Energy Policy Act of 1992 (EPAct) authorizes and encourages Federal agencies to participate in utility incentive programs. These programs range from rebates on a piece of equipment all the way to delivering a complete turnkey project. Services provided for a project can range anywhere from auditing to installation and commissioning, including financing the entire project. Utilities may cover the capital costs of the project in consideration of the energy savings the retrofits will produce. In this arrangement, the net cost to the Federal agency remains minimal, and the agency saves time and resources by using the "one-stop shopping" provided by the utility. An example of this type of contact is Fort Irwin National Training Center, CA. This project involved comprehensive base-wide lighting retrofit and HVAC technology pilots. Phase I of the project is expected to save $17 million utilizing ground source heat pumps. The utility is Southern California Edison, ENVEST Division. The contractor investment is $4,886,733 and the government share of savings is $2,119,000 over 10 years. Other examples can be seen at Aberdeen Proving Grounds and White Sands Missile Range.

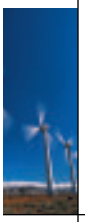
Use of New Construction Standards

Design energy use targets and life cycle cost analyses have been an effective tool in improving the energy efficiency of new buildings while increasing the use of air conditioning and improving indoor air quality, productivity and environmental conditions. Achieving the target goal requires the effective implementation of proven energy conservation techniques and the use of new energy efficient equipment, as well as demonstrating compliance with all federal energy standards and executive orders. Criteria and guidance for new construction is continually revised to incorporate new energy saving technologies. For example, detailed guidance on desiccant cooling and thermal storage have been issued while minimum equipment efficiencies have been raised to meet or exceed the upper 25% of that available commercially.

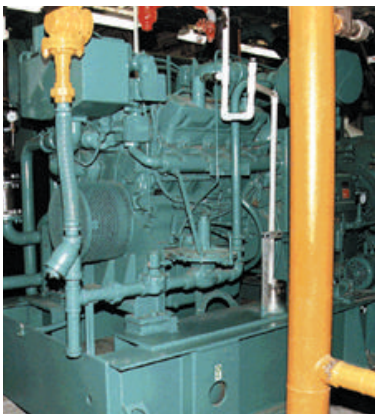
The design energy use targets have recently been reduced by 10% in recognition of the latest energy savings technologies and the emphasis on reducing greenhouse gas emissions. A typical new energy efficient facility will consume 30 to 50% less energy than a similar building in the 1995 Army inventory of existing facilities.

Demonstration of Innovative Energy Technologies

The Army continues to take the lead in DoD and the Federal Government for DOE designated showcase facilities demonstrating new and innovative energy saving technologies. In 1998, DOE selected fifteen new and renovated Army facilities, representing over $3 million in annual energy cost avoidance, as energy showcase facilities. Past facilities have demonstrated a variety of technologies including natural lighting and other passive solar features, fuel cells, energy saving controls, thermal storage, solar photovoltaics and gas fired chillers. ■



ENERGY MANAGEMENT PROGRAM STRATEGY



Introduction

Energy management on Army installations is focused on improving efficiency, eliminating waste, and enhancing the quality of life while meeting mission requirements. Accomplishing these objectives will reduce costs and ensure that the program goals are achieved. Executive Order 13123 established facilities energy reduction goal of 30% by 2005 and 35% by 2010. Fiscal year 1985 is the baseline year. To date, the Army Energy Program has achieved reduction of 22.9% towards the FY 2010 goal. The challenge now is to maintain this momentum in a rapidly changing fiscal and business environment.

The facilities energy program is decentralized, with Army installations managing site specific energy and water conservation programs. The installations are responsible for maintaining awareness, developing and implementing projects, and ensuring that new construction meets their requirements. Army headquarters provide guidance and funding through the Major Commands. The responsibilities and functions of Army elements implementing the program are outlined in the AR 11-27, Army Energy Program, and in the DoD Energy Manager's Handbook.

The energy program has a multi-faceted approach made up of several interrelated initiatives. These include energy awareness, energy manager training, energy engineering and project development efforts, project implementation, new construction standards, and demonstrations of innovative technology. Funding of projects also has a multi-faceted approach with a combination of government and alternative financing initiatives.

Responsibilities

Deputy Assistant Secretary of the Army (Installations and Housing) DASA (I&H)

The DASA(I&H) serves as the Special Assistant for Energy on the staff of the Secretary of the Army. The responsibilities of the Special Assistant are to represent the Army on the Defense Energy Policy Council (DEPC), to implement tasks and initiatives from the DEPC, and to monitor the Army Energy Program.

Army Advisory Group on Energy (AAGE).

The AAGE is the senior level Department of the Army forum for review, evaluation, and presentation of policy guidance on Army energy management. The AAGE policy group is a general officer council group chaired by the Director of Transportation, Energy, and Troop Support, Office of the Deputy Chief of Staff for Logistics (ODCSLOG). To assist the AAGE policy group, a working group is established with representatives from each Army Staff agency. The working group is chaired by the Chief, Army Energy Office, ODCSLOG. Membership and responsibilities of the AAGE are defined in Army Regulation (AR) 11-27.

Army Energy Office (AEO)

The Deputy Chief of Staff for Logistics (DCSLOG) is assigned Army General Staff responsibility for energy-related functions.

To execute this responsibility, the AEO was established in 1973 as part of the Directorate of Transportation, Energy, and Troop Support, ODCSLOG. The AEO is responsible to the DCSLOG for the Army Energy Program.

Army Energy Team, US Army Logistics Integration Agency (USALIA)

The Army Energy Team, USALIA, was appointed as the ODCSLOG Executive Agent for Energy Management in 1984. As Executive Agent, the team provides advice, analysis, and evaluation on the Army energy program to ODCSLOG, Office of the Assistant Chief of Staff for Installation Management (OACSIM), US Army Corps of Engineers, MACOMs, and installations.

Office of the Assistant Chief of Staff for Installation Management (OACSIM)

The OACSIM is the proponent of the facilities energy program and is responsible for policy, programming, and guidance of the program. The Utilities Privatization and Energy Team at the Facilities Policy Division of OACSIM provides installation policy guidance, develops resource requirements, prioritizes ECIP/FEMP projects, and chairs Tri-Service and DA steering committees.

US Army Corps of Engineers (USACE)

The USACE provides technical assistance for centrally managed programs such as Energy Savings Performance Contracts and Demand Side Management. USACE is responsible for development of criteria for new construction and sustainable design. USACE manages the Facilities Infrastructure Technology R&D program and provides technical assistance and guidance on all areas of facility energy and water conservation.

Army Energy Steering Committee R&D Program

This is a working committee chaired by the Chief, Utilities Privatization and Energy Team, OACSIM. Other members include representatives from the Logistics Integration Office, representing the ODCSLOG; the Installation Support Division at HQ USA Corps of Engineers; and the Construction Engineering Research Laboratory. The committee meets every quarter to discuss all aspects of the Army Energy Program.

Corps of Engineers National Energy Team (CENET)

CENET is an advisory group with representatives from HQDA, USACE, MACOMs, and installations supported by Corps of Engineers laboratories. Its charter is to review, prioritize, and promote technology transfer of energy research and development performed by the various engineering laboratories. Also it provides counsel on the selection of promising Research & Development (R&D) products and systems in the areas of energy awareness, facilities planning, programming, design, construction, operations, maintenance, and demolition.

Headquarters, Department of the Army (HQDA)

Principal staff responsibilities for energy management and conservation are identified in AR 11-27, Army Energy Program.

MACOM/Command Energy Coordinator

Responsibilities for energy management and conservation are identified in Army Regulation 11-27. AR 5-3, Installation Management and Organization, assigns the Directorate of Logistics (DOL) responsibility for energy policy at the installation level, but the program must have the active support and involvement of the Directorate of Public Works (DPW). The DOL develops command policies that focus on the use of energy by the installation's personnel. Also, the DOL should be the focal point for energy awareness on the installation. The DPW supports these policies by operating facilities in an energy-efficient manner, identifying and supporting energy-saving projects, and ensuring that energy-related work orders receive reasonable priority. When the DOL and the DPW work together significant energy savings can be achieved. The Energy Coordinator is the focal point for energy-related activities. This individual must take an active role in the program and have command support. Working with the Energy Coordinator are the Building Energy Monitors (BEMs). The BEMs are the "eyes and

ears" in individual buildings. They must be able to spot energy-related problems, fix or submit work orders for corrections, and keep the building occupants energy conscious. The coordinator must have regular meetings with the BEMs to educate and provide them direction and feedback on the status of energy-related work orders. Also they need to help get things fixed that are beyond the capability of the BEMs. The energy coordinator serves as the energy liaison between the DOL and the DPW. The DA Building Energy Monitor Handbook, CEHSC-P Pam 89-17, July 1989, provides information on BEM responsibilities. This pamphlet is available through the USALIA Energy Team.

Management Initiatives

The Army Energy Program is holistic in concept. It incorporates all aspects of installation construction, operation, and maintenance that effect energy and water consumption. Thus the entire life-cycle of buildings and systems, including occupant behavior, are part of the program.

Utilities Modernization

One focus of the Army's Utility Strategy is modernization of central energy plants and systems that are least likely to be privatized. Modernization of heating and cooling systems also saves OMA funds through more efficient equipment, reduced fuel requirements, elimination of steam and hot water leaks, and reduced manpower requirements. The Army has programmed $60 million per year from FY 98 through FY 02 for central heating plant (CHP) modernization. A final list of projects for heating plant modernization has been developed for 16 installations. Projects are expected to provide life-cycle energy and cost savings, as well as improve the maintainability, reliability, and safety of the Army's central heating plants. Criteria used to prioritize CHP modernization projects include the Installation Status Report; cost of operation, maintenance and repair; MACOM priorities; and monetary savings achieved.

Utilities Privatization

The Army will privatize all utility (electric, natural gas, potable water and domestic wastewater) systems at active, federally owned installations serving the Active, Reserve and National Guard (when federally owned) Components worldwide, except where privatization is uneconomical or where unique security reasons requires ownership by the Department. Since 1991, the Army has had a program underway to privatize installation utility systems. The program focused on the 265 systems serving 67 major installations in CONUS. The program goal was to privatize 75% of the systems by 2003. This deadline was moved to 1 January 2000 by Defense Reform Initiative Directive (DRID) #9. In December 1998, DRID #49 raised the stakes by expanding the scope to include all Army and changing the target date once again. The program now focuses on 320 CONUS systems to be privatized by 30 September 2003.

Alternative Financing

Alternative Financing is the term used to describe projects not using capital appropriations. Simply put, projects executed on Army installations are financed by the private sector. Alternative financing has been an option for years, but has become more important as traditional energy project funding sources have been reduced or eliminated. Hundreds of millions of energy set-asides have been replaced by legislative authority to enter into alternative financing arrangements with the private sector. The Army intends to use alternative financing as the keystone of the energy program and maximum use of these financing strategies is required at all levels of project implementation and construction.

Regulated Utility Programs.

Demand Side Management (DSM)

Though widespread in the early 1990s, these programs are dwindling in a utility environment dominated by deregulation and market transformation. Where still available, installations shall consider this option in their financing mix.

Utility Energy Service Contracts (UESC)

The Energy Policy Act of 1992 (EPAct) authorizes and encourages Federal agencies to participate in utility incentive programs entitled Utility Energy Service Contracts (also known as Utility Partnerships). These programs range from rebates on a piece of equipment to delivering a complete turnkey project. Services provided for a project can range anywhere from auditing to installation and commissioning, including financing the entire project. Utilities may cover the capital costs of the project in consideration of the energy savings the retrofits will produce. In this arrangement, the net cost to the Federal agency remains minimal,

and the agency saves time and resources by using the "one-stop shopping" provided by the utility. Utilities are one source for financing Federal projects. DOE provides guidelines to help Federal facility personnel select the most appropriate utility contracting vehicle and put a contract in place. Maximum use of this contracting method is encouraged as it can be more cost effective than ESPC's and the costs can be amortized over a shorter time span.

Energy Saving Performance Contracts (ESPC)

Shared Energy Savings Contracts, as a resource, have been replaced with Energy Saving Performance Contracting. An ESPC is a process by which contractors audit federal facilities, propose energy saving retrofits, and privately finance, install, operate, and maintain retrofits. Contractors are paid by receiving a portion of the cost savings realized through reduced energy consumption due to the retrofit. Remaining savings are returned to taxpayers and the agency. The authority to utilize ESPCs is derived from section 155 of the EPAct. Executive Order 13123 further encourages use of ESPC as a means of alternative financing. The President released the memorandum entitled "Federal Use of Energy Savings Performance Contracting" on July 25, 1998. This memo is intended to encourage increased use of ESPC and improve Federal energy management. Government-wide regulatory guidance on ESPC is contained at 10 CFR 436. The Department of Energy's Federal Energy Management Program (FEMP) developed model procurement documents; the Measurement and Verification Guideline for Federal Energy Projects; a how-to manual for ESPCs; a home page on the internet; and educational videos for management, legal, and contracting personnel.

The use of ESPCs has been simplified by the availability of existing contracting vehicles through the Department of Energy, the Army Corps of Engineers, Huntsville Engineering and Support Center, (CEHNC) and the US Army Medical Command (MEDCOM). The Department of Energy has awarded Super ESPC contracts covering its six geographic regions and three Technology Specific ESPC contracts. These contracts are available to all government agencies as a vehicle for utilizing ESPCs and their use is encouraged.

The Corps of Engineers, Huntsville Engineering and Support Center has been designated as the Technical Center of Expertise for ESPC projects within the Army. There are 19 area-wide contracts in place to service all 50 states, the District of Columbia, and Puerto Rico. Although some funding was provided by OSD, future ESPC delivery orders will require customer financing. MEDCOM recently awarded 9 similar contracts for use by its medical facilities throughout the United States.

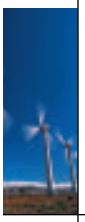
Energy Star Buildings and Products

ENERGY STAR Buildings℠ is a program developed by the U.S. Environmental Protection Agency (EPA) to promote energy efficiency in buildings. Army installations shall assess their buildings and leasing activities against the ENERGY STAR Building℠ criteria by the end of 2002. ENERGY STAR Buildings℠ must meet a set of criteria based on going through an integrated set of steps to reduce energy consumption. The five stage implementation strategy consists of lighting upgrades, building tune-up, other load reductions, fan system upgrades, and heating and cooling system upgrades. Actual ENERGY STAR Building℠ certification and labeling is based on measured building data and a comparison with archetypes in various regions of the country. Since Army buildings are not generally metered and temporary metering schemes are cost prohibitive, the installation may self-certify and develop a local label for non-metered buildings based on the knowledge of what retrofits and no cost/low cost options have been completed in those buildings. Where metered data is available, the installation will use that data to input the Benchmarking software program available on the EPA web site to certify the buildings against criteria and label accordingly.

To the greatest extent practicable, installations shall select ENERGY STAR℠ and other energy efficient products when acquiring energy-using products.

Sustainable Design and Development

Sustainability initiatives require an integrated design approach to the life-cycle of buildings and infrastructure. Sustainable design incorporates energy efficiency, the use of renewables and passive tempering, the reduction or elimination of toxic substances, improvements to indoor air quality (IAQ), efficiency in resource and materials, the recycling of building materials and construction waste, the use of recycled materials, and



the reduction of wastes during the entire life-cycle. Since this is a relatively new area for the design and construction industry, the design of new buildings and systems should be guided by the principles defined in the *Leadership in Energy and Environmental Design (LEED) Rating System* which is being developed by the US Green Buildings Council (USGBC). These practices should be adopted not only for new designs, but for retrofits and building rehabilitation projects.

The Office of the Chief of Engineers (OCE) has the mission to incorporate sustainability principles into the Army's design and construction process.

The concepts of sustainable development as applied to Army installations shall be incorporated into the master planning process. Installations are encouraged to approach land use planning and urban design in a more holistic manner and integrate it with energy planning. A recommended method for accomplishing this process is PLAnning for Community Energy, Economic, and Environmental Sustainability (PLACE^{3}S). Smart Places is public domain software that has been developed to help implement the PLACE^{3}S method. The outcome of the PLACE^{3}S method is a more information-based decision process and more thorough integration of community or installation goals. PLACE^{3}S is available from USACERL.

Integrated Energy Planning and Building Audits

The Renewables and Energy Efficiency Planning (REEP) program is a headquarters level screening tool for energy and water conservation opportunities which allows energy technologies to be evaluated for their energy savings potential, financial viability, and global warming reduction potential. REEP is designed to provide a quick overview of energy technologies and their savings potential on a Service-wide basis. This program can be coupled with an integrated energy methodology being developed by U.S. Army Construction Engineering Research Laboratory (USACERL) to help installations prepare an energy master plan and strategy. The methodology will evaluate an installation's progress towards goals, determine what needs to be done and what technologies should be considered, develop an investment strategy that uses alternative financing to achieve the goals, and provide monitoring and verification guidance for the installation. The integrated planning methodology employs various tools that have been developed over the past several years to assist with the energy program such as the REEP model and the Federal Energy Decision System (FEDS). Integrated planning concepts will also contain guidance and selection criteria for new technology such as gas cooling, thermal storage, and co-generation and can be used in developing installation strategies for meeting the year 2005 and 2010 energy conservation and greenhouse gas reduction goals.

REEP and FEDS analyses will serve as the energy auditing tools for the Army. REEP is updated annually and incorporates penetration factors for various energy efficiency improvements at individual

installations. The annual REEP results provide an effective assessment tool to determine the level of energy and water saving projects that typically remain at individual installations. Therefore, annual energy audits are not required unless in conjunction with an ESPC proposal and performed by the vendor. Evaluation of such proposals can be accomplished using Energy Manager Project Assistant (PA) software available from USACERL.

Industrial, Laboratory, and Leased Facilities

Industrial and Laboratory Facilities are required to meet energy goals of a 20% reduction by 2005 and a 25% reduction by 2010 without exception. Many of the Army's industrial facilities are in various stages of reduced production. The relationship between energy consumption and production is generally non-linear and difficult to determine. Therefore, the Army will use energy usage per square foot as the basis of evaluation for both industrial and laboratory facilities. The baseline year is 1990. Industrial facilities should utilize the Process Energy and Pollution

Reduction (PEPR) software developed by and available from USACERL to evaluate their energy reduction potential. Installations leasing facilities will incorporate energy goals into their leases. It is the Army's intent to have the lessor make appropriate investments in energy efficiency which can be amortized in the lease, provided the new total cost (energy costs plus lease cost) does not exceed total costs without improvements. Leases should amortize the investments over the economic life of the improvements. Build-to-lease solicitations for Army facilities will contain criteria encouraging sustainable design and development, energy efficiency, and verification of building performance.

Source Energy

The Army seeks to reduce total energy use as measured at the source and its associated carbon emissions. With certain fuel switching technologies, projects that reduce source energy tend to increase site energy. This is true of natural gas cooling and on-site electrical generation such as microturbines and engine-generator sets. Installations may take credit for instances of fuel switching where source energy is decreased but site energy is increased. A full accounting for the energy displaced is required based upon the generation mix of the region in which the installation is located. The mix of generation and carbon dioxide emission factors for states in various regions are found in **Table III-1**, below. For the purpose of calculating source energy, the efficiency assumptions in **Table III-2** apply:

Electrical Power

The most expensive energy type for the Army is electricity. Although the Army has made significant progress in reducing total energy consumption, the use of electricity has actually increased since 1985. Greater use of air conditioning and the overall trend toward electrification experienced nation-wide have been driving forces. The widespread expansion of information age technology within the Army facility structure increased electrical plug loads. Increased emphasis on reducing electrical consumption is an ongoing imperative.

The energy conservation opportunities having the greatest potential for reducing electrical power consumption in the Army are improved lighting effectiveness and increased chiller efficiencies. Lighting rep-

Table III-1. Regional Electrical Source Generation Mixes

Region (By State)	Electrical Source Fuel (%)						CO2 Factor (lbs/Kwh)
	Coal	Oil	Nat Gas	Nuclear	Hydro	Renewable	
MA, ME, NH, VT, RI, CT	23	17	12	40	7	1	.85
NY	20	9	13	34	25	0	0.77
PA, NJ, MD	56	2	2	38	2	0	1.21
DE, VA, WV	78	1	3	18	1	0	1.52
AL, AR, GA, KY, LA, MS, NC, SC, TN	61	0	5	28	6	0	1.33
FL	45	16	21	18	0	0	1.34
IL, IN, MI, OH	76	0	1	23	0	0	1.63
TX	49	0	37	13	0	0	1.53
KS, MO, OK	77	0	10	11	2	0	1.82
IA, MN, WI	74	1	1	21	3	1	1.77
ND, NE, SD	67	0	0	14	19	0	1.61
CA	0	1	27	30	38	4	0.32
ID, MT, OR, WA, WY	26	0	1	2	71	0	0.59
AZ, CO, NM, NV, UT	72	0	5	15	8	0	1.61
AK	5	13	57	0	25	0	0.15
HI, PR	0	100	0	0	0	0	1.49

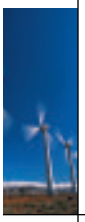


Table III-2.
Electrical System
Efficiency Assumptions

Source Type	Generation Efficiency (%)
Coal	27.5
Petroleum	36.1
Natural Gas	31.4
Nuclear	33
Hydroelectric	100
Renewables	100
Transmission and Distribution	90

resents a significant portion of the facilities energy consumption at an installation. Examples of funded lighting projects include installation of higher efficiency luminaires, lighting controls, and use of daylighting. Space cooling accounts for about a third of electrical energy consumed in the Army and is also responsible for more than half of electrical peak demand costs. During the last 20 years, the average chiller efficiency has improved nearly 40 percent. Replacement of old chillers with current energy efficient ones will help the Army conserve energy as well as meet the CFC refrigerant phase out requirements resulting from provisions of the Clean Air Act, 1990 Amendments. Other projects being implemented to reduce electrical energy use at installations are high efficiency motors, refrigeration equipment, and improved building energy management controls.

In an effort to reduce electrical costs, the Army shall take maximum advantage of competitive opportunities to reduce costs and improve services. The Army will continue to expand these efforts and aggregate procurements as opportunities arise through utility restructuring initiatives. As part of this effort, the Army will select providers who utilize high efficiency generation technology and have lower greenhouse gas emissions associated with their power.

Renewable Energy

Technologies that convert renewable energy resources, such as solar, wind, geothermal, and biomass, have advanced to the point that they are life cycle cost-effective for a variety of DoD applications and facilities. By displacing conventional engine-driven generators and fossil fuel heating equipment, these systems provide the additional environmental benefit of reducing harmful air emissions. Building-integrated solar technologies, such as photovoltaic power systems, solar water heating systems, and transpired solar collectors (solar walls), are specifically promoted for use by federal agencies through the President's Million Solar Roofs Initiative (part of the Buildings for the 21st Century program).

Renewable energy projects implemented to provide electricity or heat for facilities have included ground source heat pumps, solar water heating systems, and photovoltaic systems to generate electricity for isolated loads such as range targets, air field landing strip lighting, and remote water pumping stations. Examples of small photovoltaic units for a single building and larger grid connected systems, such as the 900 kW photovoltaic utility size array at Yuma Proving Ground, have been demonstrated. Active solar heating applications have included maintenance facility solar walls, swimming pool heating, and hot water heating for housing.

Renewable energy projects have not had significant impact because their paybacks are considerably longer than competing conventional technology. The capital costs tend to be high for the energy savings generated. Simply put, projects for renew-

Table III-3. Renewable Energy Potential ($M)

PROJECT TYPE	TOTAL INVESTMENT	TOTAL NET DISCOUNTED SAVINGS	TOTAL ANNUAL SAVINGS	SIMPLE PAYBACK	SIR	TOTAL MBTU SAVINGS
Barracks Solar Water Htg	$51	$66	$5	10.89	1.30	944,530
FH Solar Wtr Htg — Freeze Proof	$14	$19	$2	8.84	1.39	114,785
SolarWall for Maint Bldgs	$13	$31	$2	5.91	2.36	548,173
Wind Energy	$84	$154	$13	6.62	1.82	926,114
	$162	$270	$21	7.65	1.66	2,533,602

ables do not compete well. **Table III-3** shows the potential for renewable energy projects in the Army based on a life-cycle analysis and not restricted to a ten year payback or a Savings-to-Investment Ratio (SIR) greater than 1.25. The Army will make special emphasis to fund renewable energy projects under ECIP and through use of DOE renewable energy funding programs.

Greenhouse Gases

Greenhouse gas emissions attributed to building energy use shall be tracked and calculated at the Headquarters level and based upon Defense Utilities Energy Reporting System (DUERS) data. US average factors for gaseous emissions, both from site energy usage and purchased electricity, will be used for the calculations. The greenhouse gas reduction goal is a 30% reduction by 2010 with 1990 as the base year. Of the six greenhouse gases defined in the Kyoto Protocol, only carbon dioxide will be considered as resulting from building energy use and will be tracked. **Figure III-5** shows estimated Army carbon dioxide emissions both from site energy and source energy since 1990. Since this is based on total facility energy consumption, the Army has already met the 30% reduction goal for both site and source energy. The site energy goal was met in 1996 and the source energy goal was met in 1998. It took longer to meet the source energy goal due to electrical intensification on installations and the purchase of district heat dropped site energy faster than source energy.

Petroleum

The use of petroleum as an energy source for buildings and heating plants is discouraged. Installations should investigate alternative fuels, such as natural gas and renewables, that are less carbon intensive and are less likely to be disrupted. Where fuel switching is not possible, maximum efforts will be taken to improve the efficiency of plants and systems using petroleum based fuels and reducing the demand for this resource. These projects should take precedence over competing projects. Petroleum may be used for a backup fuel in the case where natural gas contract is interruptible, although propane/air is the preferred backup fuel.

Water Conservation

Water and water disposal costs are increasing at a rate greater than inflation for many Army installations. In certain regions, water shortages can create situations that impact the mission and morale of installations. The Energy Policy Act of 1992 added water conservation to the Federal Government's energy management efforts. It requires Federal agencies to implement all water conservation measures that pay back in 10 years or less. EO 13123 reiterates the importance of water conservation and encourages the use of ESPCs to achieve water conservation. There is no specific baseline or goal specified in the EO. Fiscal Year 2000 will probably be the baseline for any goals to be established. The Army will use information from the Tech Data Report as the basis for establishing water conservation goals and measurement.

Army water use has been steadily decreasing, but there is still a need to take steps to reduce the amount of water wasted on Army installations. While water use dropped by almost 45% between FY92 and FY97, the cost of water service only decreased by 13%. This is because the unit cost of water has more than doubled. Similar trends exist for water disposal volumes and costs. In the same time period, water disposal volume dropped by 49%, while costs decreased by only 8%. This reflects a unit disposal cost increase of 80%. The trend lines are show in **Figures III-6 and III-7**. Greater treatment and testing requirements imposed on water suppliers by the Safe Drinking Water Act and amendments have increased the cost of providing potable drinking water. Additionally, some of those installations that purchase their water are likely to be on rate schedules designed to encourage conservation, such as increasing block rates or summer peak demand charges. Thus, water conservation efforts, in addition to being environmentally responsible, can help installations stretch dwin-

Figure III-5. Army Carbon Dioxide Emissions

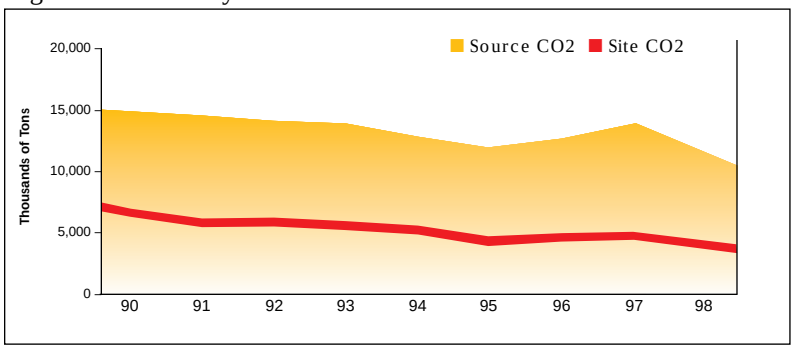


Figure III-6. Army Water Usage & Disposal Volume Trends

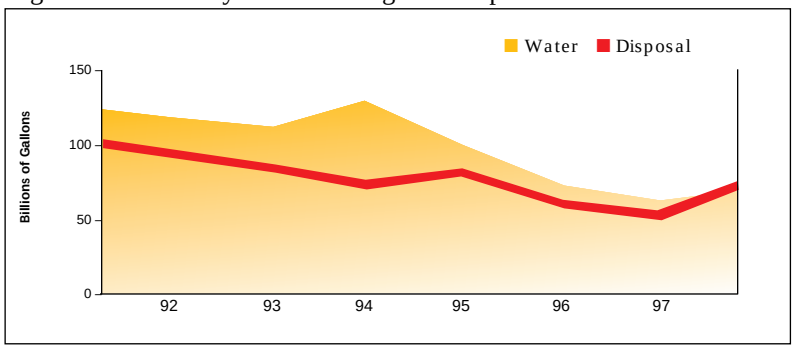
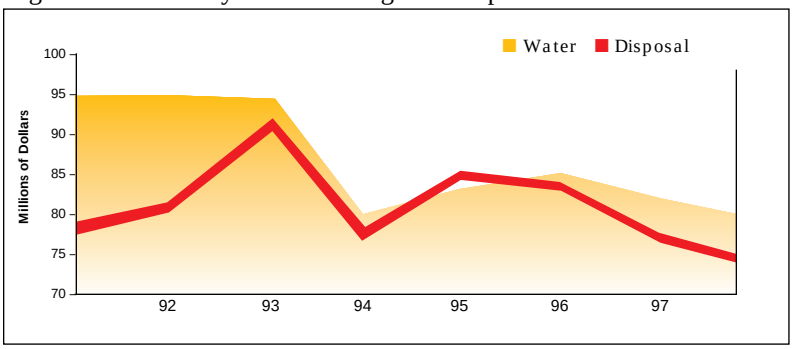


Figure III-7. Army Water Usage & Disposal Cost Trends



dling O&M dollars. Also, those water conservation measures that also reduce wastewater quantities provide an additional opportunity for savings.

One of the difficulties in instituting water conservation programs on Army installations is the lack of information on where and how the water is being used. Water meters are rare, so little information is available on the best opportunities to save water. In the early l980s, USACERL conducted a water use characterization study to determine where water is used on Army installations. Water use at four installations (Forts Bliss, Bragg, Carson, and Lewis), representing a variety of climatic regions, was evaluated. The major water users were found to be housing and irrigation. Housing use accounted for 20 to 45% of the installations' annual water use. Irrigation accounted for up to 50% of annual water use, and in some cases, caused the monthly water use in summer to be double that of the winter months. Thus, housing, irrigation, and industrial processes are likely candidates for water conservation efforts.

Water conservation methods in the Army should be concentrated on toilets, urinals, showerheads, and faucets in housing, barracks, and other buildings. Laundry and food service areas are also prime candidates for heat recovery by use of heat pump water heaters, providing efficient water heating as well as providing the additional benefit of "free cooling." Since irrigation can account for over 50% of the water used at an installation, proper landscaping can significantly reduce the amount of water needed for irrigation. Installations should follow the principles of Xeriscape™ landscaping which can reduce water use by 30 to 80% and also result in a healthier, easier-to-maintain landscape.

Water conservation measures can not only reduce water use and cost, but also reduce energy consumption (for pumping) and sewage treatment costs. In every case, the principle of externality costs (and savings) is that reduction of use of one resource leads to savings and benefits in related areas. Water conservation externalities also include reduced quantities of wastewater treatment chemicals (most notably chlorine) being released to the environment, as well as reduced risk of drawing down aquifers or salt water intrusion into the aquifer. **Table III-4** shows the potential for water conservation projects in the Army based on a life-cycle analysis and restricted to a ten year payback and a Savings-to-Investment Ratio (SIR) greater than 1.25. It demonstrates the potential for water saving projects is about 20% of present consumption.

Research and Development (R&D)

Army energy R&D will focus on the research, development, evaluation, and implementation of energy technologies that improve energy efficiency and provide secure energy sources to operate on a worldwide basis. This will include R&D that leads to:

- Efficient design and operation of buildings and utility systems.
- Efficient vehicles and equipment or modifications to the current inventory to reduce fuel consumption.

Table III-4. Water Conservation Potential ($M)

WATER CONSERVATION OPPORTUNITY	TOTAL INVESTMENT	TOTAL NET DISCOUNTED SAVINGS	TOTAL ANNUAL SAVINGS	SIMPLE PAYBACK	SIR	TOTAL KGAL SAVINGS
Barracks Res Eff Wshng Mchns	$12.7	$44.8	$5.7	2.24	3.53	1,093,670
FH Faucet Aerators	$0.8	$9.1	$1.2	0.72	10.90	235,581
Flush Valve – Toilets	$0.4	$30.4	$3.8	0.09	86.66	1,335,080
Flush Valve – Urinals	$0.2	$15.7	$2.0	0.10	84.37	730,301
Low-flow Shower Head	$1.0	$23.5	$3.0	0.34	23.01	542,869
FH Resource Eff Wshng Mchns	$15.7	$21.6	$2.0	7.89	1.37	189,862
Ultra Low Flow Toilets	$50.1	$168.1	$12.5	4.02	3.35	4,009,063
FH Water Consrvng Dishwshrs	$1.2	$1.3	$0.2	7.25	1.07	5,638
Water Distribution Leak Repair	$6.6	$42.8	$3.2	2.06	6.48	5,676,450
	$88.7	$357.3	$33.6	2.66	4.03	13,818,514

- Use of renewable energy sources and the development of cost-effective alternatives that reduce dependence on petroleum fuels.
- In-process reviews on proposed Army weapons systems, vehicles, and equipment, including an analysis of energy requirements. Energy used in development, production, and operation of the item will be evaluated, and the energy impact of alternative proposals will be considered.

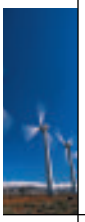
Environmental Issues

Energy and Environmental Linkage

Energy efficiency directly benefits the environment, helping Army installations meet environmental goals. Reducing energy use decreases the amount of air pollutants resulting from the direct burning of fossil fuels and indirect burning when generating electricity. Less electricity consumption means less air pollution; a 10% reduction in US electricity use would cut annual carbon dioxide emissions by over 200 million tons, sulfur dioxide emissions by 1.7 million tons, and nitrogen oxide emissions by 900 thousand tons. Use of less fuel to produce thermal energy on Army installations means less worry about the cost of meeting legally permitted emissions levels.

Environmental Externality Costs

Environmental externality costs are costs that are not built into the cost of energy production but that may be borne by society as a whole, now and in the future. The cost of the damage done by air pollution emissions from heating or electrical generating plants is very difficult to estimate. Numerous studies have been conducted to assess the potential environmental externality costs. Depending upon the fuel used to generate the electricity and the local electricity costs, the potential environmental costs can be as much or more than the actual purchase costs according to Pace Center for Environmental Law. Regardless of the actual externality costs, it should be obvious that if energy conservation measures can be justified on a life-cycle cost basis alone, then the environmental benefits are an additional bonus. This is the principle behind numerous Government and non-profit programs based on energy/environmental initiatives. Despite the externality benefits, Army energy managers must use only actual cost to the Government in conducting LCC analyses. Specific externality benefits should be identified, if appropriate, as an additional, intangible benefit and can advance potential projects in the funding priority list, if significant. Both the REEP and FEDS programs develop estimates of the emissions avoided by energy and water conservation opportunities and the REEP program also calculates the societal savings using the Pace University data. The environmental externality benefits of meeting EO 13123 are estimated to be about $81 million per year for the projects yet to be completed. ■



DEFENSE UTILITY ENERGY REPORTING SYSTEM (DUERS)

The Department of Defense is required to report energy consumption and progress towards achieving energy reduction targets to DOE and Congress. This is achieved using the Defense Utility Energy Reporting System (DUERS). DUERS collects data on energy consumption, inventory, and cost data from the services, and includes all purchased and non-purchased energy, except nuclear. DOD Manual 5126.46-M-2, Defense Energy Utilities Reporting System, describes these energy reporting requirements. It provides instructions for the preparation and submission of energy data to support the DUERS and furnishes information regarding the use of the DUERS.

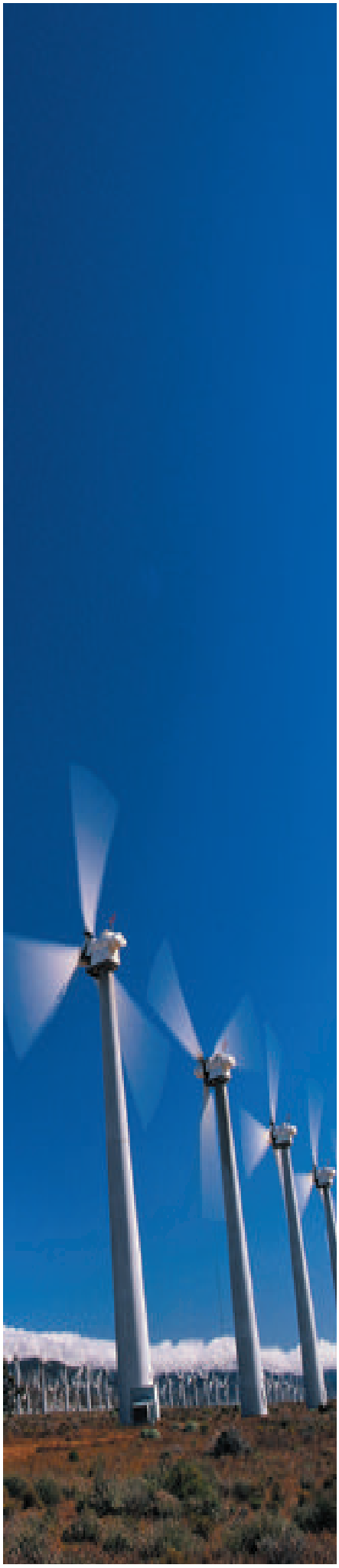
Army installations report DUERS data monthly through the Revised Army DUERS Data System (RADDS). The data is then assembled and reported to DUERS by LIA. LIA is the Army coordinator for DUERS activities. RADDS is a Web-based system that enables generation of automated reports on an installation, major subordinate command, MACOM, or total Army basis. Data is available in use categories of family housing, OMA, process, mobility substitution, or total. Authorized users have access to 31 reports for a specific installation, SUBMACOM, MACOM, or Army wide. Data is available in monthly, quarterly, and annual totals.

Process energy data shall be reported to the Revised Army DUERS Data System (RADDS) monthly with other DUERS information by each installation in accordance with RADDS instructions. Productivity indicators and their relationship to process energy reduction will be explained in the MACOM Energy Resources Management Plan (ERMP) and Annual Progress Report. A productivity indicator is a quantifiable measure of goods or equipment resulting from the production or rehabilitation process. Annual Progress Reports submitted to HQDA will describe progress toward energy reduction goals.

TENANT ACTIVITIES

Energy consumed by tenants, not excluded by the provisions of AR 11-27, will remain part of the installation's total energy consumption and will be used in determining MACOM progress toward goals. Installations and MACOMs that separately monitor tenant energy consumption and measure progress toward locally developed goals may install meters. Meters are useful tools in reporting and analyzing energy progress and should be used when deemed necessary and economically viable by local commanders. When determining whether metering is cost-effective, installations and tenants should assess the metering requirement relative to site specific factors. Where questions arise regarding the role or support of an installation energy program by tenant activities, installation commanders should work with the tenant's chain of command. Tenant activity headquarters with energy offices can be effective in assisting to meet energy reduction goals and improving facilities.

Commissaries are managed by the Defense Commissary Agency (DeCA). Commissaries are required to report energy consumption data directly to DeCA. Installation energy coordinators should coordinate with the commissary to ensure that it is reporting to DeCA. The installation will not report commissary energy and building data once the commissary starts reporting to DeCA. This arrangement will be similar to reporting tenant activities from other non-Army activities. ■



Significant resources are required to meet the goals and requirements of the Army Energy Program. An investment strategy to meet the 2005 and 2010 goals of the energy program is comprised of energy saving projects, renewable energy projects, and water saving projects. Section III, Renewable Energy, discusses the potential for renewable energy projects. Section III, Water Conservation, discusses the potential for water saving projects. **Table VI-1** shows the total investment requirements to meet EO 13123.

Table VI-1. Energy Program Investment Requirements ($million)

PROJECT TYPE	TOTAL INVESTMENT	TOTAL NET DISCOUNTED SAVINGS	TOTAL ANNUAL SAVINGS	SIMPLE PAYBACK	SIR	TOTAL MBTU SAVINGS
Renewable Energy	$162	$270	$21	7.65	1.66	2,533,602
Water Saving	$89	$357	$33	2.66	4.03	1,137,774
Energy Saving	$192	$817	$71	2.72	4.25	6,881,395
Total for 30%	$443	$1,444	$125	3.54	3.26	10,552,771
Additional Energy Saving for 35%	$383	$934	$84	4.55	2.44	5,769,348
Total for 35%	$826	$2,378	$209	3.95	2.88	16,322,119

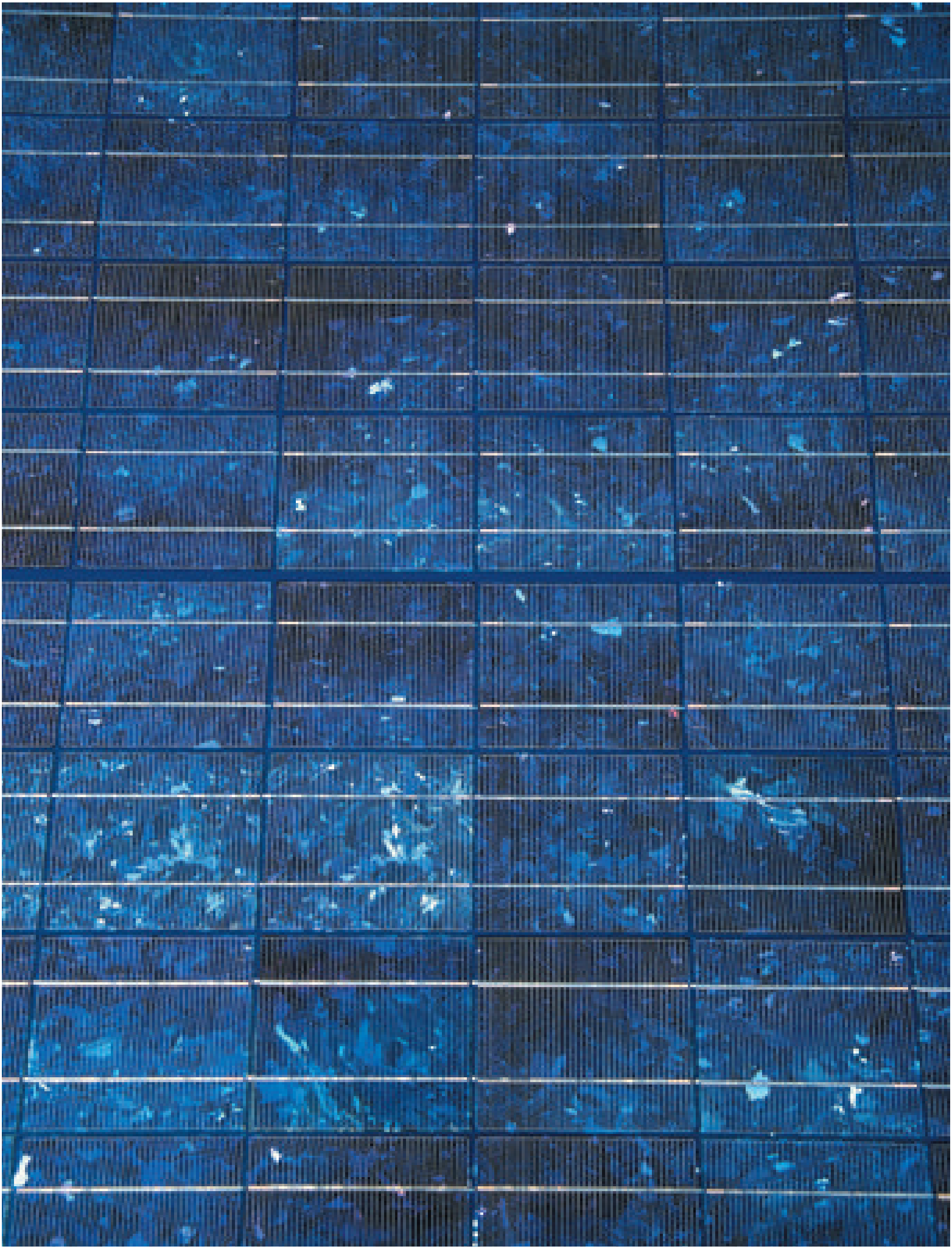
There has been inconsistent funding support for energy projects by Congress and DOD and little project funding is expected in the future. ECIP is expected to be funded at about $10 million/year through 2010 and should be reserved for renewable energy projects but was unfunded for FY00. Therefore, implementing the above projects will require major use of alternative financing, specifically ESPC and UESC. These programs require implementation costs. Funding required to execute the projects is about $2.4 million per year for the next ten years.

Since the overwhelming majority of projects will be executed using private capital, there may be little or no monetary savings accruing to the government. Private contractors have much higher discount rates in order to recover the cost of capital, taxes, and profits. Also maintenance costs to ensure continued effectiveness of the projects must be funded through cost savings. The main benefit to the government is improved facilities and meeting targets and goals for reduced energy and water consumption.

Other funding requirements include $1 million per year for energy program awareness efforts; training energy managers; and program evaluation, management, and support. ■

AAGE . . . . . Army Advisory Group on Energy
ACSIM. . . . . Assistant Chief of Staff for Installation Management
AEO . . . . . Army Energy Office
AR. . . . . Army Regulation
BEMs. . . . . Building Energy Monitors
CD . . . . . compact disk
CEHNC . . . . . Corps of Engineers, Huntsville Engineering and Support Center
CENET. . . . . Corps of Engineers National Energy Team
CFC. . . . . Chlorofluorocarbon
CFR . . . . . Code of Federal Regulation
CHP. . . . . Central Heating Plant
COBRA . . . . . Comprehensive Omnibus Budget Reconciliation Act
CONUS . . . . . Continental United States
DASA (I&H) . . . . . Deputy Assistant Secretary of the Army (Installations and Housing)
DCSLOG . . . . . Deputy Chief of Staff for Logistics
DeCA . . . . . Defense Commissary Agency
DEPC. . . . . Defense Energy Policy Council
DEPPM . . . . . Defense Energy Program Policy Memorandum
DLA. . . . . Defense Logistic Agency
DoD . . . . . Department of Defense
DODI. . . . . Department of Defense Instructions
DOE . . . . . Department of Energy
DOL. . . . . Directorate of Logistics
DPW . . . . . Directorate of Public Works
DRID . . . . . Defense Reform Initiative Directive
DSM . . . . . Demand Side Management
DUERS. . . . . Defense Utility Energy Reporting System
ECIP . . . . . Energy Conservation and Investment Program
EEAP . . . . . Energy Engineering Analysis Program
EPA . . . . . Environmental Protection Agency
EPAct. . . . . Energy Policy Act of 1992
EPCA. . . . . Energy Policy and Conservation Act
EO . . . . . Executive Order
ERMP . . . . . Energy Resources Management Plan
ESPC . . . . . Energy Savings Performance Contracts
FEAP . . . . . Facilities Engineering Application Program
FEDS . . . . . Federal Energy Decision System
FEMIA . . . . . Federal Energy Management Improvement Act
FEMP. . . . . Federal Energy Management Program
FETS . . . . . Facilities Energy Technology Service
GSA . . . . . General Services Administration
HQDA . . . . . Headquarters, Department of the Army
HQUSACE . . . . . Headquarters, U.S. Army Corps of Engineers
HVAC . . . . . Heating, Ventilation, and Air Conditioning
IAQ . . . . . Indoor Air Quality
IDIQ. . . . . Indefinite Delivery Indefinite Quantity
LCCA . . . . . Life Cycle Cost Analysis
LEED . . . . . Leadership in Energy and Environmental Design
LIA . . . . . Logistics Integration Agency
MACOM . . . . . Major Command
MEDCOM . . . . . U.S. Army Medical Command
NECPA. . . . . National Energy Conservation Policy Act
O&M. . . . . Operations and Maintenance
OACSIM . . . . . Office of the Assistant Chief of Staff for Installation Management
ODCSLOG . . . . . Office of the Deputy Chief of Staff for Logistics
OMA. . . . . Operations and Maintenance, Army
OSD . . . . . Office of the Secretary of Defense
PEPR . . . . . Process Energy and Pollution Reduction
PLACE^{3}S. . . . . Planning for Community Energy, Economic, and Environmental Sustainability
RADDS . . . . . Revised Army DUERS Data System
R&D . . . . . Research and Development
REEP . . . . . Renewables and Energy Efficiency Planning
SIR. . . . . Savings to Investment Ratio
UESC. . . . . Utility Energy Service Contracts
USALIA . . . . . U.S. Army Logistics Integration Agency
USACE. . . . . U.S. Army Corps of Engineers
USACERL. . . . . U.S. Army Construction Engineering Research Laboratory
USGBC . . . . . U.S. Green Buildings Council

army energy management plan



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