FEMP's BEST Program Champions Federal Push to Showcase Energy-Saving Technologies in Federal Facilities

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Each year the federal government consumes approximately 0.82 quadrillion British thermal units of energy in operating over 500,000 buildings and facilities around the world. These energy expenditures cost the federal government nearly $3.7 billion (U. S. Department of Energy 1992). Energy-saving technologies could significantly reduce these expenditures as well as lower the use of fossil fuel consumption and improve environmental quality.

The Best Energy Saving Technology (BEST) program is a comprehensive service for federal energy managers that offers easy access to all Federal Energy Management Programs (FEMP). Through this umbrella approach, resources and services such as analytical software, tools, Helpline, training, awards, and other information are made readily available to Federal energy managers to facilitate their planning and implementation of energy-saving projects.

The theme of the BEST program is "We are Here to Help" and it reflects the commitment of FEMP. The BEST program is designed to assist federal energy managers in the installation of all cost-effective measures in energy efficiency, renewable energy, and water conservation. It also supports the achievement of our country's goals of economic development and deficit reduction.

Introduction

The recent Executive Order 12902 established that each agency of the federal government "shall develop and implement a program with the intent of reducing energy consumption by 30 percent by the year 2005 . .." relative to 1985 energy usage. This goal, along with Public Law 102-486, and Executive Order 12759 sustain the impetus of the current federal energy efficiency efforts. Efficiency goals were established based on studies that estimated cost-effective energy savings available to the Government of at least 25 percent (Office of Technology Assessment 1991).

The federal government's annual facility energy expenditures approach $3.7 billion in support of non-mobility operations of over 500,000 buildings and facilities around the world. Management of each individual facility is the responsibility of the agency that claims ownership. Thus, many of the federal agencies are responsible for managing building inventories that cover the entire country, and in some cases the world. In order to properly manage energy efficiency efforts and complex issues throughout this building inventory, a comprehensive approach was needed that recognizes the diverse building inventory, the differing management practices of the various federal agencies, limitations on available staffing, limitations on staffing expertise in the area of energy efficiency, and varying degrees of funding available for implementation of energy efficiency measures.

The Best Energy Saving Technology (BEST) approach, which was developed by the U.S. Department of Energy's Office (DOE's) of Federal Energy Management Programs (FEMP), takes into account the many variables and constraints present in the federal energy environment by developing and applying tools and strategies specifically targeted for federal facility managers. The BEST approach makes its tools and strategies available to Federal energy managers to assist them in overcoming the limited resources and barriers to achieving the most life-cycle cost effective energy efficiency solutions available.

The Best Approach

The BEST approach is designed to apply tools and strategies to meet the energy reduction goals as mandated through public law and Executive Order. These tools and strategies apply the life-cycle costing procedures as

established by 10 CFR 436, Subpart A. In addition, an emphasis is placed on "non-traditional" funding mechanisms such as demand side management (DSM) programs and energy savings performance contracting (ESPC). Multiple funding mechanisms enable the facilities to consider a broader range of technologies that will assist them in meeting and exceeding the legislated and mandated reduction goals.

Six Steps of the BEST Approach

The BEST approach uses six steps, which are shown in Figure 1, to ensure that energy efficiency programs capture the available cost effective energy efficiency improvements. Tools and strategies have been developed to support the completion of each of these six steps. The BEST approach by no means addresses each situation and circumstance to be encountered, so additional developments are ongoing within FEMP to further expand the capabilities of the federal energy managers. For example, tools are being developed, but are not formally in-place, to assist federal facilities in increasing the application of water conservation and renewable energy technologies as directed in Executive Order 12902.

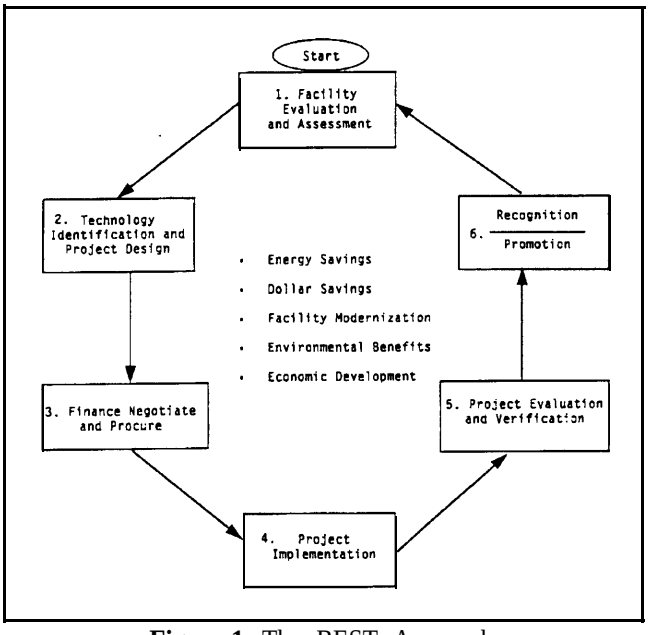

Figure 1. The BEST Approach

Step 1: Facility Evaluation and Assessment. The primary purpose of this step is to assess the facility's energy efficiency potential and utility cost reduction opportunities. This step assists in establishing an overall facility energy strategy. A baseline of the current facility energy usage and the costs associated with the energy consumption is established by answering the following questions:

- What types of energy are being used?
- How much energy is being used?
- How much do these energy services cost?
- What are the energy consuming systems?
- What are the energy usage patterns?
- How are the energy consuming systems operated and maintained?

The tools and strategies that may be applied to complete this assessment are as follows:

- SAVEnergy. This new program was developed by FEMP to provide a comprehensive service to federal agencies to identify and implement energy and water conservation. Upon the request of an agency, FEMP will provide a SAVEnergy analysis for a facility. This analysis will provide the facility an action plan that prioritizes projects, identifies potential funding mechanisms, and recommends verification strategies.

- Federal Energy Decision Screening (FEDS) Software System. This software, which currently includes FEDS Level-1 and Level-2 modules, provides a means for energy managers to assess energy conservation opportunities throughout a facility, as well as specific project-by-project technology selection and economic information. This software has been developed to provide a fuel-neutral, technology independent, planning and acquisition tool that can be used by federal energy managers. A FEDS Level-1 analysis provides the energy manager an estimate of the total potential energy and cost savings, as well as an estimate of the capital investment required to capture these savings. FEDS Level-2 is discussed in further detail under step 2.

- Lighting System Screening Tool (LSST). This software tool was developed for energy managers who prefer to target lighting retrofit opportunities. LSST assists in identifying and prioritizing potential energy savings for a number of facility types. The LSST evaluation can be performed at either of two levels: pre-walkthrough and post-walkthrough. LSST generates a rank ordering of buildings based on the ratio of the present value of the estimated available energy savings to the estimated retrofit costs.

- Lighting Technology Screening Matrix (LTSM). This software tool was also developed for energy managers who prefer to target lighting retrofit opportunities.

LTSM generates a rank ordering of configurations for lighting fixture retrofits based on a minimum of information. LTSM can evaluate fluorescent, incandescent, and exit sign lighting retrofit opportunities and allows for analyses to be performed either on a one-for-one basis (which assumes all fixtures will be retrofitted regardless of original lumen output) or a lumen equivalent basis.

Step 2: Technology Identification and Project Design. The objective of this step is to select technologies and projects that minimize total life cycle costs and optimize retrofit project designs. Also, the technical requirements must be properly established to ensure the selected technologies are defined within the design specifications. The tools developed for this step include more detailed input and specialize in identifying energy efficient technologies and life-cycle cost effective projects. The tools for this step are as follows:

- FEDS Level-2 Software. This software assists the federal energy manager in identifying detailed project-by-project technology selections which can be used to develop the design criteria for retrofit projects. FEDS Level-2 input data files may be generated from modified FEDS Level- 1 input data files as the Level-2 analysis requires more detailed user input. A FEDS Level-2 analysis can be performed for an entire facility or a single building.

- Federal Lighting Energy eXpert (FLEX). This lighting design software package simulates the decision making process of a lighting expert. FLEX provides detailed room-by-room lighting retrofit recommendations and applies the rules of federal life-cycle costing. Moreover, it has lighting systems, whole building, and special application reporting ability. FLEX also has extensive on-line help guidance.

- Master Specification, Section 16500, Energy Efficient Lighting Technologies for Existing Federal Facilities. This guide specification assists the designer in properly specifying state-of-the-art lighting retrofit technologies once the technologies have been selected. This specification covers ballasts, lamps, occupancy sensors, and reflectors, and will be updated periodically to incorporate new technologies and operating capabilities.

- A Simplified Energy Analysis Method (ASEAM). This software tool assists energy managers in identifying cost effective systems/equipment alternatives for new and existing facilities. This is accomplished through thermal performance modelling. Application of ASEAM assists users that are interested in pursuing energy efficiency through a total building approach as interactive effects of energy efficiency actions are taken into account.

Step 3: Financing, Negotiations, and Procurement. The number of financing alternatives available to Federal agencies has increased significantly. Originally, funding for energy efficiency actions was limited primarily to funds identified by agencies, as well as local finding identified by the facilities for low/no cost actions. The passage of Public Law 99-272 made available a new funding mechanism as agencies were granted authority to enter into multi-year shared energy savings contracts. The recent availability of utility DSM resources, along with new congressional authorizations specifically for energy efficiency projects, has greatly expanded the financing alternatives available to federal facilities. The objective for each facility is to identify and utilize the funding mechanism that yields the lowest life-cycle cost to the government. Current funding alternatives available to federal facilities are described in greater detail below.

- Appropriated Federal Agency Funding. Many federal agencies (e.g., U.S. Department of Defense, the DOE, and the General Services Administration) make funds available to their facility managers for energy efficiency retrofit projects. Annual levels of finding and rules regarding the distribution of these funds are established by the individual agencies.

- Federal Energy Efficiency Fund (FEEF). Implemented in fiscal year 1994, FEEF funds are now available to assist federal agencies in meeting the energy and water conservation goals established in EPAct. Agencies submit application for FEEF funding to supplement other funding vehicles. FEMP awards FEEF grants to agencies on a competitive basis after evaluating the agency proposals on a number of criteria including life-cycle cost effectiveness, total estimated energy and water savings, leveraging of other funding sources, the facility's commitment to timely completion, and the quality and reliability of information found in the proposals.

- DSM Programs. Utility DSM programs offer funding for the implementation of energy efficiency projects. The availability of DSM programs varies by utility. EPAct encourages federal agencies to participate in these DSM programs where available. Because DSM programs may offer utility companies the opportunity to avoid the construction of new generating capacity by acquiring cheaper saved capacity, utilities may be open to developing "customized" programs to meet the specific needs of their federal customers. Agencies are encouraged to participate in these programs where they are available.

- ESPC. Formerly referred to as Shared Energy Savings, this contracting vehicle assists facilities in identifying private sector funds to up-front the cost of energy efficiency actions. Where all other funding sources are subject to limited availability, the availability of funds for ESPCs is driven by the annual savings potential of the proposed renovation. The federal government already has a number of ESPC contracts in place covering lighting, HVAC controls, cogeneration, chiller retrofits, and other technologies. FEMP is currently developing contracting procedures that will make it easier for federal agencies to implement ESPC contracts.

Funding mechanisms may also be combined to help leverage the limited government funds available and to assist each facility in implementing the lowest life-cycle cost funding alternative to the government.

Step 4: Project Implementation. The elements of the BEST approach to project implementation that are considered as key to the successful implementation of energy efficiency actions are

- Project planning
- Architect/Engineering selection and design contract management
- Commissioning
- Operations and maintenance
- Employee awareness programs.

Employee awareness programs are often overlooked but represent the opportunity to educate employees on the planned and ongoing energy efficiency projects, as well as the benefits to be realized. A well structured, continuous, and sustained education process will result in the establishment of an infrastructure that will sustain energy efficient practices and establish a "corporate" culture that will reduce the cost of government.

In this step, the federal energy manager must ensure that

- Designs meet the requirements established in step 2
- Installed systems meet the specified requirements
- New systems are fully tested prior to acceptance in accordance with procedures established in the specifications
- Facility operations staff operate the equipment and systems within the manufacturers' and designers' stated operating parameters
- Maintenance is performed on the new systems per the manufacturer's instructions
- Building occupants are aware of, and involved in, energy efficiency efforts and practices.

Step 5: Project Evaluation and Verification. Project evaluation and verification is an integral step in the BEST approach that serves two functions. First, it provides input and support for each of steps 1-4 in subsequent energy efficiency efforts. Second, it provides an assessment of the effects of the implemented actions. A verification of results will assist energy managers by providing the following:

- An assessment of the performance of energy efficiency measures which may be used in future selections of technologies
- Information that can be used negotiating utility rates or a customized demand side management program
- A measure to rate the performance of an energy services performance contractor
- An assessment on project design procedures, including the assumptions used.

In addition, many utilities are now requiring verification of energy savings persistence over time. When this is the case, utilities may direct that retrofitted systems be monitored prior to approval of application for DSM funding.

FEMP also encourages federal facility managers to perform occupant evaluations to gauge the response of the building occupants to changes in their work environment. Responses from occupants can be used to assist in improving future retrofit project designs so that energy efficiency projects improve the comfort of the building's occupants resulting in increased workforce productivity.

Step 6: Recognition and Promotion. Where project evaluation and verification provide technical feedback that assists in the development of subsequent projects, recognition and promotion provide feedback in the form of encouragement to the facility staff to continue on with additional energy efficiency efforts. The need to encourage further energy efficiency efforts through reward of successful individuals and organizations is critical to a

program's continued success. Recognition and promotion do not lead directly to reduced energy consumption, but they do foster the environment necessary for successful energy programs.

- Federal Energy Efficiency Awards (FEEA). These awards are presented annually and recognize outstanding efforts of individuals and organizations in the areas of energy efficiency and water conservation. Nominations are submitted by the federal agencies and evaluated against scoring criteria which typically address the following areas:

  - Energy savings, renewable energy produced, or water savings
  - Description of actions taken
  - Transferability and innovation
  - Effectiveness of investment
  - Outreach, education, and user behavior
  - Environmental benefits.

With the passage of EPAct, cash awards are now authorized as financial incentives for FEEF award winners.

- Private Sector Media. Federal energy managers and facility managers are encouraged to share the stories of their successes and lessons learned with the private sector media. This offers an opportunity to highlight successes and encourage continued attention on future energy efficiency efforts.

BEST Support Services and Communications Mechanisms

FEMP is committed to its theme of "We are here to help you." Key elements to support this theme are training, Helpline, and regional support services. FEMP recognizes the need to provide training services that assist federal energy managers in developing energy efficiency and energy management skills. FEMP offers a curriculum of courses available to employees of federal agencies on the application and use of ESPC, federal life-cycle costing, passive solar strategies, and FEMP software (FEDS, LSST, LTSM, FLEX, and ASEAM). FEMP also makes available the FEMP Training Course Locator System which assists federal energy managers in identifying and locating training courses in a wide variety of energy related areas.

FEMP Focus is a hi-monthly newsletter developed and distributed by FEMP. FEMP Focus presents articles on federal energy management issues and initiatives, success stories of federal energy projects, information on upcoming training courses, and software releases.

The FEMP Help Desk is a new service offered by FEMP that provides answers to anyone with a question on federal energy management and efficiency. The FEMP Help Desk is open Monday through Friday from 9:00-5:00 EST and can be reached at 1-800-566-2877.

Support assistance with any of the FEMP resources is also available from any of the DOE Regional Support Offices which are located in each of the ten federal centers: Atlanta, Boston, Chicago, Dallas, Denver, Kansas City, New York, Philadelphia, San Francisco (Oakland), and Seattle.

Case Studies

Customized DSM at Fort Lewis, Washington

Fort Lewis, Washington purchases its electricity from the Tacoma Public Utilities (TPU) at an average (blended) rate of 2.3 cents/kWh. This large installation consists of approximately 4,500 buildings and hosts approximately 25,000 people daily. In a cooperative effort involving TPU, U.S. Army Forces Command, Bonneville Power Administration, Fort Lewis, and FEMP, the BEST approach was applied to this installation in an effort to cost effectively reduce energy costs and consumption.

A fuel-blind energy resource assessment was conducted at Fort Lewis. A minimum of 43,000 MWH of annual life-cycle cost effective energy savings were identified. This 43,000 MWH was then "marketed" to the utility as a resource. Fort Lewis and TPU then entered into an agreement where TPU would up-front finance 100% of the estimated $35 million for installation costs of cost effective retrofit technologies. An energy services contractor was also acquired by TPU to conduct the building audits, recommend and install new technologies, and verify energy savings. In turn, Fort Lewis will pay TPU 15% of the total installed cost of the new technologies.

The anticipated result of this customized DSM agreement is a 20% reduction in the fort's electrical energy use, an annual reduction of $3.7 million in electric bills over the five-year contract period, and an additional $1-1.5 million/year after the contract expiration.

ESPC at Forrestal Building, Washington, D.C.

The Forrestal Building in Washington, D.C., serves as the headquarters building for the DOE. The annual cost of electricity to light the building's 34,179 lighting fixtures was $539,000 with an annual consumption of 8,339,234 kWh (DOE 1993). The 2-tube 1x4 fluorescent fixtures in the building were 1969 vintage and employed T-12 lamps with standard magnetic ballasts. Low lighting levels and poor lighting quality prevailed throughout the building.

In 1993, an ESPC contract with a seven-year term was awarded. $1 million in utility rebates were received as fixtures were retrofitted with electronic ballasts, 1-tube T-8's, specular silver reflectors, and occupancy controls. The contractor is also responsible for all planned and unplanned maintenance activities throughout the contract period.

No federal funds were invested in the retrofit effort. A 63% reduction in lighting electrical consumption is being achieved, which translates into an annual energy savings of $399,000. An added benefit of this effort is the improved lighting quality throughout the building.

Conclusions

FEMPs BEST program is available to assist all federal facilities in meeting the mandated energy reduction requirement of the new Executive Order.

Previously, the tools and strategies developed by FEMP and now incorporated into the BEST approach were made available to federal energy managers as stand-alone tools. One result of this approach has been the apparent emphasis on projects with fast simple payback periods, such as the conversion of overhead T-12 fluorescent lighting systems to T-8 lighting systems, to meet the established energy reduction goals.

Although agencies of the Executive Branch have demonstrated an ability to improve energy efficiency, the availability of a comprehensive approach that starts with a facility audit and continues through the operating life of the new equipment/systems should assist in accelerating the realization of the most cost effective energy efficiencies available. Improvements resulting from the BEST approach will become evident within the next two or three years as projects developed as the audits and evaluations performed under SAVEnergy and the FEDS software result in the placement of new, cost effective equipment and systems installed in federal facilities.

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References

10 CFR 436, Subpart A. 1993. *Methodology and Procedures for Life-Cycle Cost Analysis.*

56 FR 16257. April 17, 1991. Executive Order 12759. "Federal Energy Management." *Federal Register.*

59 FR 11462. March 10, 1994. Executive Order 12902. "Energy Efficiency and Water Conservation at Federal Facilities." *Federal Register.*

Consolidated Omnibus Budget Reconciliation Act of 1985. 1992. Public Law 99-272.

Energy Policy Act of 1992.1992. Public Law 102-486.

Federal Energy Management Improvement Act of 1988. 1988. Public Law 100-652.

Federal Energy Management Program. 1993. *Successful Energy Savings Projects.* U.S. Department of Energy, Washington, D.C.

Office of Technology Assessment. 1991. *Energy Efficiency for the Federal Government: Government by Good Example?* OTA-E-492, U.S. Congress, Washington, D.C.

U.S. Department of Energy. 1992. *Annual Report to Congress on Federal Government Energy Management and Conservation Programs, Fiscal Year 1991.* U.S. Department of Energy, Washington, D.C.