

PNL-SA-26429

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IDENTIFYING NEW TECHNOLOGIES THAT  
SAVE ENERGY AND REDUCE COSTS TO THE  
FEDERAL SECTOR: THE NEW TECHNOLOGY  
DEMONSTRATION PROGRAM

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November 1995

Presented at the  
Association of Energy Engineers 18th World  
Energy Engineering Conference  
November 8-10, 1995  
Atlanta, Georgia

Work supported by  
the U.S. Department of Energy  
under Contract DE-AC06-76RLO 1830

Pacific Northwest Laboratory  
Richland, WA 99352

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# **Identifying New Technologies that Save Energy and Reduce Costs to the Federal Sector: The New Technology Demonstration Program**

## **ABSTRACT**

In the operation of over 500,000 buildings and facilities at over 8,000 sites, the Federal government is the largest consumer of energy in the United States, with annual consumption exceeding 400 trillion Btu (site energy) at a cost of \$3.7 billion. In addition, the Federal government is the largest customer in the world for supplies and equipment, spending over \$70 billion/year of which energy-related products account for \$10-20 billion. However, many in both the public and private sectors feel that the Federal government is slow to adopt and apply new, cost effective, energy efficient, commercially proven technologies.

In 1990 the New Technology Demonstration Program (formerly the Test Bed Demonstration Program) was initiated by the U.S. Department of Energy's Office (DOE's) of Federal Energy Management Programs with the purpose of accelerating the introduction of new technologies into the Federal sector. The program has since expanded into a multi-laboratory collaborative effort that evaluates new technologies and shares the results with the Federal design and procurement communities. These evaluations are performed on a collaborative basis which typically includes technology manufacturers, Federal facilities, utilities, trade associations, research institutes, and other in partnership with DOE. The end result is a range of effective technology transfer tools that provide operations and performance data on new technologies to Federal designers, building managers, and procurement officials. These tools assist in accelerating a technology's Federal application and realizing reductions in energy consumption and costs.

## **INTRODUCTION**

The main objective of the New Technology Demonstration Program (the Program) is to speed that application of new, cost effective, energy efficient technologies in the Federal sector. Started in 1990, the Program recognizes that there are a number of hurdles in place that slow the acceptance of new technologies in the Federal sector. Paramount is the awareness of these new technologies by individuals that specify and purchase technologies at thousands of sites across the United States.

Energy efficiency efforts on the part of the Federal government are driven by legislated and mandated energy reduction goals established in the Energy Policy Act of 1992 (Public Law 102-486) and Executive Order 12902 (Energy Efficiency and Water Conservation at Federal Facilities). Federal agencies are now tasked with reducing energy consumption by 20 percent by the year 2000 and 30 percent by the year 2005 compared to 1985 consumption levels when measured on a Btu per gross square foot basis. If these goals are to be met, Federal agencies must more quickly adopt proven technologies that are cost effective to install and efficient and reliable to operate. Further, since the efficiency or operational experience of many products entering the commercial market change over time, it is increasingly important that individuals specifying and purchasing equipment receive information that is up to date.

From the perspective of the Federal facility manager, the main objective in installing any new product is to support the facility's mission. While new, more efficient and cost effective technologies continually enter the commercial marketplace, past experiences may indicate that manufacturers' claims are very different from actual performance results and/or do not fully address operations and maintenance issues. This may lead to reluctance on the part of a facility manager to consider the

application of a new technology that, although proven in private sector application, is unproven in the Federal sector.

Individuals making design or procurement decisions need reliable information that can lead to technology decisions that can reduce energy consumption while ensuring continued reliable facility operations. One method to bridge this gap is the transfer of information on new technologies in a timely manner to Federal designers and procurement officials. The New Technology Demonstration Program was created specifically to bridge this gap and spur a more rapid acceptance of new technologies in the Federal sector.

### **THE PROGRAM**

The Program was established by DOE in 1990. Additional funds were made available to the Program in 1993 from the Strategic Environmental Research and Development Program. Since then four technology demonstrations have been initiated, a series of technology transfer documents has been issued, an ongoing proposal (solicitation) process has been put into place, a communications program has been implemented, and a number of new technologies have been identified for evaluation by the Program in the future.

The Program is managed by DOE's Office of Federal Energy Management Programs (FEMP) and involves the participation of Lawrence Berkeley Laboratory (LBL), National Renewable Energy Laboratory (NREL), Oak Ridge National Laboratory (ORNL), and Pacific Northwest Laboratory (PNL). The overall program objectives are the following:

- Reduce Federal sector energy costs and improve overall energy efficiency
- Introduce new energy efficiency technologies to the Federal sector more quickly, thereby narrowing the gap between private sector and Federal deployment rates of new technologies
- Create jobs in the manufacturing sector by spurring the use of new, energy efficient and environmentally beneficial technologies manufactured in the United States.

When first established, the Program demonstrated selected technologies by installing and evaluating a technology at a Federal site (the I&E process). Technologies selected for I&E evaluations are those that are new to the commercial market and have very few Federal and private sector installations. In 1994, a second evaluation approach and communications method, the *Federal Technology Alert (FTA)*, was introduced. Technologies selected for the FTA evaluation process are those that have a significant number of private sector installations from which operational data exist, but only a small number of Federal sector installations.

A key aspect of the Program is the use of collaborative efforts between the Federal government and the private sector. This arrangement allows for the leveraging of limited Program funds by having the partners perform the required tasks and share the results. Cooperative Research and Development Agreements (CRADAs) are the vehicles used to formalize these working relationships. Each partner to a CRADA makes a contribution of materials or in-kind services necessary to monitor, evaluate, and/or assist in the post evaluation outreach effort.

## **I&E PROCESS**

Once a technology is selected for an I&E, the first step is to identify potential collaborative partners. These include DOE; a Federal facility to host the installation of the technology; the manufacturer(s) of the technology; the facility's servicing utility(ies); and a trade association, research institute, or other organization interested in promoting the use of the technology. The general roles and benefits to each of these participants is summarized below:

- DOE FEMP leads the technology demonstration effort by identifying partners, managing the overall I&E effort, monitoring the operation of the technology, and evaluating the overall performance of the technology. FEMP benefits from the Program by acquiring information on new technologies that can be shared with Federal facilities to assist in meeting energy reducing goals.
- A Federal site provides a suitable location for the installation of the technology, assists with installation, and provides access to the technology installation throughout the monitoring period. The Federal site benefits by realizing the energy and cost savings resulting from the installation of the technology as well as establishing itself as a leader in the Federal energy efficiency community.
- Technology manufacturers provide the technology and in some cases their services. In return, the manufacturer acquires actual performance monitoring and establishes a Federal track record for that particular technology. Performance monitoring assists the manufacturer in identifying improvement opportunities for the technology.
- The servicing utility assists with costs to install and monitor the technology and may help defray the cost of the technology. In addition, the utility provides technical expertise to assist in the review of the I&E monitoring plan and/or generated data. The utility benefits by the opportunity to validate the performance of a new technology that may play a role in offsetting new capacity requirements or increasing market shares.
- Trade association and research institutes lead in the demonstration outreach efforts which focus on sharing the results of the technology evaluations with Federal designers and procurement officials. These technology demonstrations provide these organizations an opportunity to promote new technologies, emphasize technology transfer, create partnerships with the Federal sector, and communicate technology benefits to a wide audience, something generally compatible with their mission.

One component of the partnership is the Joint Statement of Work (JSOW) which outlines the activities that take place during the demonstration and the roles of each of the participants. The major activities defined by the JSOW are planning, execution, documentation, and decommissioning:

- Planning includes project design so the technology can be installed, necessary operating data on the technology and existing "baseline" technologies can be obtained, and the technology can be formally evaluated.
- Execution includes demonstration activities necessary to operate, maintain, monitor, and document the performance of the technology.

- Documentation includes those efforts necessary to record the project activities, evaluate the technology, and present the results. Specific areas include performance monitoring and acquisition of technology operating data and necessary "baseline" information, operation and maintenance of the technology, and the analysis of the resultant operating data.
- Decommissioning is the orderly shutdown of the monitoring and evaluation activities and transition of the site to non-test conditions. Should the technology not meet certain conditions of service specified in the CRADA, decommissioning can also include the technology's removal and replacement prior to project completion.

A final report is developed for each I&E which presents a summary of the evaluation methodology employed and highlights information of greatest concern to the Federal facility managers: life-cycle cost effectiveness, energy efficiency, maintenance requirements, and technology reliability. These reports are distributed by the Program to Federal facility managers. In addition, workshops are conducted for each I&E where the results of the demonstration are presented.

### **FTA PROCESS**

The FTA is developed by FEMP to help speed the technology transfer process. Since technologies selected for FTAs have been installed in a significant number of private sector applications, data to evaluate the technologies are likely to be available. By using available data, the FTA process bypasses the need to form partnerships and install and monitor technologies. The result is more timely and cost effective information tailored to address concerns specific to Federal facility managers, designers, and procurement officials on applying and operating new technologies.

Information provided in the FTA assists individuals at Federal facility sites in making informed decisions regarding new technologies that may not otherwise be considered owing to the lack of reliable information and analysis. Each FTA is developed with the intention of evaluating particular types of technologies and does not constitute an endorsement of the subject technologies by FEMP.

Once a technology has been selected as the subject of an FTA, the technical lead at one of the collaborating DOE Labs responsible for the FTA development works with the manufacturer that originally proposed the technology. The technical lead acquires operating data on current installations as well as locations and points of contact at the installation sites. Manufacturers of like technologies are also contacted and invited to participate in the FTA development by providing like data on installations of their product line. The end result is a document that presents the following information:

- Detailed description of the technology and what the technology does
- Guidelines on proper applications and situations/applications where the technology is not appropriate or cost effective
- A summary of the technology's predicted performance and a summary of field experience
- A summary of energy savings and maintenance, codes and standards, and environmental impacts, as appropriate

- A case study that shows readers how to evaluate the technology for application at their own facilities.

The final FTA is distributed to Federal facility managers, designers and procurement officials. Manufacturers that participate in the development of the FTA are encouraged to make copies of and distribute the FTA as a part of their own outreach efforts to Federal facilities.

### **TECHNOLOGY IDEAS SOLICITATIONS**

In October 1993, a technology solicitation was issued by the Program that requested manufacturers, Federal sites, utilities, trade associations and others to submit proposals for technologies to be evaluated by the Program. The solicitation listed the following criteria:

- Must be at least ready for the manufacturing production stage and at most not have significant applications currently in place in the Federal sector
- Must improve overall cost effectiveness of energy using services when evaluated using Federal life-cycle costing procedures
- Must have maintenance and service requirements that are not significantly more demanding than those of the presently used technology
- Must be a U.S. developed and manufactured technology
- Must have appropriate health, life safety, and emissions certifications
- Must have a potential for widespread application in the private and public sector markets.

The solicitation requested a technology specific description including capacities, fuel(s) used, operating efficiencies, performance parameters, quantification of limitations on installation, cost to purchase and install, maintenance requirements, expected life, number of current Federal and private sector installations, and information on health, safety and emissions certifications. A total of 41 responses proposing 48 technologies were received.

Technology proposals were first evaluated against the eligibility criteria listed in the solicitation. Technologies judged to satisfy these criteria were further evaluated to develop a rank ordering based on the greatest aggregate potential to benefit the Federal sector. Specifically, the Program is interested in evaluating technologies that can have the greatest impact on energy and energy costs in the Federal sector. This process yielded a total of 16 new technologies that are now being evaluated by the Program in 1995. A summary of these technologies appears in Table 1.

Although the solicitation and technology selection process for fiscal year 1995 has been completed, new technology proposals may still be submitted to the Program for consideration for fiscal year 1996 and beyond on an ongoing basis. Proposals should be submitted in accordance with the procedures as noted in the "Guidelines for Unsolicited Technology Ideas for the New Technology Demonstration Program" which are available by contacting Mr. Dave Hunt, Battelle Washington Operations, 901 D Street, S.W., Suite 900, Washington, D.C. 20024-2115.

## **RESULTS TO DATE**

The CRADA for the first I&E technology demonstration, a natural gas engine driven rooftop air conditioner at the Naval Air Station in Willow Grove, PA, was signed May 4, 1992. Since then, three additional technology demonstrations are nearing completion and one FTA has been issued.

The partners to the CRADA for the first demonstration were the Thermo King Corporation (manufacturer), Willow Grove Naval Air Station (Federal facility), Philadelphia Electric Company (servicing utility), and the American Gas Cooling Center. The first-year interim report, published in 1993, showed that the technology installation, which consisted of two 15-ton rooftop gas engine driven air conditioners, yields a net savings of more than \$120,000 over the expected 15 year equipment life with a savings-to-investment ratio of 5.56. The CRADA was amended after the first cooling season to allow for monitoring the technology for one additional cooling season as the monitoring and evaluating process helped to identify operational improvements that were incorporated into the system by the manufacturer. A final report on the technology will be in September 1995.

In September 1993 a second technology demonstration was initiated at Willow Grove Naval Air Station. The partners to the CRADA were the same as those to the original CRADA while the technology demonstrated was a 15-ton natural gas engine driven reciprocating compressor/air-cooled condenser (split-system air conditioner). Monitoring of the equipment began in the Spring of 1994. Data collection at this site is complete and a final report will be released in September 1995.

The third demonstration is of a natural gas engine driven heat pump at Fort Sam Houston in San Antonio, Texas. In addition to the fort, partners to the CRADA are York International (manufacturer), City Public Service of San Antonio (utility), the Gas Research Institute, and the American Gas Cooling Center. The heat pump is the York International Triathlon unit which has a single-cylinder, four-stroke, five-horsepower engine with variable speed controls. The unit is installed at a single family home and was one of the technology's first production run units. Data collection at this site is complete and a final report will be released in September 1995.

The fourth demonstration performed by the Program is of a technology that converts existing domestic water heaters from electric power to natural gas. Partners to this CRADA are Gas-Fired Products (manufacturer), Fort Stewart (Federal site), Atlanta Gas Light (servicing utility), Public Service Company of North Carolina, and the U.S. Army Corps of Engineers, Huntsville Division. The technology, the Seahorse gas water conversion system, was installed in the Spring of 1994. Data collection at this site is complete and a final report will be released in July 1995.

The first FTA, which addresses liquid refrigerant pumping, was published in December 1994. This technology was originally proposed in response to the general technology solicitation issued by the Program in October 1993. The manufacturer's proposal indicated that although there are approximately 15,000 applications across the United States, the number of installations in Federal facilities totaled approximately 200. The site specific case study presented in the FTA showed resulting energy savings of 14 percent with a simple payback of 1.2 years.

## **OUTREACH**

Although the evaluation of technologies accounts for the vast majority of the Program's effort, the measure of the Program's success is its effectiveness in transferring information on the technologies to the Federal sector and securing their use of the technologies. Several mechanisms have been developed thus far to address this goal. However, it should be noted final evaluation results have not yet been developed for any of the ongoing demonstrations.

All of the existing CRADAs identify one of the partners as a lead for the outreach activities. Outreach activities are seen as the development of materials for distribution to the Federal sector, including workshops where results of the demonstration are presented to target audiences. Also, press releases and articles are prepared and distributed to media outlets throughout the course of the technology demonstrations. These activities are targeted to secure a greater level of interest in the Program and spur increased use of the technologies in the Federal sector.

In the case of FTAs, the outreach strategy is somewhat different for a number of reasons. The development time of each FTA is relatively short (several months), which does not allow for the same media based approach applied to the technology demonstrations. Instead, FTAs are distributed directly to the Federal sector upon completion. With the FTA the Program is beginning to broaden information dissemination through the use of electronic bulletin boards and CD-ROM.

A significant avenue for Program outreach is presented at trade shows and conferences, such as the WEEC. The Program has developed an exhibit which has been on display at numerous trade shows, conferences, and DOE functions. A Program presentation has also been developed and delivered at a number of trade shows and conferences, as well as to trade associations and other organizations interested in Program participation.

Since its inception, the Program has worked to identify individuals in the Federal sector that are a part of the design and procurement processes. The resulting list of contacts are those individuals to which the Program distributes updates, demonstration results, and FTAs. Individuals within the Federal sector interested in having their name included in this contacts list should contact Ms. Karen Stockmeyer, Battelle Washington Operations, 901 D Street, S.W., Suite 900, Washington, D.C. 20024-2115.

To measure the effectiveness of these outreach activities and the overall Program, FEMP has requested that the Program contact manufacturers of evaluated technologies on a periodic basis after the distribution of evaluation results. Manufacturers will be asked to identify the number of new installations of their technology in the Federal sector. This information will be used to assess the impact on the sales of the evaluated technologies in the Federal sector.

## **SUMMARY**

The installation of new, more energy efficient and cost effective technologies in the Federal sector represents a significant opportunity to capture energy savings. The transfer of new, cost effective, energy efficient technologies into the Federal sector requires that individuals who specify and purchase the technologies understand and consider all alternatives.

By installing new technologies in Federal facilities and monitoring and evaluating their performance, the Program develops information needed to evaluate their performance. Through partnerships



between the public and private sectors, these new technologies can be provided to the Federal site, installed, monitored, and evaluated at a lower cost to the government. Further, the transfer of technology evaluation information targeted for Federal facility managers is likely more to be viewed by Federal designers and procurement officials as directly transferable.

Since Federal facility managers place an emphasis on technology reliability and maintenance requirements, transfer materials must address these issues to overcome any reluctance on the part of the designer or procurement official. By providing these officials independent evaluations that address their areas of concern as new technologies enter the commercial market, the Federal sector will give stronger consideration to their application. This will speed the deployment rates of these technologies into the Federal sector, reduce Federal energy costs, improve energy efficiency, and create jobs by advancing the purchase of U.S. manufactured technologies.

#### **ACKNOWLEDGEMENTS**

The Pacific Northwest Laboratory is operated by Battelle Memorial Institute for the U.S. Department of Energy under Contract DE-AC06-76RLO 1830.

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