

The Role of New Technologies⁽¹⁾

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ABSTRACT

This paper describes the FEMP New Technology Demonstration Program, which seeks to reduce federal-sector costs and improve overall energy efficiency at federal facilities by accelerating federal adoption of new and emerging energy-efficient, renewable-energy, and water-conserving technologies through education and demonstrations. The Program focuses on technologies that are commercially available but have not penetrated the federal market. This paper describes the Program, how new technologies fit into an overall energy management program, and how the Program disseminates information on new technologies. The paper also provides a successful case study, as well as a caution regarding new technologies.

INTRODUCTION

There are many strategies that can be used to reduce energy consumption and costs. These strategies might include:

- *awareness programs*, to motivate users and occupants to change behaviors that result in saved energy
- *operations and maintenance programs*, to keep equipment running efficiently and optimize run times
- *training programs*, to educate people on how to reduce energy consumption and costs
- *equipment procurement programs*, to buy the most efficient equipment available (rather than the cheapest first cost) to minimize life-cycle costs, which include energy costs
- *commodity procurement programs*, to buy the least expensive energy source available
- *energy-efficient technology programs*, to replace existing or conventional equipment with

⁽¹⁾ This paper was developed from a series of articles published in the DOE FEMP Focus during fiscal year 2002.

⁽²⁾ The Pacific Northwest National Laboratory is a multi-program national laboratory operated by Battelle for the U.S. Department of Energy.

more efficient equipment.

An effective energy management program will likely use many, if not all, of these strategies. This article will concentrate on the role of new and emerging energy-efficient technologies in an effective energy management program.

Removing old, inefficient equipment and replacing it with newer, more energy-efficient equipment is a common method of reducing a site's energy consumption and costs. In fact, some energy management programs are based almost exclusively on this type of activity. Two questions that get asked include, "*Which* energy-efficient technology should I select?" And just as important, "From *what list* of alternatives should I select?"

The answer to the first question should be, "I should select the alternative with the lowest life-cycle cost." The answer to the second question may be more difficult. If you don't put a new technology on the list of alternatives, it can never be selected. One issue may deal with new and emerging technologies and the concern about risk and reliability. When something is new, it is perceived to have more risk. "*It claims to be more energy efficient but I've not seen one in operation before. Will it work here? Will it work in this application? Is my maintenance team ready to work with this new technology?*" These are all important, and relevant, questions.

The time it takes for a "new" technology to become accepted to the point of being considered a "conventional" technology can be surprising. Take, for example, the fluorescent T-8 lamp and electronic ballast. Is this what you consider a new, energy-efficient lighting technology? Did you know that this technology is 30-years old? Granted, most designers today accept this technology as "conventional" for standard office lighting configurations. Now, think of the energy savings that could have been realized if this technology could have fully penetrated the market in only 5 to 10 years instead of 20 to 30 years? Don't limit your thinking to this lighting technology; the same is true for any energy-consuming equipment (cooling, heating, ventilation, water heating, battery chargers, and the list goes on).

Of course, balanced against the potential energy reduction is the potential for risk. The way you manage the risk, or at least better understand the risk, is to evaluate the new technology on a limited basis before it is mass deployed. This is the purpose of demonstrations, pilot projects, and case studies. With these options, you can look before you leap, and in some cases, learn from the mistakes of others. This is why the U.S. Department of Energy's (DOE) Office of Federal Energy Management Programs (FEMP) supports the New Technology Demonstration Program.

THE FEMP NEW TECHNOLOGY DEMONSTRATION PROGRAM

The FEMP New Technology Demonstration Program was established in 1990 to fulfill three goals:

- Reduce federal-sector costs and improve overall energy efficiency
- Accelerate federal adoption of new and emerging energy-efficient technologies, including

water-conservation, solar and other renewable-energy technologies, and improve the rate of technology transfer

- Help federal facilities implement pollution prevention strategies and reduce operations and maintenance costs.

These goals are reinforced by the Energy Policy Act of 1992 and subsequent Executive Orders. Four DOE National Laboratories currently support the FEMP New Technology Demonstration Program. The Program accomplishes its goals by conducting technology evaluations and sharing the results with federal energy managers, facility managers, procurement specialists, contracting officials, and others involved in specifying, buying, operating, or maintaining energy- and water-management technologies.

The purpose of Program publications is to inform federal agencies by providing accurate, up-to-date, information on new technologies. New Technology Demonstration Program publications do not constitute FEMP endorsements; rather they provide information so that readers can make educated judgements as to whether the subject technologies are suitable for their sites.

NEW TECHNOLOGIES AVAILABLE FOR REDUCING ENERGY COSTS

To date, the FEMP New Technology Demonstration Program has issued more than 45 publications, each covering a different technology including ground-source (geothermal) heat pumps, thermal energy storage systems, combined heat and power (cogeneration) systems, fuel cells, window glazings, and several renewable energy technologies. More than 35 additional technologies are currently being investigated including micro turbines, building control systems, water conservation, and new lighting technologies.

Most Program publications are available from the FEMP New Technology Demonstration Program web site: www.eren.doe.gov/femp/prodtech/newtechdemo.html. The *Technology Index* categorizes the technologies and includes links to each publication. For larger demonstration reports, which are not available through the web site, a brief summary is provided along with instructions on how to order the demonstration report.

The depth of FEMP-sponsored technology evaluations varies according to the maturity of the technology and the availability of reliable technical information. The New Technology Demonstration Program publishes five publication types:

- Demonstration reports
- ***Federal Technology Alerts***
- ***Technology Installation Reviews***
- ***Technology Focuses***
- Other technology guideline reports.

Demonstration reports are published as formal DOE National Laboratory reports. The reports

are available to DOE and DOE contractors from the Office of Scientific and Technical Information⁽¹⁾ and to the public from the National Technical Information Service.⁽¹⁾ A metered demonstration is used for technologies that are emerging, and where little is known about technology performance under various operating conditions. The results are based on field research overseen by one of the National Laboratories supporting FEMP.

For other technologies, where performance is better understood but the technologies have not penetrated the federal sector, the Program has other publication series that are available through the FEMP web site. These include the *Federal Technology Alert*, the *Technology Installation Review*, and the *Technology Focus*.

Federal Technology Alerts, the Program's signature series, provide evaluative information on new and emerging technologies based on the cumulative results of public- and private-sector experience with a specific technology. These reports typically include a description of the technology, including where to apply the technology and what to avoid. They also include estimates for federal-sector savings potential; a description of the technology's performance, applications, and field experience; a detailed case study; a list of known U.S. manufacturers; contact information; and worksheets to help assess the life-cycle cost-effectiveness of the technology.

Technology Installation Reviews are more concise but less technical publications. They include a description of the technology and a case study. The case study may include the results from another demonstration program or pilot project and is designed to provide a summary of what others have learned from their activities.

Technology Focuses provide brief information on a technology that may be of interest to the federal facility or energy manager. They also identify where to find additional information on the technology.

The Program has also released other publications from time to time. Recently, the Program released the *Low-Energy Building Design Guidelines* (DOE/EE-0249). Because this publication covers multiple technologies, as well as strategies, which are used holistically to achieve a highly-efficient building design, a guideline-style publication was used. Other publications of this type are being considered by the New Technology Demonstration Program.

NEW TECHNOLOGY SUCCESS STORY

Give a man a fish, and you feed him for a day.

⁽³⁾ Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831; 865-576-1188; or at www.osti.gov.

⁽⁴⁾ National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161; 703-605-6585; or at www.nist.gov.

Teach a man to fish, and you feed him for a lifetime.

Like many educational, outreach and training programs, the New Technology Demonstration Program is not designed to give you the answer. Instead, its purpose is to give you (the reader) understanding (information) so that you may come to a better decision. The following tells the story of one federal site and their path toward energy efficiency.

It is hard to tell where this story began and it certainly hasn't ended. We will begin in September 1995, when the New Technology Demonstration Program issued a ***Federal Technology Alert*** titled, *Ground-Source Heat Pumps Applied to Commercial Facilities*.⁽¹⁾ Ground-source heat pumps have been around for several decades, but their use in federal facilities had been limited. The scope of the ***Federal Technology Alert*** was to show how the heating, ventilating, and air-conditioning (HVAC) requirements of larger⁽¹⁾ facilities can be achieved using multiple ground-source heat pumps.

You might think that issuing the publication would be the end of the project for the New Technology Demonstration Program. When things go well, issuing the publication becomes the start of new activities. In addition to identifying the general Program contacts, the contact block on the back of each publication lists a technical contact. The technical contact is usually the author of the document.

A few years after publication, the New Technology Demonstration Program received a call from the Energy Program Manager at a U.S. Navy facility. The Energy Program Manager was seeking permission to use some of the information contained in the ***Federal Technology Alert*** for an article in the local Base newspaper. On further inquiry, it was learned that the Energy Program Manager was using the ***Federal Technology Alert*** to evaluate and assess the use of ground-source heat pumps at the site but was coming up against several obstacles. Normally, the New Technology Demonstration Program would have brought the request to the FEMP Design Assistance program. The FEMP Design Assistance program is one of FEMP's resources to assist federal agencies with this type of request. However, in this case, the Site was introduced to another government-funded technical assistance⁽¹⁾ program led by the International Ground-Source Heat Pump Association (IGSHPA) at Oklahoma State University. An IGSHPA engineering team assisted the Site engineering department and contractors in overcoming technical barriers leading to an improved design with lower capital cost requirements. The Site went on to install over 410 tons of ground-source heat pumps in six new and two renovated facilities, over 265,000 square foot of building space. The FEMP New Technology Demonstration Program counts this type of follow up as a success story but the story did not end there.

⁽⁵⁾ This Federal Technology Alert was updated in March 2001 and re-titled, *Ground-Source Heat Pumps Applied to Federal Facilities – Second Edition*

⁽⁶⁾ The term "larger" is intended to imply any building larger than single-family housing units, such as offices, schools, dormitories and other facilities.

⁽⁷⁾ While this specific technical assistance program is no longer available, similar programs may still be available through other sources.

Later, the Site once again contacted the New Technology Demonstration Program. The Site wanted to more fully deploy the technology but like most federal agencies, the Site did not have the financial resources to implement all cost-effective energy-efficiency projects. Coincidentally, FEMP was in the early stages of developing a technology-specific, super-ESPC for ground-source heat pumps and was looking for federal sites interested in being included in the request for proposal (RFP). The New Technology Demonstration Program introduced the Navy site to the FEMP Alternative Finance Program. A new partnership was formed. The technology-specific super-ESPC has since been awarded and the Site is working on establishing a delivery order under the DOE contract. The deliver order, when completed, is expected to include 15 more facilities, almost 460,000 square feet, which would add another 950 tons of ground-source heat pumps. The capital cost of the delivery order is estimated to be around \$7 to \$8 million.

While the New Technology Demonstration Program obviously can not take full credit for these energy-saving projects, we know that the Program played a significant role in the early stages.

The *Ground-Source Heat Pumps Applied to Commercial Facilities*, ***Federal Technology Alert*** has been one of the more popular publications. It has been used as supplemental material in training workshops sponsored by the IGSHPA and the Association of Energy Engineers (AEE). It was at the request of the IGSHPA that the New Technology Demonstration Program elected to update the ***Federal Technology Alert*** in 2001.

NEW TECHNOLOGIES: CAVEAT EMPTOR, LET THE BUYER BEWARE

Unfortunately, as with all things new, there are risks. As noted earlier, some risks are minimized by evaluating new technologies on a limited basis before they are deployed on a larger scale. Demonstrations and pilot projects allow a site to “look before they leap.” From case studies, one site may learn from the lessons of others.

Within the New Technology Demonstration Program, only the demonstration reports are based on measured and verified findings. Unfortunately, metered demonstrations are expensive undertakings and take a long time to produce results. For the other publications, including ***Federal Technology Alerts***, ***Technology Installation Reviews***, and ***Technology Focuses***, the Program does not independently verify performance data provided by manufacturers or pulled from literature reviews.

All of the Program’s publications are for informational purposes only. Neither the DOE nor the National Laboratories are implying endorsements of either the technology or the technology provider. Those who claim DOE, FEMP, or National Laboratory endorsement are misleading the public. Furthermore, Program publications are not substitutes for sound engineering or due diligence on the part of the reader.⁽¹⁾

⁽⁸⁾ The Program does, however, strive to be accurate and responsible. Remember, the Program’s goal is to help federal agencies achieve their goals.

Also note that “new and emerging” implies that things are subject to change. It is important to note the date on the publication. Program publications offer a snapshot of a technology at a given time. As time passes, technologies, costs, maintenance recommendations, even manufacturers change. In many cases, this can be a good thing. In the case of the *Natural Gas Fuel Cell*, **Federal Technology Alert**, the manufacturer has made numerous improvements to the equipment as everyone learns more about the technology. In other cases, things may not change for the better. As another example, new manufacturers may develop the product line that may not have been in that business when the report was published. Other manufacturers, which were known at the time of publication, may relocate, merge, consolidate, drop the product line, or even go out of business. The readers must do their homework.

Federal energy managers and facility staff need to be wary: *Caveat emptor*, let the buyer beware, definitely applies. FEMP is aware that some New Technology Demonstration Program publications have been altered, without DOE consent, and distributed to readers as genuine DOE reports. There are private web sites that have copied FEMP **Federal Technology Alerts** from the FEMP and National Laboratory web sites. Some are honest; others have purposely been altered either to make the technology appear more positive or to alter the list of technology providers. If the web site you are reading does not have a “.gov” address, then *caveat emptor*.

Again and unfortunately, the problem of altered DOE publications is not limited to the Internet. FEMP is also aware that some **Federal Technology Alerts** have been purposely modified and reprinted to make the technology and vendor look more positive. In some cases, it is very difficult to determine which publications are genuine and which have been altered⁽⁹⁾. If you have any doubts whether or not the FEMP publication you have is genuine, visit the FEMP web site to view the publication or to request a genuine copy from the DOE Clearinghouse⁽¹⁰⁾.

IN SUMMATION

Technologies are continuously evolving. Efficiencies are improving, controls are improving, and maintenance is being simplified. New and emerging technologies can be used to help the energy manager achieve and surpass energy and cost reduction goals. Trying something new may not be easy or risk free, but the New Technology Demonstration Program is doing its part to help clear the way.

⁽⁹⁾ One method that can be used to identify an altered New Technology Demonstration Program publication is to look at the section that lists manufacturers or suppliers. Unusual arrangements of white space, cover ups, or other unusual print marks, may indicate that the document may not be genuine. Be cautious, other statements throughout the report may also have been altered.

⁽¹⁰⁾ Call the DOE Clearinghouse at 1-800-363-3732. International callers please use 703-287-8391.

ABOUT THE AUTHORS

Steven A. Parker, PE, CEM, is a senior research engineer at the Pacific Northwest National Laboratory (PNNL). In addition, Steven currently serves as the 2002 National President of the Association of Energy Engineers. He presently supports several technical assistance programs at PNNL for the U.S. Department of Energy (DOE), Federal Energy Management Program (FEMP), including the New Technology Demonstration Program. He has served on several planning committees for the World Energy Engineering Congress, an international energy-efficiency conference sponsored by the Association of Energy Engineers (AEE). He has also served on the planning committees for Energy '98 through Energy 2002 Energy Efficiency Workshop and Exposition sponsored by the DOE. During 1998 and 1999, Steven served as a vice president for the Association of Energy Engineers serving Region 5, which covers the western United States. The Association of Energy Engineers awarded Steven with the Regional Energy Professional Development Award (2000) and the International Energy Professional Development Award (2001) for his accomplishments in training and development of energy engineers and managers and for superior service to the Association. Deeply involved in energy management since 1981, Steven has conducted several hundred energy audits of industrial, commercial, institutional, and Federal facilities both in the United States and overseas. In addition, Steven has instructed numerous energy-efficiency workshops and seminars both for the DOE and AEE and has been a significant contributor to the AEE-sponsored Certified Energy Manager (CEM) program. Steven Parker has authored numerous technical reports, articles and other professional publications in the area of energy efficiency and energy cost reduction.

Ted Collins is a Program Manager at the U.S. Department of Energy, Office of Federal Energy Management Programs, in Washington DC. Ted has been FEMP's training program manager for several years, during which time there have been over 20,000 attendees. Currently, he is also manager of FEMP's New Technology Demonstrations Program, and FEMP's life-cycle costing, and lighting activities. At DOE, he has worked in the industrial and transportation offices before FEMP. Previously he worked at the Commerce Department in domestic and international business areas. He has studied economics, business and government at George Washington, American and Stanford universities.