

Renewable Energy Deployment in the Federal Sector: A Strategy and Examples

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ABSTRACT

To reduce energy costs and help protect the environment, the U.S. Department of Energy's (DOE's) Federal Energy Management Program (FEMP) assists Federal agencies in becoming more energy efficient and using more renewable energy. FEMP's renewable energy program has identified three technology pathways to this goal: (1) purchasing and installing cost-effective renewable energy technologies at Federal sites; (2) purchasing a portion of Federal facilities' electricity from renewable power sources; and (3) incorporating the principles of low-energy design in new construction. To support these pathways, FEMP has also identified three overarching actions that need to be taken: (1) partnering with others to develop clear messages about renewable energy that resonate with the public; (2) coordinating agency programs to leverage resources and emphasize renewables; and (3) securing commitments and support from Federal leadership. This paper describes FEMP's progress in each pathway and supporting action and includes examples of recent Federal projects.

1. INTRODUCTION

Staff in FEMP's renewable energy program are playing an active role in the deployment of these energy technologies in the Federal sector. Working with representatives of other Federal agencies and industry, FEMP staff began formulating a new strategic plan in FY 1998. The resulting document, titled An Integrated Strategy for Renewable Energy in the Federal Sector, contains the following mission statement:

To facilitate and establish the conditions necessary to assist Federal agencies in increasing their use of renewable energy by:

- C Increasing their purchases of cost-effective renewable energy technologies;
- C Obtaining a portion of their electricity from renewable power sources; and
- C Incorporating the principles of low-energy sustainable design in new construction on an accelerated basis in the near term, leading to the use of renewable energy technology as routine practice in the long term (1).

The three key points in this mission statement represent the three primary pathways to the goal of significantly increasing the deployment of renewable energy systems in the Federal sector. And they form the foundation of an orderly, comprehensive, strategic plan for implementing these energy systems in Federal facilities.

Accomplishing this mission will significantly benefit the public in several ways. It will improve the quality of our air and water and reduce greenhouse-gas emissions, which should help slow global climate change. It will also spur economic development in the renewable energy industry and many related industries, which will provide new jobs for thousands of Americans. In the long run, it will save taxpayers millions of dollars. And it will reduce our growing dependence on imported fuels.

2. BACKGROUND AND RATIONALE

Today's renewable energy costs, although lower than they have ever been, remain higher than the costs of conventional energy (e.g., from coal, gas, and oil) for most applications. But in some applications (e.g., remote power and power generation in areas with high utility costs), nonpolluting renewable energy systems are already cost-effective. By supporting cost-effective purchases of renewable energy equipment and power generated from renewable sources, the Federal government can provide a market stimulus for these

technologies that will eventually help reduce costs. This will occur when demand increases enough so that manufacturers and suppliers can take advantage of economies of scale. Realizing this potential, however, requires eliminating or reducing the current barriers to purchasing renewable energy systems, such as higher initial costs and a lack of knowledge about the performance and reliability of these technologies.

Using both energy efficiency measures and renewable energy in Federal facilities helps to accomplish the same environmental and energy security objectives. And they complement each other both technically and economically. Energy-efficient facilities, because of their lower energy costs, can afford to use more renewable energy, and small-scale renewable systems can provide a higher portion of an efficient facility's energy requirements. Low-energy building design in the Federal sector has been greatly underutilized, yet it has significant potential. In low-energy designs, solar and other renewable energy systems can be combined with energy-efficient measures to reduce the government's reliance on conventional energy sources.

As the electric power industry continues to be restructured, Federal agencies will have more options in purchasing green power. This will provide them with much greater leverage (e.g., through volume purchasing) than they would have in designing and installing individual renewable energy systems, particularly when there are constraints on their capital equipment budgets or when the cost of retrofitting their facilities is prohibitive.

The strategic goal of the FEMP renewable energy program, as stated in its strategic plan, is to increase the percentage of renewable power used in Federal facilities to 5.5% of total government electricity purchases by 2010. This goal includes renewable power generated on site as well as green power purchased from energy supply companies. In the following sections, we discuss the progress being made in each pathway to the goal of lower costs and greater use of clean energy in government facilities.

3. FIRST PATHWAY: INSTALLING RENEWABLE ENERGY SYSTEMS

To date, the Federal government obtains approximately 0.16% of its electricity from on-site solar and other renewable power generation (2). This might not seem like much, but it is actually the equivalent of approximately 85,592 MWh; at an avoided cost of at least \$0.06/kWh (average Federal costs), this saves about \$5.1 million per year and avoids about 27,000 metric tons of CO₂

emissions per year (based on the U.S. power generation mix).

Historically, FEMP has focused primarily on the purchase and installation of decentralized renewable energy systems. FEMP offers Federal agencies direct technical assistance in specifying and purchasing these energy systems. FEMP also provides indirect assistance in the form of training courses, information-sharing meetings, and reports, case studies, and other communication products, in both printed and online formats. Today, this technology pathway is still a primary focus. Two current FEMP activities that are resulting in significant purchases of renewable energy systems in the field are the Federal Million Solar Roofs Initiative (MSRI) and FEMP's funding program for renewable energy systems and equipment (hardware).

The goal of the MSRI is to have 20,000 solar systems installed on Federal facilities by 2010. The near-term goal is 2,000 systems by the year 2000. This commitment was announced on October 22, 1997, and in the first 14 months of the initiative, the Federal government installed 619 solar energy systems. These included 608 solar water heating systems, 10 photovoltaic systems, and 1 transpired solar collector for ventilation air preheating (a kind of "solar wall" that qualifies under the initiative). The largest number of systems to date have been installed by the U.S. Navy in the Department of Defense (DOD) at Moanalua Terrace family housing in Pearl Harbor, Hawaii.



Fig. 1: Solar hot water systems installed on residences in the Navy's Moanalua Terrace family housing project.

At Moanalua Terrace, the Navy plans to install solar water heating on a total of 752 base housing units. The Navy obtained a \$1500-per-system rebate from Hawaiian Electric Company (HECO) for solar systems installed on new construction, and \$800 per system for those installed as retrofits on existing housing units. The Navy also secured \$130,000 for this project from the FEMP renewable system hardware awards. Phase 1 included 100 retrofitted systems;

Phase II involved new construction on 136 homes. The Phase II systems are direct (open-loop) active solar systems that circulate potable water through flat-plate collectors with a black chrome selective surface. Each system consists of a 4-foot by 8-foot (1.2 m x 2.4 m.) collector produced by American Energy Technologies and an 80-gallon (303-liter) Rheem tank containing an electric backup element. The up-front cost was \$2310 per system.

When the \$1500 rebate is included, the systems have a six-year simple payback at an electricity cost of \$0.11/kWh. Phases III and IV plan to include systems for 516 additional housing units and are partially completed.

As part of FY 1999 MSRI-related work, FEMP is targeting Federal facilities in areas that have been designated as partner communities. In the Western states, MSRI communities have been designated in Washington, Oregon, California, Nevada, Arizona, and Hawaii. Each community has set a goal for the number of roofs that it plans to install. Within these communities, FEMP is identifying opportunities for solar energy applications on Federal buildings. For example, Los Angeles intends to install solar systems on 100,000 roofs. And the Los Angeles Department of Water and Power utility has offered to install five 10-kW systems on Federal roofs. FEMP is now seeking Federal agencies that are interested in hosting these systems.

The second key activity, the FEMP renewable energy system hardware awards, has made significant progress. In FY 1998, FEMP issued a solicitation and selected and funded 26 solar projects at a total of \$1.9 million. Eligible renewable energy technologies included solar water heating, photovoltaics (PV), ventilation air preheating systems (transpired solar collectors or "solar walls"), passive solar and daylighting systems, and wind systems. A panel of five reviewers independently evaluated and ranked approximately 70 proposals, identifying 26 for awards. These 26 proposals resulted in the purchase of 85 PV systems, 65 PV-powered lights, 116 solar water heating systems, approximately 74 daylighting skylights, 1 solar ventilation air preheating system, and 1 large wind turbine. Successful projects had to be cost-effective with a payback period of 10 years or less as required in the appropriations bill for these awards.

Proposers were also awarded points for meeting these additional criteria:

- Multiple standardized solar or renewable energy systems were to be installed at more than one location.
- Energy conservation measures as well as renewable energy systems were included.
- System design, hardware, and vendors were specified.
- Applicable agency approvals were obtained.

- The spending plan leveraged agency resources with those of Federal or non-Federal project partners.
- The project could be easily replicated or the facility could be a showcase that would help to educate and inform other agencies about renewable energy.

These are examples of the types of projects funded:

- Solar water heaters were installed on 62 U.S. Coast Guard (Department of Transportation) housing units in Kia'i Kai Hale, Hawaii, and this leveraged funding provided by HECO's rebate program.
- Eight small portable PV power systems were purchased for campground host systems for the Bureau of Land Management in the Department of the Interior (DOI); this demonstrated the benefits of purchasing multiple standardized solar systems.
- PV parking lot lights were purchased for three agencies; this demonstrated the benefits of an aggregated Federal procurement, and it included lights for the DOI USS Arizona parking lot at Pearl Harbor, the Marine Corps Recruit Depot in Parris Island, South Carolina, and the Indian Health Services A-C-L Hospital in Albuquerque, New Mexico.

A complete list of projects funded and resulting estimated savings is available from the authors.

In FY 1999, another solicitation was developed to distribute an additional \$1.5 million in renewable system hardware funding. The criteria for project selection are similar to the criteria established in FY 1998, with a few key differences:

- These projects must be life-cycle-cost-effective and meet a 25-year payback requirement.
- If the project has a simple payback less than 5 years, the agency needs to explain why it is not being financed through an Energy Savings Performance Contract (ESPC) or a utility contract.
- FEMP is particularly interested in funding systems meeting the requirements of the MSRI program.

Leveraging purchases for the greatest number of multiple standardized systems is the overall objective of these hardware awards. The due date for proposals in response to the solicitation is March 15, 1999. The selected agencies should be announced in April or early May, 1999.

FEMP encourages the use of ESPC and utility contracting by agencies that lack the budgeted funds needed to purchase renewable energy systems directly. Agencies are also encouraged to use these financing mechanisms whenever leveraging private capital provides a better opportunity for a Federal agency to achieve greater savings. To assist in this process, FEMP has selected energy service companies and energy savings performance contractors (ESCOs), on a competitive basis, as a means of helping Federal agencies

achieve their goals for greater energy efficiency and greater use of renewable energy.

FEMP has also been working with the General Services Administration (GSA) to get more solar products on the Federal General Supply Schedule. The Solar Schedule is available on the Internet at <http://www.gsa.gov/regions/7fss/7fx/schedules> (click on Schedule 62, Part II). Services such as design assistance and installation supervision can also be ordered using the GSA Solar Schedule.

FEMP is working closely with the GSA, Federal agencies, and vendors to ensure that solar products and services are procured in a streamlined, efficient manner through the Supply Schedule. In FY 1998, FEMP assisted the National Park Service (NPS), Bureau of Land Management, Environmental Protection Agency (EPA), and others in acquiring cost-effective, "best value" solar systems through the GSA.

4. SECOND PATHWAY: PURCHASING GREEN POWER

In many states, the government and other customers can now purchase power generated by renewable energy systems partly as a result of the restructuring of the electric utility industry. These changes in the marketplace provide opportunities for the Federal government to use its considerable purchasing power to boost demand for renewable energy, while allowing markets to determine the best mix of renewable energy technologies. As part of this pathway, FEMP recommends that the government seek statutory authority to require a percentage of green power purchases and to allow a price premium to be paid for green power technologies, based on local resources and markets. Another key aspect of this pathway involves working on pilot projects to test, review, and evaluate a model Federal green power procurement contract.

For example, the EPA is working with the GSA and the National Renewable Energy Laboratory (NREL) to purchase 100% green power for EPA's Region 9 laboratory in Richmond, California. The request for proposals was issued in mid-February 1999. The EPA RFP defined green power as electricity from biomass, solar, thermal, photovoltaics, wind, geothermal, digester gas, landfill gas, and small-scale hydroelectric systems (30 MW or less) (3). In addition, the GSA has an electricity supply contract in the Northeast with Enron that includes an option to purchase green power. The GSA has pledged to buy a green power product (one that contains at least 50% green power) for 4% of its total load in that region

(3). Other agencies have stated that they will follow GSA's lead with similar green power purchases.

In other related activities, Federal agencies have provided input to draft language for a Presidential Executive Order and legislation to establish a clear Federal policy regarding green power procurements, through the FEMP-sponsored Renewables Working Group (RWG) (4). FEMP supports 5.5% by the year 2010 as the percentage of renewable energy that Federal agencies should procure. FEMP also analyzed this requirement in terms of its cost and impact on Federal agencies. The analysis found that, if the 5.5% renewables purchase requirement applies only to electricity purchases, this would equal 2,942,253 MWh of renewable power per year. (This figure is based on Federal agencies' reported 53,495,175 MWh of electricity used in 1997.) The DOD, DOE, GSA, U.S. Postal Service, and Veterans Administration account for 68% of Federal electricity use and would therefore be the agencies most affected by a renewable energy purchase requirement. In 1997, U.S. renewables-based electricity production, excluding hydropower, was 76,614,000 MWh. A 5.5% Federal electricity purchasing requirement equals 3.84% of total U.S. renewable power generation. Cost estimates for the 5.5% requirement range from a high of \$82 million (representing a 2.6% increase in Federal electricity costs) to a low of \$15 million (representing a 0.5% increase in Federal electricity costs) (4). There are still many issues to be resolved, however; for example:

- C Thorough data will be needed on renewable energy supplies and the availability of green power on both a state and regional basis.
- C The definition of renewable energy needs to be clarified. For example, if small-scale hydropower is included, a low-cost, substantial source of renewable electricity generation would be added to the supply, especially if "small" is defined as producing 50 MW or less rather than 10 MW or less.
- C If on-site renewable energy projects (such as solar water heating, PV, biomass, and geothermal for direct heat) that displace direct electricity purchases are allowed, agencies will have more opportunities to meet the requirement by using renewables in high-value applications like displacing remote diesel systems.
- C Defining which part of Federal energy consumption is used to estimate the 5.5% requirement could have a significant impact. Energy-intensive operations are currently exempt from agency energy-efficiency targets. This analysis assumes that the exemption will not be allowed for the renewables-based electricity purchase requirement.
- C The way in which individual agencies account for and manage the 5.5% requirement could have a significant impact on costs. If this becomes an agency-wide goal,

renewable energy can be purchased where this energy is relatively inexpensive and abundant, to offset purchases made where it is more expensive or scarce.

If the requirement is enforced at the local level, mismatches between the available renewable supply and Federal demand may increase the cost of compliance (4). According to the GSA, for example, the top five states in terms of Federally owned and leased floor space, which account for 33% of the total, are California, Texas, Virginia, Maryland, and New York (5). According to the Energy Information Administration, the five states producing the most non-hydroelectric renewable power (0.32%) are California, Florida, Maine, Alabama, and New York (6).

5. THIRD PATHWAY: USING LESS ENERGY IN NEW CONSTRUCTION

The objective of this pathway is to establish a new level of excellence for Federal building construction and renovation that emphasizes energy efficiency, quality, affordability, and sustainability through the use of low-energy building design. Low-energy building design incorporates state-of-the-art energy efficiency, renewable energy, and passive solar design practices.

Several government agencies are being very proactive in the area of low-energy design. One is the Navy's Facility Engineering Command. In its planning and design policy statement, this group states that its objective is "to incorporate sustainability principles and concepts in the design of all facilities and infrastructure projects to the fullest extent possible, consistent with budget constraints and customer requirements" (7).

The GSA has also developed a nationwide initiative called "Planet GSA." This initiative addresses sustainable design issues in buildings, purchasing, and vehicles. The GSA will break ground on a pilot project for sustainable energy this summer. The project is a 383,000-square-foot (35,581-square-meter) United States Courthouse Expansion in Denver, Colorado. Sustainable design features include high-performance glazing; daylighting; energy-efficient lighting; energy-efficient heating, ventilation, and air-conditioning equipment; an integrated building automation system, and building-integrated photovoltaic systems. The proposed design will use approximately 50% less energy than a building meeting the Federal standard stipulated in 10 CFR 435.

In addition, various agencies within DOI, including the Fish and Wildlife Service and the NPS, have recently

designed and built a number of buildings that incorporate the principles of low-energy design.

Working with the Passive Solar Industries Council (PSIC) as a subcontractor, FEMP is redesigning a short course for Federal agencies titled "Designing Sustainable Low-Energy Buildings." The course will be offered in classrooms as well as in a distance-learning format.

FEMP-supported activities related to this third pathway include these:

- C Establish policies to institutionalize low-energy design in new construction.
- C Identify and target key opportunities.
- C Develop an organizational capacity among architectural and engineering firms.
- C Work with agencies with missions that complement FEMP's in order to leverage limited Federal resources.
- C Showcase successful projects.
- C Expand financing opportunities for low-energy and solar building designs.

6. TAKING ACTION TO SUPPORT EACH PATHWAY

Ultimately, achieving the goals of each pathway will depend on FEMP and its partners taking these three overarching actions:

- C Helping the public understand the benefits and limitations of renewable energy systems so they can support the program. The Federal government must partner with the renewable energy industry, electric utilities, and state and local governments to share the responsibility for taking this action.
- C Assisting major Federal agencies in coordinating their renewable energy programs to leverage resources and emphasize renewables.
- C Finally, so that agencies have a clear understanding of programmatic goals and ways to achieve them, engaging leaders in Congress and in the Executive Branch of the government so they will be specific in describing and supporting these national goals and policies.

The FEMP-sponsored RWG is addressing and coordinating many activities in support of these overarching actions.

7. CONCLUSIONS

In many ways, DOE FEMP has served as the deployment arm of the Federal government's renewable energy program. FEMP has helped create a nationwide testing ground for the development and installation of renewable energy system hardware and has gathered a considerable amount of data on the feasibility of many applications. In

this way, FEMP builds the bridges that link industry, Federal agencies, and DOE research and development programs in renewable energy. FEMP will continue to develop ways to remove barriers to deployment and increase the government's access to renewable energy technologies through training programs and information sharing. FEMP will also continue to provide technical assistance to Federal agencies so they can continue to develop successful models of deployment. These actions all strengthen the infrastructure needed to increase the use of renewable energy in the Federal sector.

FEMP's strategic plan for renewable energy deployment (1) builds on this foundation by continuing to emphasize the purchase of cost-effective renewable energy technologies as a strategic pathway. FEMP has also added proactive efforts to expand green power purchases and encourage the use of low-energy building design in new construction; these are equally important and complementary pathways. FEMP's efforts, in combination with supportive Executive Branch and Congressional actions, are producing results. Together, they are helping to create a substantial, stable market for clean, cost-effective renewable energy in the Federal sector.

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