

# **Implementing Water Conservation Goals at Federal Facilities—Lessons Learned**

**Preprint**

S. Tanner

*National Renewable Energy Laboratory*

D. Braver

*Consultant*

*To be presented at the 2002 Water Sources Conference: Reuse, Resources, Conservation  
Las Vegas, Nevada  
January 27-30, 2002*



**able Energy Laboratory**

1617 Cole Boulevard  
Golden, Colorado 80401-3393

NREL is a U.S. Department of Energy Laboratory  
Operated by Midwest Research Institute • Battelle • Bechtel

Contract No. DE-AC36-99-GO10337

## NOTICE

The submitted manuscript has been offered by an employee of the Midwest Research Institute (MRI), a contractor of the US Government under Contract No. DE-AC36-99GO10337. Accordingly, the US Government and MRI retain a nonexclusive royalty-free license to publish or reproduce the published form of this contribution, or allow others to do so, for US Government purposes.

This report was prepared as an account of work sponsored by an agency of the United States government. Neither the United States government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or any agency thereof.

Available electronically at <http://www.osti.gov/bridge>

Available for a processing fee to U.S. Department of Energy  
and its contractors, in paper, from:

U.S. Department of Energy  
Office of Scientific and Technical Information  
P.O. Box 62  
Oak Ridge, TN 37831-0062  
phone: 865.576.8401  
fax: 865.576.5728  
email: [reports@adonis.osti.gov](mailto:reports@adonis.osti.gov)

Available for sale to the public, in paper, from:

U.S. Department of Commerce  
National Technical Information Service  
5285 Port Royal Road  
Springfield, VA 22161  
phone: 800.553.6847  
fax: 703.605.6900  
email: [orders@ntis.fedworld.gov](mailto:orders@ntis.fedworld.gov)  
online ordering: <http://www.ntis.gov/ordering.htm>



## **Implementing Water Conservation Goals at Federal Facilities – Lessons Learned**

**Stephanie Tanner**  
**Senior Project Leader**  
**National Renewable Energy Laboratory**  
**Washington, DC**

**Deborah Braver**  
**Consultant**  
**Sacramento, California**

### **Abstract**

Executive Order 13123, issued in June 1999, directed Federal agencies to develop and implement methods to improve water-use efficiency at government-owned facilities. Specifically, the order required all Federal agencies to identify their existing water consumption and to establish a goal for reducing that consumption. Under the leadership of the U.S. Department of Energy's Federal Energy Management Program (FEMP) and National Renewable Energy Laboratory (NREL), representatives from Federal agencies established a working group to recommend guidelines and methods for achieving the mandated water efficiency improvements.

A review of Federal water use revealed the complications typically associated with assessing water usage. For example, most of the buildings were not separately metered, making it difficult to identify areas in which water usage was greatest and to prioritize those areas for improvements. Frequently, the infrastructure was aging, and capital improvements and maintenance had been deferred for many years. Because of billing practices, many agencies had no idea how much water was being used, or at what cost. It was also apparent, however, that some Federal agencies had already implemented many water efficiency improvements at various sites. When establishing the baseline for water usage, it was important to credit these successes and not penalize facilities that were already conserving water. It was also important to remain focused on cost-effectiveness, since program implementation is usually financed through normal Federal budget procedures.

In 1999, FEMP established a method to identify baseline water usage and a water efficiency improvement goal. The goal established 10 Best Management Practices (BMPs) for Federal water efficiency, similar to those developed under the California Urban Water Conservation Council's Memorandum of Understanding. The Federal BMPs focus primarily on office water use, landscaping, heating and cooling, leak detection, and education and emphasize cost-effectiveness, flexibility, and creativity.

### **Background**

Federal agencies have been working for many years to meet energy-reduction goals established in the Energy Policy Act (EPAAct, 1992) and in Executive Order (E.O.) 12902

(1994), “Energy Efficiency and Water Conservation at Federal Facilities.” Both set requirements for energy conservation but stated no specific requirements or goals for water conservation. They did, however, establish that water conservation was part of the energy management program, and allocated responsibility for developing a program for Federal energy and water management to FEMP<sup>1</sup> within the Department of Energy (DOE).

When E.O. 12902 was issued, most Federal agencies kept only spotty records of water use. If they were metered at all, facilities had only one central meter at the gate. Billing records were not always located at the facility, and many large facilities were served by more than one utility. Often, it was not known at the facility management level which utility provided water service or how much was being paid for it. To make any progress at all on this issue, the first step was to try to collect information on Federal water usage.

In 1997, FEMP completed a study on water usage in the Federal sector.<sup>2</sup> Because of the lack of reliable data for all agencies, the study had to estimate water usage based on building square footage, building type, and location. The study estimated that the Federal sector used 300 million-450 million gallons per day at a cost of \$225 million-\$500 million per year, and that the government could save at least 40% of that by implementing conservative conservation methods. The study also looked at how water is used in the Federal sector.

Water is used in the Federal sector in every conceivable way—for domestic, commercial, irrigation, industrial, and agricultural needs. Federal facilities are located in almost every community, and they consist of every building type, including post offices, large military facilities, national parks, and courthouses. These facilities receive water services under a wide variety of arrangements, including producing and treating their own water, and they are therefore billed for water service under a wide variety of methods.

In 1999, President Clinton signed E.O. 13123, “Greening the Government through Efficient Energy Management,” which superseded E.O. 12902. This order looked more broadly at energy efficiency and required DOE to establish specific water conservation goals and requirements for Federal facilities. It was felt that a more specific requirement would focus attention on the issue, increase the implementation of projects, and provide more comprehensive efficiency at Federal sites. However, problems with collecting reliable information on water usage and costs in the Federal sector soon became apparent.

Although office buildings comprise a large portion of Federal building stock, 80% of estimated water usage occurs in Federal hospitals and housing. Since the FEMP study was completed, anecdotal information from individual agencies now suggests that the study’s usage numbers are extremely conservative and that a large portion of water is used in Federal industrial activities, such as minting coins, printing money, conducting research, and supporting military activities.

---

<sup>1</sup> The mission of the Federal Energy Management Program is to reduce the cost of the Federal government by advancing energy efficiency and water conservation, promoting the use of distributed and renewable energy, and improving utility management decisions at Federal sites.

<sup>2</sup> Lombardo Associates, *Federal Facilities Water Use and Water/Energy Conservation Potential*, National Renewable Energy Laboratory, September 1997. pp. 8-9.

Despite the lack of reliable data, FEMP was required by E.O. 13123 to establish a baseline of water use in the Federal sector and set a goal for Federal water conservation.

To ensure that the result would be fair to all agencies, FEMP turned to the Federal Water Working Group (WWG). The WWG had been established under E.O. 12902 as a subcommittee to the Federal Interagency Energy Management Task Force.<sup>3</sup> The WWG's role is to identify barriers to Federal water conservation and advise FEMP on ways to overcome those barriers. It is made up of representatives from all interested Federal agencies, some water conservation companies, and utilities.

FEMP charged the group with developing a set of guidelines based on high expectations of facilities in conserving water. The challenge was to develop one simple set of requirements that would make water use more efficient at all the various types of Federal facilities, as well as provide better information in the future about water usage and costs.

### **Establishing a Process**

FEMP was required by E.O. 13123 to develop guidance for establishing a water-use baseline within 90 days of the signing of the order and to have guidance in place for setting the water efficiency goal within 180 days of the order. This meant organizing the members of the WWG to complete the task well in advance of those deadlines in order for DOE to review and finalize it. The WWG included representatives of all Federal agencies as well as other interested parties from all over the United States. In addition, FEMP encouraged and welcomed participation from any interested Federal entity. Since the National Renewable Energy Laboratory<sup>4</sup> had been coordinating the water conservation program and Water Working Group for FEMP since 1994, it was tasked to lead the development of a process for establishing the baseline for water use and setting the goal through the WWG.

Because of the time limit and the wide geographic distribution of the WWG's membership, as much work as possible was done via the Internet. To reduce the impact on travel funds, FEMP also limited the number of meetings. Therefore, one half-day meeting was held to agree on the process and identify barriers. Two one-day meetings were held—one to establish the baseline and one to set the goal. As coordinator of the WWG, NREL believed that the process would be better served by having a third-party facilitator. The preferred choice was someone familiar with the issues surrounding institutional water conservation that also had the ability to bring groups with disparate agendas to a consensus. The facilitator was to be present at all meetings and would work closely with NREL throughout the process.

### **Identifying Barriers**

Although the first meeting established the process to be used, its main purpose was to identify barriers to Federal water conservation and setting a goal. The WWG understood that

---

<sup>3</sup> Two organizations led by FEMP, the Federal Interagency Policy Committee and its Interagency Energy Management Task Force, develop energy management policy, identify customer needs, establish priorities, and coordinate communications across Federal agencies. These groups are essential for promoting the philosophy that proper energy management practices are sound business practices and do not compete with agency missions.

<sup>4</sup> NREL is the U.S. Department of Energy's premier laboratory for renewable energy research and development and a lead lab for energy efficiency R&D. NREL's mission is to develop renewable energy and energy efficiency technologies and practices, advance related science and engineering, and transfer knowledge and innovations to address the nation's energy and environmental goals.

there is great potential for saving water, energy, and money through effective water conservation programs, and that the technologies to accomplish this are proven and widely available. Unfortunately, they also knew that there are many barriers to implementing water conservation at Federal facilities. Not all barriers could be effectively addressed through the Executive Order process, however. The WWG thus decided to focus on a limited number of barriers and develop recommendations that would reduce or eliminate them and allow the Federal facility manager to be creative with conservation measures. They focused primarily on barriers that involved a lack of the following:

- Coordination between water planning and other aspects of facility planning and management
- Knowledge about the amount of water a particular facility uses
- Knowledge about the cost of water services at facilities
- Knowledge about the cost-effectiveness of water conservation projects in comparison to other facility projects
- Consistency in levels of project implementation at Federal sites.

*Coordination between water planning and other aspects of facility planning and management.* Responsibility for water management is often located in a number of areas at the facility level, including energy management, environmental management, property management, or outside contractors. In some cases, there is no coordination between these different groups when planning maintenance, retrofit, or replacement of facilities. Agency-level requirements for standardization that do not consider site-specific issues and local resource planning needs can further complicate the process. The WWG wanted to encourage long-term unified planning for water resource management. Water issues should be considered an integral part of the overall site planning process. In addition, plans need to be responsive to local situations and needs.

*Knowledge about the amount of water a particular facility uses.* Managers often do not know what their facility's total water usage is or exactly how water is being used at their site. Although metering is a good way to obtain this data, other methods do exist. Widespread metering of water use is usually cost-prohibitive and resisted at the facility level. Facilities have neither the funding for metering nor the staff to read and maintain meters. The WWG wanted to encourage facilities to use all available methods to learn more about their water use, such as engineering estimates, water-use audits, or the use of small, portable meters for individual technologies and processes.

*Knowledge about the cost of water services at facilities.* In some areas of the country, water rates are very low. The reasons for this are varied and complex, but the result is the same. Low rates can limit cost-effective projects. In addition, Federal facilities (usually military ones) that provide their own water and sewer services have complex accounting methods, which do not always attribute all costs associated with water. For example, these facilities may consider only the variable costs associated with water—such as for chemicals and energy—and not the fixed costs of the plant and labor. This approach greatly reduces the apparent cost of water.

A study by Pacific Northwest National Laboratory showed that the average rate for water paid by the military was \$1.29/kgal, while the average rate at facilities on a utility system was \$4.17/kgal.<sup>5</sup> Although there was little the process could do about the rate for water service charged by utilities, the WWG wanted to encourage facilities to include in their cost estimates all associated costs, such as the cost of pumping and treatment, energy for heating or otherwise processing water, and chemicals and other additives associated with certain processes, as well as environmental costs, such as the cost of a discharge permit.

*Knowledge about the opportunities for water conservation and their cost-effectiveness compared to other facility projects.* Some facility managers believe they have little opportunity for water conservation. They are either unaware of the range of opportunities available to most facilities or have too narrow a view of what water conservation entails. Also, incorrect information about such conservation technologies as low-flow toilets has led some managers to avoid considering these options. The WWG wanted to provide information on a range of conservation options as well as resources for obtaining additional information on projects and methods used at other facilities.

Many managers are also not aware that water conservation projects can be one of the most cost-effective efficiency expenditures they can make. Facility managers sometimes mistakenly believe that water conservation measures would lengthen the payback period when bundled in other conservation projects. Since Federal facilities are required under EAct to implement all projects with a payback period of 10 years or less, these managers can be unwilling to implement water conservation projects. WWG members wanted to encourage managers to bundle water projects with energy efficiency projects. Bundling often enables facilities to obtain better project economics and implement more comprehensive programs. In fact, the Navy has found that when water, sewer, energy, and other costs are included, water efficiency projects often have a discounted payback period of only 2-4 years.<sup>6</sup>

*Consistency in levels of project implementation at Federal sites.* Federal agencies have been required to implement water conservation since EAct was passed in 1992. EAct requires that agencies implement all cost-effective conservation projects by January 2005.<sup>7</sup> Actual project implementation has been sporadic, however, mainly because of different interpretations of this requirement. Some agencies and facilities had already pursued significant numbers of projects and had model processes in place for conservation. Others would be starting from scratch. One problem involved timing. If a baseline and goal were set that involved a recent starting date, facilities that were proactive could be punished by the progress they had already made. If a comparison or baseline starting date were set well in the past, most facilities would be unable to produce data for the intervening time period. The WWG wanted to reward and encourage proactive and creative facilities while allowing the best possible data to be collected.

---

<sup>5</sup> Parker, G.B., et al., *Market Assessment for Capturing Water Conservation Opportunities in the Federal Sector*, Pacific Northwest National Laboratory, August 1997, p. 4.2.

<sup>6</sup> Kelly, Matt, and Peter Ford, "Water Conservation Opportunities," presentation given at Federal Utility Partnership Working Group meeting, March 7, 2001.

<sup>7</sup> Energy Policy Act of 1992, PL 102-486, Oct. 24, 1992, Subtitle F, section 152 (b).

### **Establishing the Baseline**

The second meeting of the WWG was held to decide on the type of water efficiency goal to be pursued as well as to develop guidance for establishing the baseline for water use. It was important to do both at the same time because of their interdependence. The major type of goal used thus far in the implementation of Executive Order 13123 was a percentage reduction from an established baseline, such as the energy reduction goal of 35% per square foot by 2010, relative to a 1985 baseline. After five years of working with the WWG group, FEMP and NREL staff knew that it would be hard to obtain a consensus on such a goal. Therefore, as a preliminary step, NREL had researched other types of goals, which would serve to overcome many barriers and be acceptable to WWG members and the agencies they represented. The Best Management Practices, or BMP, established in California seemed to be an acceptable option.<sup>8</sup>

The BMP concept presented by NREL proposed establishing a number of practices that would cover a wide range of conservation options available to most facilities, and then to require a certain number of them to be completed by 2010, the main time frame in the Executive Order. Other options considered included setting a numeric reduction of 20%-40% from the baseline; establishing different goals for different types of facilities, such as hospitals or office buildings; and proposing goals based on an agency's mission or region.

After much discussion of the benefits and consequences of each type of goal, the WWG agreed to the BMP concept for the following reasons:

- The goal would be independent of the established baseline for water usage. This would allow Federal agencies time to implement procedures to improve water usage data collection.
- A recent start date for the baseline could be set, which would provide a fairly complete set of data from all agencies.
- Proactive agencies that had implemented significant conservation measures before the baseline date would not be punished.
- It allowed the most flexibility to on-site facility managers and could be tailored to the specific needs of the facility.

With a goal framework that was independent of the baseline, the group decided it would be best to set a baseline in the current year. Agencies without reliable historical data on water usage could establish a process for collecting and maintaining better future data. And sites that had already implemented water efficiency projects would not be penalized.

### **Setting the Goal**

After the baseline was established, the next step was to fully develop the BMP concept to provide Federal facilities with clear and correct information on the opportunities available in water conservation. NREL drafted a set of practices based on information from a number of

---

<sup>8</sup> California Urban Water Conservation Council, "Memorandum of Understanding Regarding Urban Water Conservation in California," 1991.

sources.<sup>9</sup> NREL and FEMP wanted to be sure that the BMPs represented the best information available as well as the wisdom of practitioners in the field. To that end, volunteers from the California Urban Water Conservation Council provided a technical review of the draft and recommended some additional BMPs. To improve communication, a forum Web site was set up on the Internet to allow WWG members to review and comment on the draft practices and see each other's comments.

The objective of the third and final meeting was to establish the actual goal and finalize the language of all the BMPs. The WWG wanted to provide a wide range of options and allow unforeseen methods or unidentified processes to be included in meeting the goal. In all, 10 BMPs were finally approved:

- BMP # 1 – Public Information and Education Programs
- BMP # 2 – Distribution System Audits, Leak Detection & Repair
- BMP # 3 – Water Efficient Landscape
- BMP # 4 – Toilets and Urinals
- BMP # 5 – Faucets and Showerheads
- BMP # 6 – Boiler /Steam Systems
- BMP # 7 – Single-Pass Cooling Systems
- BMP # 8 – Cooling Tower Systems
- BMP # 9 – Miscellaneous High Water-Using Processes
- BMP #10 – Water Reuse and Recycling

The first problem was establishing the number of BMPs to be completed by each agency, and the process to be used to meet that goal. Since DOE would review and approve any recommendation made by the WWG, it was important that the goal be challenging but not impossible to meet. Also, the WWG felt that better planning was essential to accomplishing the goal and improving water management practices at all facilities. Without a requirement for comprehensive planning, facilities would continue to implement projects in a disjointed manner, and the quality of projects would suffer.

The second problem was that, with a BMP-type goal, facilities could be required to implement projects that were not cost-effective.<sup>10</sup> The WWG wanted to ensure that the process remained flexible at the facility level to allow the most cost-effective and appropriate measures to be implemented. They wanted facility staff to focus on improving the long-term efficiency of water use at the site, not just short-term conservation. They also wanted to be sure that agencies would focus on facilities using the highest amounts of water and prioritize projects accordingly. For example, in some facilities, such as remote fire watch stations, it would be impractical to expend a significant level of effort.

---

<sup>9</sup> General Services Administration, *Water Management: A Comprehensive Approach for Facility Managers*, 1994; New Mexico Office of the State Engineer, *A Water Conservation Guide for Commercial, Institutional and Industrial Users*, 1999; American Water Works Association, *Manual of Water Supply Practices*, "Water Audits and Leak Detection," AWWA M36, 1990; *Military Handbook 1165 Water Conservation*, Mil-HDBK-1165, 1996.

<sup>10</sup> A Federal efficiency project must meet the cost-effectiveness standard established in EPAct, using the methodology in 10 CFR 436.

## Results

When the type of goal was agreed to, the WWG then set the baseline for the next fiscal year (FY) report, which was to be the one for FY 2000.<sup>11</sup> The scope was narrowed down to include just potable water usage. The intention was to reduce usage of expensive, treated water and to encourage appropriate use of reclaimed or raw water sources. The baseline thus included water pumped from wells and treated to drinking water standards. It did not include water used for animal watering, fire suppression, or electricity generation, or water provided by the Bureau of Reclamation to other water utilities.

A decision was also made to use this process to help FEMP gain better information on water usage in the Federal sector. Since the goal would not be to reduce usage from this baseline, agencies could estimate usage where no better data were available. New information would need to be reported every two years. As data collection systems improved, the number could increase. The baseline would be reported in million gallons per year (MGY) with no denominator, such as per square foot or per employee. Agencies could establish their own denominator based on their mission. They would also have to explain increases and attribute them to better data collection or increases in production. For example, the Treasury could show increasing total water use, but improvement in production efficiency using gallons of water used per dollar produced.

The goal requires agencies to develop a comprehensive water management plan and to incorporate this planning into existing planning processes. The plans must be finished by January 2005. Agencies must complete at least four of the 10 BMPs at 80% of their facilities by 2010. No credit is given unless the BMP has been implemented. Options must have been reviewed within the last two years. For example, if a facility completed toilet retrofits in the last five years, staff must review the measure to see if there is a current cost-effective option, such as more efficient toilets. If there are no new efficiency opportunities, they can receive credit for the retrofit. If there were a newer, cost-effective project opportunity, they would need to implement it before receiving credit. The implementation schedule, which applies to every agency, is to have at least four BMPs in place in –

- 5% of facilities by 2002
- 15% of facilities by 2004
- 30% of facilities by 2006
- 50% of facilities by 2008
- 80% of facilities by 2010.

## First Data Report

In December 2000, Federal agencies were required to submit the first set of their water-use baseline data. Although the results are preliminary, they do show a significant increase above the estimated data from FEMP's 1997 study. The preliminary report shows 256,500 MGY of water being used by Federal agencies in FY 2000.<sup>12</sup> This equals more than 700 million gallons per day (MGD), or 57% more than the estimated figure. Data show that

---

<sup>11</sup> E.O. 13123 requires agencies to report on their progress toward the goals at the end of every fiscal year. The information is compiled by FEMP in a report to Congress titled, *Annual Report to Congress on Federal Government Energy Management and Conservation Programs, Fiscal Year XXXX*.

<sup>12</sup> FY 2000 extended from October 1, 1999, through September 30, 2000.

\$432,100,000<sup>13</sup> was spent on water use during the period. Table 1 compares the data estimates per agency in the 1997 report with data collected for those agencies in the first report for FY 2000.

**Table 1. Estimated vs. Actual Water Consumption, by Agency<sup>14</sup>**  
(Preliminary Data)

<b>Agency</b>	<b>Estimated MGY</b>	<b>Actual MGY</b>
Central Intelligence Agency	82.1	135.7
Department of Agriculture	1,366.9	1,579.4
Department of Commerce	229.6	627.9
Department of Defense	76,273.3	207,371.4
Department of Energy	2,766.3	5,483.8
Department of Interior	1,995.8	1,850.8
Department of Justice	1,781.2	9,098.7
Department of Labor	467.2	
Department of State	16.1	
Department of the Treasury	259.2	344.2
Department of Transportation	771.2	1,713.0
Department of Veterans Affairs	15,444.6	9,390.0
Environmental Protection Agency	46.7	161.5
Federal Communications Commission	1.1	0.8
Federal Emergency Management Administration	16.4	41.0
Federal Trade Commission		3.3
General Services Administration	2,195.8	4,000.0
Health & Human Services	1,802.4	1,327.6
National Aeronautics and Space Administration	1,138.4	2,215.0
National Archives and Records Administration	52.9	143.0
Nuclear Regulatory Commission		23.0
Postal Service	2,833.9	10,446.0
Railroad Retirement Board	11.7	0.9
Social Security Administration	48.2	151.8
Tennessee Valley Authority	19.0	377.7
Other	576.0	
<b>Total</b>	<b>109,620.1</b>	<b>256,108.8</b>

Agencies were also required to report on project activity during the year. A brief list shows the wide variety of projects being completed at Federal sites. Agencies' conservation efforts in FY 2000 included installation or implementation of the following:

- Recycled effluent water
- Computer control systems programmed to operate wells and pumps
- Low-flow faucets

<sup>13</sup> Because of differences in reporting methods, some agencies reported water and sewer costs while others reported only water costs in this number.

<sup>14</sup> U.S. Department of Energy, *Annual Report to Congress on Federal Government Energy Management and Conservation Programs, Fiscal Year 2000*. The report is scheduled to be issued in or around May 2002.

- Ultra-low-consumption toilets with electric flush sensors
- Electric sensor-controlled lavatories
- Chilled water consumption monitoring
- Leak detection on distribution systems
- Reviews of water management operation procedures
- Minimization of the amount of water used to water lawns and landscapes
- Replacement of worn booster pumps with newer variable-speed systems.

In 2002, FEMP will receive the first report on progress toward the BMP implementation goal as well as a new set of data on Federal water usage.

### **Conclusions: Lessons Learned**

When this process started, the prevailing wisdom from the WWG and others involved was that developing a water-conservation goal and establishing a baseline would be extremely difficult. The WWG had been discussing the idea of a goal and a baseline for several years without reaching a consensus. Every agency had concerns and wanted to protect staff in the field from burdensome increases in reporting and unfunded mandates. Nevertheless, when the WWG and NREL submitted final recommendations to FEMP, not only was FEMP satisfied, but the recommendations were more stringent than expected. This successful effort provides at least five good lessons for other institutions undertaking a similar process:

1. *Make sure the process is open.* An open invitation to interested parties gives everyone involved a high level of confidence that the outcome will be fair. An open process also allows a greater influx of new ideas and opinions. This type of creativity helps in resolving complex issues.
2. *Use a knowledgeable outside facilitator.* A good facilitator ensures that the process remains open and gives everyone a chance to participate equally. The facilitator can also assist in establishing specific objectives for meetings and help to make sure they are accomplished before the meeting adjourns. A facilitator who is knowledgeable about water conservation can help participants sort out and prioritize issues, as well as bring up issues the group may have overlooked.
3. *Use appropriate technology.* In this case, the forum Web site allowed all participants to review the work in progress, even those unable to attend meetings. Participants could see and discuss each other's comments. This allowed actual meeting time to be more productive, and many issues were resolved via the forum. The Web site also reduced the need for travel, saving everyone considerable time and money.
4. *Understand the barriers to your objective.* A portion of the process devoted to identifying barriers will help to ensure that important issues are raised and fully discussed. This must be done carefully, so that it does not degrade into negativity and complaining. The facilitator needs to keep participants focused on developing solutions. When the process does not suggest ways to overcome some of the barriers, those issues should be set aside to allow participants to concentrate on barriers that *can* be overcome.

5. *Set high expectations.* One of the main reasons for the success of this effort was FEMP's willingness to expect great things from the process and the people involved. People rise to what is expected of them, and setting the bar high produces better results. Also, only positive intentions were assumed on the part of the participants, from the very start. This allowed the group to focus on solving problems, not creating additional barriers or defending their positions.

In the coming years, FEMP hopes to see new life and creativity brought to the water conservation and efficiency efforts of Federal facilities. Initial results look very promising.

### **Acknowledgements**

The authors would like to thank Trina Brown, Mary Colvin, Margo Melendez, and Paula Pitchford for their invaluable assistance in completing this paper.

### **References**

Lombardo Associates, *Federal Facilities Water Use and Water/Energy Conservation Potential*, National Renewable Energy Laboratory, September 1997.

Parker, G.B., et al., *Market Assessment for Capturing Water Conservation Opportunities in the Federal Sector*, Pacific Northwest National Laboratory, August 1997.

Kelly, Matt, and Peter Ford, *Water Conservation Opportunities*, presentation given at Federal Utility Partnership Working Group meeting, March 7, 2001.

Energy Policy Act of 1992, PL 102-486, Oct. 24, 1992, Subtitle F, section 152(b).

California Urban Water Conservation Council, "Memorandum of Understanding Regarding Urban Water Conservation in California," 1991.

General Services Administration, *Water Management: A Comprehensive Approach for Facility Managers*, 1994.

New Mexico Office of the State Engineer, *A Water Conservation Guide for Commercial, Institutional and Industrial Users*, 1999.

American Water Works Association, *Manual of Water Supply Practices*, "Water Audits and Leak Detection," AWWA M36, 1990.

*Military Handbook 1165 Water Conservation*, Mil-HDBK-1165, 1996.

U.S. Department of Energy, *Annual Report to Congress on Federal Government Energy Management and Conservation Programs, Fiscal Year 2000*. Forthcoming; scheduled for publication in or around May 2002.

# REPORT DOCUMENTATION PAGE

Form Approved  
OMB NO. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE December 2001	3. REPORT TYPE AND DATES COVERED Conference Paper	
4. TITLE AND SUBTITLE Implementing Water Conservation Goals at Federal Facilities—Lessons Learned			5. FUNDING NUMBERS FE01.3015	
6. AUTHOR(S) S. Tanner, National Renewable Energy Laboratory; D, Braver, Consultant				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) National Renewable Energy Laboratory 1617 Cole Blvd. Golden, CO 80401-3393			8. PERFORMING ORGANIZATION REPORT NUMBER NREL/CP-710-31303	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION/AVAILABILITY STATEMENT National Technical Information Service U.S. Department of Commerce 5285 Port Royal Road Springfield, VA 22161			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) Executive Order 13123 (June 1999) directed Federal agencies to improve water-use efficiency at government-owned facilities. The order required agencies to determine their water consumption and establish a goal for reducing it. Under the leadership of the Department of Energy's Federal Energy Management Program (FEMP) and National Renewal Energy Laboratory (NREL), representatives from several agencies established a working group to recommend guidelines and methods for improving water efficiency. Some agencies were already implementing effective conservation measures. However, many agencies lacked ways to determine how much water they were using or what it cost. In 1999, FEMP established methods agencies can use to identify baseline water usage and set reasonable water efficiency improvement goals. As a result, 10 Best Management Practices (BMPs), similar to those established by the California Urban Water Conservation Council, were developed for Federal water efficiency. The Federal BMPs focus on office water use, landscaping, heating and cooling, leak detection, and education. They emphasize flexibility, cost-effectiveness, and creativity. This paper describes these methods for determining baseline usage, selecting appropriate BMPs for a facility, and meeting efficiency goals. It also includes lessons learned throughout the process.				
14. SUBJECT TERMS Water conservation; FEMP, best practices; Federal water use			15. NUMBER OF PAGES	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL	