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IN THIS ISSUE

- Explaining the Discrepancy Between Guaranteed Savings in ESPC Projects and Utility Bills – p. 4
- Super ESPC Provides Combined Heat and Power, PV, and Energy Savings to FDA Office/Lab Complex – p. 6
- VA Medical Center Uses Super ESPC for Solar Mercury Turbine Beta Test – p. 8
- U.S. Coast Guard Air Station Cape Cod Demonstrates Successful Fuel Cell – p. 10
- FEMP Analyzes Federal Energy Savings through Utilities Service Programs – p. 12
- DOE HQ Increases Renewable Purchase to 100 Percent – p. 15
- Marine Corps Base Camp Pendleton Shares the Keys to their Successful Energy Program – p. 18
- FEMP Conducts E-Learning Energy Training Pilot – p. 20

...and more!

Use of Quantitative Uncertainty Analysis to Support M&V Decisions in Super ESPCs

Introduction

Super Energy Savings Performance Contracts (ESPCs) are a flexible tool to make energy efficiency improvements in federal facilities. While they specify general terms and conditions for the contract between the agency and the energy services company (ESCO), the contract leaves broad latitude to customize specifics such as measurement and verification (M&V) requirements.

M&V is a critical element of an ESPC—without it, there is no way to confirm that the projected savings are in fact being realized. Every FEMP Super ESPC is required to have an M&V plan, which describes how the savings will be verified for each energy conservation measure (ECM), and includes details on the parameters that will be measured, how they will be measured, etc. For any given ECM, there are usually several M&V choices, which will vary in terms of measurement uncertainty, cost, and technical feasibility. At one end of the spectrum, the M&V plan may simply state that most of the parameters that affect a savings estimate be stipulated for the length of the contract, with as little as only one parameter of the savings estimate being measured. At the other end of the spectrum, M&V may involve detailed long-term measurements of most parameters. Typically there is a tradeoff between measurement uncertainty and cost, e.g., a savings calculation method that requires spot measurements will typically cost less than one that requires continuous long-term measurements, but will result in greater uncertainty in the expected savings.

FEMP has developed several tools to aid the M&V decision-making process for Super ESPCs. These include the *M&V Guidelines: Measurement and Verification for Federal Energy Management Projects* (available online at http//www.eere.energy.gov/femp/financing/Super ESPCs_measguide.cfm), which are based on the International Measurement and Verification Protocol (available online at *www.ipmvp.org),* the Risk/Responsibility Matrix, and the M&V decision support flow chart. These tools mostly provide qualitative guidance and advocate the use of Quantitative Uncertainty Analysis (QUA) to augment the qualitative guidance. ASHRAE *Guideline 14: Measurement of Energy and Demand Savings*, *Annex B* provides some information on how to conduct uncertainty analysis for energy savings. As noted in the standard, "[a] proper uncertainty analysis can be very complex

continued on page 2

and cumbersome especially if the potential user strives to be very meticulous." In practice, QUA is seen as too complicated and cumbersome, and its use in Super ESPCs has been minimal.

FEMP initiated a pilot project to explore the use of Monte-Carlo simulation to assess savings uncertainty and thereby augment the M&V decision-making process. Monte-Carlo simulation is a flexible QUA technique that has been widely used for risk analysis in various domains. The intent is to use QUA selectively in combination with heuristic knowledge, in order to obtain quantitative estimates of the savings uncertainty without the burden of a comprehensive "bottoms-up" QUA.

Monte-Carlo simulation

Although a full description of Monte-Carlo simulation is beyond the scope of this article, a brief description is provided. Consider a lighting retrofit project in which the lighting energy savings is calculated from the following inputs: total wattage before retrofit (kWpre), total wattage after retrofit (kWpost), and operation hours (hrs). Each of these first-order inputs is in turn determined from second-order inputs. For example, total kWpre is determined from the number and wattage of each fixture type. Typically, point estimates of the inputs are used to calculate the savings. In reality, however, there is uncertainty associated with each input.

In Monte-Carlo simulation, the user applies probability distributions to one or more inputs, reflecting the uncertainty of that input (see figure on page 3). For example, the probability distribution of kWpre indicates that the estimate of 1,800 kilowatts varies from 1,710 kilowatts to 1,890 kilowatts, with a triangular distribution. Probability can similarly be applied to other input parameters. The user then runs the simulation, which yields the probability distribution of energy savings, which in essence describes the savings uncertainty.

QUA with Monte-Carlo simulation can be as simple or complex as the user wants it to be. For example a "bottoms-up" approach would involve applying probability distributions to all first and second order inputs in order to capture the full range of the uncertainty (e.g. wattages, fixture counts, operating hours, measurement precision, etc.). At the other end of the spectrum, probability distributions may be applied to just a few first order inputs in order to capture the uncertainty resulting from those few inputs (e.g., inputs that the ESCO controls and is responsible for). Another aspect is the source of the input probability distributions. These could be derived from empirical data, standard statistical formulae, or may be simply based on engineering expertise. Thus, the analysis is flexible in two ways—with regard to which inputs probability distributions are applied to, and with regard to the source for the probability distributions.

For this project, the Monte-Carlo analysis was done using Crystal Ball™, which is available as an "add-in" for Excel™. Since many savings calculations are done in Excel™, it is relatively easy to do the Monte-Carlo simulation – it essentially involves adding probability distributions to the input cells (e.g., kWpre) and defining the output cell (e.g., $ savings) for which the uncertainty information is desired.

Case study

While the theoretical basis for QUA is well established and widely used in other domains, the primary objective of this pilot project was to assess the practical implications of applying QUA to Super ESPCs. The QUA project team sought Super ESPC projects that: a) were in the initial stages and in which M&V decisions were not yet made; b) had multiple energy-saving measures involving several M&V choices; and

continued on page 3

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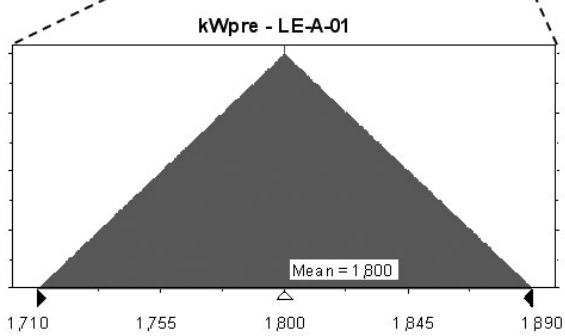
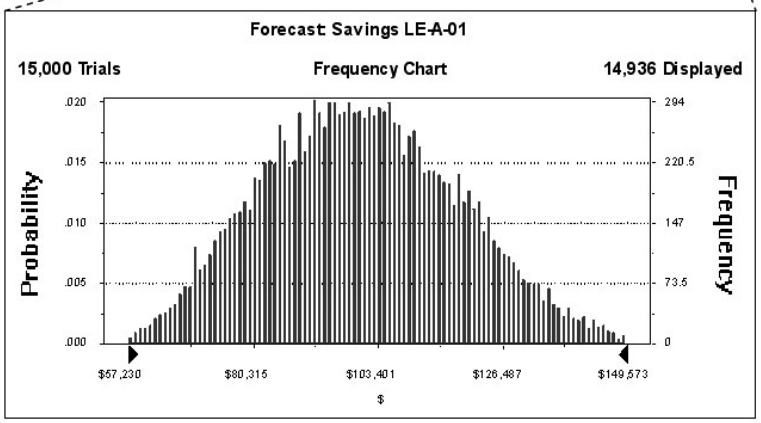
	kWpre	kWpost	Hrs	kWh sav	therm sav	$ sav
Expected value	1800	1235	3000	1,695,000	(2,119)	$ 100,853



input assumption



output forecast

Conceptual illustration of Monte-Carlo simulation for a hypothetical lighting retrofit project, using Crystal Ball.™

c) had a project facilitator, agency and ESCO who were willing to apply QUA to their Super ESPC.

This approach was used to analyze the savings uncertainty in a Super ESPC at a major federal agency, which included lighting, HVAC, and some cost-avoidance ECMs. QUA was done for each of these ECMs, as well as for the project as a whole. For the individual ECMs, the analysis was done at varying levels of granularity, depending on the size of the ECM. For larger ECMs probability distributions were applied to more inputs. Some examples of the findings from QUA include the following:

- A more measurement-intensive M&V plan for the lighting ECM would have reduced uncertainty by only $6000, which would not cover the increased M&V costs.
- Uncertainty analysis on a steam trap replacement ECM suggested that the ESCO may have been more conservative than necessary in discounting the savings estimate and may be "leaving money on the table."
- While conducting the uncertainty analysis for a cost avoidance ECM, it was discovered that a contractual anomaly could potentially reduce cost-avoidance savings significantly and almost double the portfolio savings risk.

Thus, in some cases the QUA simply confirms intuitive or qualitative information, while in other cases, it provides insight that suggests revisiting the M&V plan.

Besides analysis of the uncertainty for individual ECMs, QUA is also useful for assessing the impact of the portfolio effect in reducing overall savings uncertainty. Many agencies are primarily interested in the savings uncertainty for the whole portfolio of measures, rather than the individual measures. In this particular ECM, the simple arithmetic sum of the savings risk for each of the individual measures results in a total of about $60,000. However, this is a misleading metric, because it does not take into account the risk diversification among measures i.e., a shortfall in one measure may be compensated for by greater than expected savings in another measure (assuming the savings are not correlated). QUA can be used to model the effect of risk diversification, and in this particular ESPC, the analysis showed that the risk was actually only about $23,000.

By providing quantitative uncertainty information, QUA can effectively augment the M&V decision-making process as well as the overall ESPC financial analysis.

Conclusion

QUA can be seamlessly integrated into the current FEMP Super ESPC development process, and the incremental effort is relatively small with user-friendly tools that are commercially available. The input data requirements for QUA are flexible and can be based on empirical or theoretical data, as well as engineering judgment. Furthermore, uncertainty information

continued on page 5

Cost Avoidance vs. Utility Bill Accounting - Explaining the Discrepancy Between Guaranteed Savings in ESPC Projects and Utility Bills

Background

Federal agencies often ask if Energy Savings Performance Contracts (ESPCs) result in the energy and cost savings projected during the project development phase. After investing in ESPCs, federal agencies expect a reduction in the total energy use and energy cost at the agency level. Such questions about the program are common when implementing an ESPC project. But is this a fair or accurate perception? More importantly, should the federal agencies evaluate the success or failure of ESPCs by comparing the utility costs before and after project implementation?

In fact, ESPC contracts employ measurement and verification (M&V) protocols to measure and ensure kilowatt-hour or Btu savings at the project level. In most cases, the translation to energy cost savings is not based on actual utility rate structure, but a "contracted utility rate" that takes the existing utility rate at the time the contract is signed and escalates it by a fixed percentage for the duration of the contract. Reporting mechanisms, which advertise these savings in dollars, may imply an impact to budgets at a much higher level depending on actual utility rate structure.

FEMP has prepared the following analysis to explain why the utility bill reduction may not materialize, demonstrate its larger implication on agency's energy reduction goals, and advocate setting the right expectations at the outset to preempt the often asked question – why I am not seeing the savings in my utility bill?

Lessons Learned From the Case Study Approach

Most of the effort to date on evaluating the discrepancy between the energy savings as guaranteed by the ESPC project and utility bill has focused on the individual case study approach. This approach has been helpful in understanding and documenting the discrepancy between ESPC payments and utility bill savings, as demonstrated by various "savings verification" studies performed by FEMP for ESPC projects at Ellis Island and Fort Polk and for a UESC project at Fort Detrick. Findings from the three case studies converge on the following factors contributing to these discrepancies:

1. The M&V approaches employed in ESPCs tend to isolate the energy efficiency measure before performing the measurements, savings analysis, and calculations. Further, in many cases energy savings attributed to the ESPC project is such a small fraction (less than 10 percent) of the utility bill, that a meaningful savings validation study becomes difficult and costly.
2. In many cases a master meter serves the ESPC site, and there is no capability to sub-meter individual buildings where energy efficiency measures were implemented. Moreover, the energy consumption reporting procedure makes matching ESPC guaranteed savings with utility bills a challenging exercise; only a few people may have the knowledge that would help match the project with the meter report containing corresponding utility bill information.
3. Differences in utility rate structures were also cited as one of the main reasons for the discrepancy, since the utility rate in the contract is rarely the same as the actual rate paid by the agency. If the actual utility rate increase is higher than the "contracted utility rate" used to calculate projected energy savings, a negative perception may form because the total utility cost increases, whereas the dollar savings attributable to the ESPCs may be higher than the guaranteed amount.
4. Weather conditions may be different from those assumed by ESCOs to project the energy savings.
5. Mission changes may result in operating hour or personnel fluctuations at the facility.
6. Changes in the area of the facility being served by the ESPC may also come into play.

The case study approach is valuable in addressing site-specific concerns and identifying major factors that may cause discrepancy, particularly when the same contributing factors are found at a number of sites. Another major contribution of this approach has been the "Utility Bill Comparison With and Without ESPC Project," which stresses the value of ESPC projects and helps preclude inquiries by creating an adjusted baseline that is compared against the actual utility bills during the performance period of the ESPC project.

Lessons Learned from the Agency Level Approach

While the case study approach is helpful, site-specific findings (which do not fully explain the discrepancy at the agency or department level to program oversight bodies) are difficult to generalize and apply at the agency level. In order to address concerns regarding the ability of ESPCs to help reduce energy intensity (in Btu/square foot) and energy cost at the agency level, a different approach was taken.

continued on page 5

This broader analysis focused on matching the utility bills with ESPC savings information by tracking the actual utility bill during both the baseline and initial performance period of two years. An analysis of utility bills for all sites implementing ESPC projects was compared with the results of sites where no energy efficiency projects have been implemented during the same time period. The analysis plotted the annual ESPC guaranteed savings as a percentage of the utility bill for the year the contract was signed (unadjusted) against the ratio of the current energy cost to the baseline energy cost for each performance year. A linear regression model was developed from the ESPC project data to show a correlation between annual ESPC guaranteed savings as a percentage of the utility bill and the percent reduction in energy cost achieved. In parallel, energy use and cost data from sites where no energy efficiency projects had been implemented was also plotted for different years to figure out the "baseline creep" that takes place with the passage of time. The "linear regression fit" of the data showed an increase in energy use above the "frozen baseline" from before the ESPC projects would have been implemented.

Key findings of the macro-level analysis are that load creep and utility cost increases are occurring every year at both ESPC sites and at sites where no significant energy efficiency projects have been implemented. Most sites have experienced utility cost increases of about 10 percent per year that cannot be explained by poor ESPC performance, and load creep accounts for 25 percent of energy cost increases. These factors are largely responsible for the discrepancy between the guaranteed energy savings in ESPCs and actual utility bills. Baseline adjustments should be made that account for load creep and increased utility costs when calculating savings from ESPC projects.

Conclusions

The recent FEMP study, "Evaluation of Super ESPCs Performance Reports," states "It is important to note that in general, these performance reports are not expected to compare the Super ESPC project's savings to the site's overall current energy use[1]. Tracking and reporting a site's actual utility rates and overall energy use is not included in most ESPC projects. ESPC performance reports are not intended to address the question "If I'm saving energy, why don't I see it in my utility bills?" Although this is a commonly asked question, the information required to answer this question is usually not available to the ESCO and is generally outside the scope of an ESPC project. Often, a site energy manager or a consultant is required to address this issue by providing a more comprehensive look at a site's overall use of energy."

[1] Of the twelve projects reviewed, only one was contracted to provide utility bill analysis.

While ESPC projects should always save dollars for federal facilities, reduction in the utility bill (both energy use and dollars) may not be apparent for several reasons. Based on the experience and findings of this analysis, it is prudent not to associate the term "utility bill reduction" with ESPC projects, and instead use the term "cost avoidance" when discussing the benefits of implementing ESPC projects.

For more information, please contact Satish Kumar, LBNL, 202-646-7953 or SKumar@lbl.gov or Dale Sartor, LBNL, 510-486-5988 or DASartor@lbl.gov.

USE OF QUANTITATIVE UNCERTAINTY ANALYSIS TO SUPPORT M&V DECISIONS IN SUPER ESPCS
(continued from page 3)

does not have to be applied to all input parameters, which would be a daunting task. Rather, engineering judgment can be used to determine which parameters are most appropriate to apply uncertainty information to, taking into account factors such as relative impact on savings.

A case study on an ESPC at a large federal agency showed that in some cases the QUA simply confirms intuitive or qualitative information, while in other cases, it provides insight that suggests revisiting the M&V plan. Furthermore, the case study showed that M&V requirements should be informed by the portfolio risk diversification.

Additional case studies are required to better understand and document the optimal mix of QUA and heuristic knowledge in ESPC decision-making. The purpose of QUA is not to deterministically derive M&V requirements. Ultimately, such requirements are a business decision, based on risk analysis and a variety of other factors. QUA simply deepens the information base from which to make those business decisions. The data from QUA can also improve the financial analysis of the ESPC, in that it provides uncertainty data instead of just point estimates. Indeed, uncertainty analysis is critical to bridging the gap between technical and financial analysis in ESPCs.

For more information, please contact Satish Kumar, LBNL, 202-646-7953 or SKumar@lbl.gov or Paul Mathew, LBNL, 202-646-7952 or pamathew@lbl.gov.

Super ESPC Provides Combined Heat and Power, PV, and Energy Savings to FDA Office/Lab Complex

With the Congressional reauthorization of energy savings performance contracting (ESPC), one of the prime tools for saving energy in the federal government, the second phase of an award winning project at the Food and Drug Administration's (FDA) White Oak campus resumed in May 2005. A collaborative process, this project uses the DOE FEMP's Super ESPC for a facility built by the General Services Administration (GSA) and used by the FDA. Using the avoided costs already generated by the Super ESPC, GSA is now able to install state-of-the-art combined heat and power (CHP) and energy efficient components in the build-out of FDA's $900 million office and laboratory complex in White Oak, Maryland.

FDA's Federal Research Center at White Oak is a three million-square-foot facility comprising 14 interconnected buildings. Sempra Energy Services provides the energy-related infrastructure, and is constructing a Central Utilities Plant (CUP) that will provide heating, cooling, and electricity for the campus. Photovoltaic (PV)-generated electricity will also satisfy some of the FDA's needs.

The centerpiece of this project is the dual fuel (natural gas and diesel) co-generation plant. This plant will provide all of the electricity needs of the campus while using waste heat, recovered from engine cooling water and oil and from the exhaust gas stack, to provide hot water for heating and to power absorption water chillers for cooling the laboratories and office buildings. Dollar savings are derived by comparing the cost of buying electricity from the grid versus on-site generation and the avoided cost of using waste heat from generators that would otherwise be produced using additional fuel. The cogeneration plant distributes 13,800 volt, three-phase electricity, 39°F chilled water, and 200°F heating hot water.

The CHP project is a good example of the added reliability and security that can be provided by on-site generation. Security is a common theme in today's environment, but it is especially important to the ongoing laboratory studies being conducted by the FDA. Instead of relying on emergency generators, this site uses the grid as its back-up in the unlikely event that the cogeneration plant were to fail or if there were an interruption of both natural gas and diesel used in these dual-fuel generators.

This project also derives considerable savings from upgraded lighting, glazing, air handling units, variable frequency drives, controls (e.g., night setbacks), economizers, and operations and maintenance savings. Phase one of this project included savings-supported capital investment of about $28 million, while phase two supports about $18 million of capital investment. Over the life of this project, the government stands to save more than $119 million.

For more information, please contact Tom Hattery, FEMP, 215-370-1362 or thomas.hattery@ee.doe.gov.

U.S. Postal Service Accrues Ongoing Benefits through Innovative Project Financing

The U.S. Postal Service has had a long-standing alternative financing mechanism for energy efficiency services known as Shared Energy Savings (SES). Over the years, both utility- and competitively-provided services have been successfully procured under SES by the Postal Service. Motivated by changes that have occurred in the electricity industry since the late 1990s, the Postal Service has been engaged in process to revise the SES contract to reflect the new realities of the marketplace. FEMP-sponsored staff at Lawrence Berkeley National Laboratory (LBNL) have been actively working with the Postal Service to leverage the benefits of federal expertise in this area.

Based on this collaboration, the Postal Service issued a competitive solicitation in 2001 for regional, alternatively-financed energy efficiency services throughout California. As a result of this solicitation, Honeywell International and Viron Energy Services, subsequently purchased by Chevron Energy Solutions, were awarded SES contracts. Honeywell received the contract for services to the Postal Service in Southern California, while Chevron received the contract for Northern California.

With continuing assistance from LBNL/FEMP, particularly with respect to technical review of proposed measures, the Postal Service, under the leadership of Ray Levinson, Pacific Area Manager, Environmental Compliance and Deborah Wilcox-Loos, Category Lead of the Windsor Utilities Category Management Team, has awarded or completed nearly $60 million in retrofit activities. These projects include some of the

continued on page 7

The U.S. Postal Service used a Shared Energy Savings contract with Chevron Energy Solutions to upgrade lighting at the San Francisco Processing & Distribution Center. 250-watt high pressure sodium lamps (left) were replaced with 238-watt, high-output T8 lamps (right).

largest federally owned on-site renewable and combined heat and power systems in the country.

For example, major energy efficiency retrofits and the installation of a hybrid renewable power plant began recently at two Postal Service facilities in San Francisco. A project at the San Francisco Processing & Distribution Center, managed by Chevron Energy Solutions, will include a 250-kilowatt fuel cell and two solar photovoltaic technologies, thin-film roof-integrated panels and a tracking parking shade structure, totaling 309 kilowatts. Together, the efficiency upgrades and on-site generation are expected to lower total annual electricity purchases by about 10 million kilowatt-hours—a 46 percent reduction—saving $1.2 million in energy costs annually. The $15 million project cost will be funded by energy savings, contributions from the Postal Service's CFC/HCFC refrigerant replacement program, and more than $2.6 million in grants and incentives from the U.S. Department of Defense and the State of California.

In Southern California, Honeywell is replacing chillers and air-handling units at three Postal facilities, upgrading lighting fixtures at more than 100 others, and building a gas cogeneration system at the San Diego Processing and Distribution Center, among other projects. The cogeneration system will produce 1.5 megawatts of electricity, roughly 85 percent of the facility's forecasted electricity demand. Exhaust heat from the system will be used as the input thermal energy for a 300-ton absorption chiller, which, in turn, will provide cooled water to the facility's HVAC system. The new absorption chiller will replace the existing natural gas-fired chiller at the facility and eliminate the need to purchase about 165,000 therms of natural gas annually. Honeywell, LBNL, and the Postal Service worked together to develop a strategy to mitigate the natural gas price risk associated with this project.

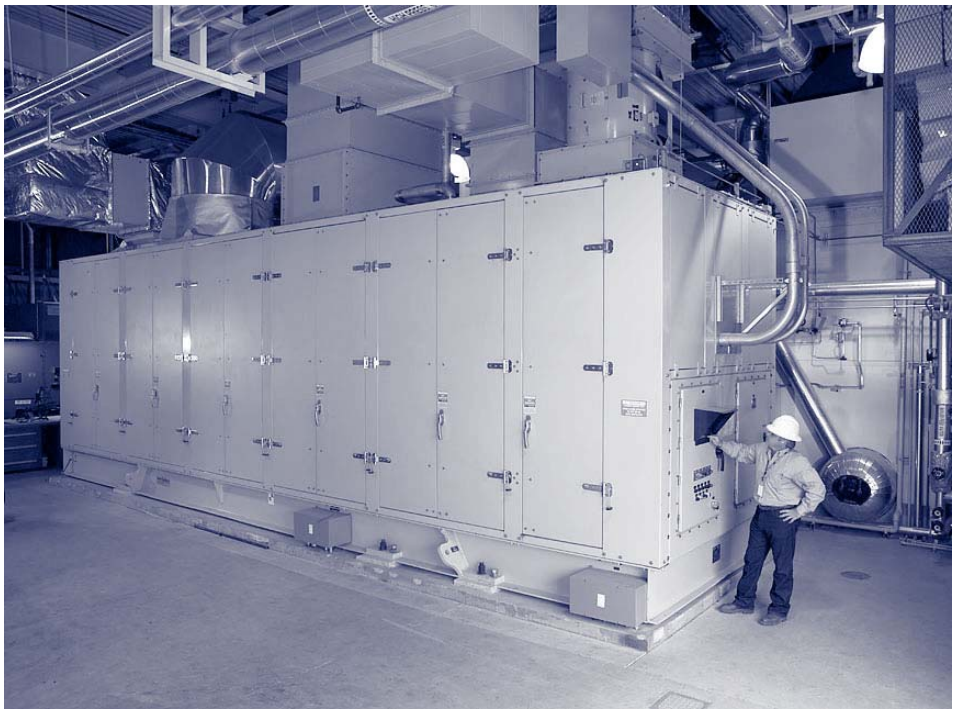
The blend of energy efficiency, renewable energy, and distributed generation projects undertaken during the past three years demonstrates the versatility of the SES contract, the technical and managerial expertise of the contractors, the benefits of FEMP services and the commitment to energy savings and environmental improvement by the Postal Service.

It is estimated that the two California contracts will generate at least $30 million in additional retrofit activity. Given this success, the Postal Service is now developing regional SES contracts—based, in part, on the California model—for regions throughout the country.

For more information, please contact Bill Golove, Lawrence Berkeley National Laboratory, 510-486-5229 or whgolove@lbl.gov .

San Diego VA Medical Center Uses Super ESPC for Solar Mercury Turbine Beta Test

The Department of Veterans Affairs (VA) San Diego Medical Center, one of the leading VA Medical Centers in terms of funded research, is close to completing several projects that will save $1.7 million per year in total energy and operating costs, reduce air pollution, and provide much needed infrastructure improvements. The projects were accomplished using a DOE FEMP Super ESPC contract with Sempra Energy Services. The contract enabled the funding and construction of three energy conservation measures: cogeneration replacement and upgrade, which includes a compressed air system upgrade; chiller replacements and cooling tower addition; and HVAC improvements. Sempra designed and implemented the measures, and will guarantee the energy cost savings during the 10-year term of the Super ESPC delivery order.



A Super ESPC with Sempra Energy Services enabled the installation of this 4.4 megawatt Solar Mercury 50 Turbine at the San Diego Veterans Affairs San Diego Medical Center

For the cogeneration replacement, the VA decided to install a natural gas fired 4.4 megawatt Solar Mercury 50 Turbine beta test unit. This innovative turbine was developed recently by Solar Turbines Incorporated as part of a collaboration with DOE's Office of Distributed Energy/DOE Advanced Turbine Systems Program and several other partners. Their goal was to develop a 21st century turbine that is cleaner, more efficient, and less expensive to operate.

The Solar Mercury 50 utilizes an ultra lean premix combustion system resulting in very low NO_x emissions, capable of meeting stringent San Diego air quality district emission requirements for NO_x without the use of selective catalytic reduction systems. The recuperator uses a portion of the waste heat in the turbine exhaust to preheat the air supplied to the turbine, resulting in increased electrical generating efficiency and decreased steam production compared to a conventional non-recuperated turbine. The electrical and steam generating capacity of the Mercury 50 are a good match with the electrical and steam demands of the hospital. After about one year of operation, a commercial production unit will replace the beta test unit. If for any reason the Solar Mercury Turbine does not meet the performance, availability, and emission requirements in the contract, Sempra will replace the turbine with conventional natural gas-fired reciprocating engines that will meet contracted requirements.

The Mercury 50 turbine was incorporated via a modification to the original delivery order to replace two conventional reciprocating engine generators originally proposed; the new turbine is less expensive, produces more power, shortens the construction schedule to avoid stand-by charges, and allows for more equipment to be installed. The replacement has also resulted in significant NO_x emissions reductions. The NO_x Emission Reduction Credits (ERCs) are being sold to Sempra as part of the ESPC project financing.

The turbine has been operational since January 2005, and will avoid utility stand-by charges for the next 7 years. DOE, VA, and Sempra anticipate that the installation will be a showcase demonstrating the Solar Mercury 50 technology.

For more information, please contact Tom Olson, VA Facilities Manager, 858-552-7593 or tom.olson@med.va.gov or Tatiana Strajnic, FEMP, tatiana.strajnic@ee.doe.gov.

Alternative Financing Q&As

You've asked...

Q. What can an agency do to obtain the lowest interest rate for their Energy Savings Performance Contract (ESPC) project?

A. A variety of factors influence the interest rate for an ESPC project. Some factors are within the control of the agency, and other factors are not. Factors within the control of the agency include the mix of energy technologies, certain negotiated contract terms and conditions, contract term, and the degree of measurement and verification employed.

To help ensure that federal agencies get the best value for their project, recent modifications to DOE's Super ESPC contract are intended to help federal agencies obtain the lowest interest rate for their ESPC projects. The energy service companies (ESCOs) are now required to perform a competition in the commercial marketplace for the acquisition of the project's financing. To expedite this task, the new Investor Deal Summary document will facilitate the financier's review of the project and help to convey the real project risks rather than the perceived risks, thereby enabling the financier to provide the lowest possible interest rate.

Q. Can utility rebates be applied to ESPC projects? How do I process utility rebate payments?

A. Utility rebates may be applied to offset an ESPC project's cost. It is the responsibility of the ESCO to research the availability of any financial incentive or rebate offered by the local utility that serves the facility and/or the State in which the facility is located. The ESCO is also responsible for coordinating and partnering with the Agency Contracting Officer as to the preparation of the required documentation. The anticipated incentive or rebate can be utilized as a pre-performance period payment.

Federal government agencies may have difficulty accepting or processing a rebate check. The rebate may be paid directly from the utility to the ESCO as long as the rebate amount is disclosed and credited to the agency's ESPC project.

Q. Can carbon emission credits be applied to ESPC projects' energy cost savings?

A. If an agency determines that it can sell "excess" emission credits resulting from an ESPC project that reduced a facility's on-site emissions, the proceeds of that sale could be considered energy-related cost savings and could be used as a component of an ESPC project's total savings. A federal agency's sale of its emission credits is a new and uncharted area from a technical, financial, and legal perspective, and FEMP does not have authority to establish policy or pricing guidance in that area.

Q. What are ESCO "markups?" How do I negotiate the ESCO markup?

A. Markups pay for an ESCO's indirect costs, plus general & administration costs and profit. DOE's Super Energy Savings Performance Contract includes a maximum ceiling price for each ESCO's markups in contract Table B-1. The markup ceilings are specified for each energy conservation measure (ECM). Agencies may negotiate the markup percentage for each ECM. Additionally, DOE's Super ESPC contract includes Table B-2, which defines the maximum ceiling for an "Added Premium," or the sum of the basis points based on the ESCO's and financier's perception of project risk. The interest rate reflects the factors such as risk, credit rating, and project complexity.

Q. Is it legal for federal government agencies to make annual payments in advance versus monthly payments in arrears?

A. Although each federal agency is subject to its own regulations, the FEMP interpretation of FAR Part 32.402 allows annual payments in Advance of the Performance Period based on the benefit to the government through deferred finance charges associated with that performance year. Advance payment of this nature may be viewed as the government paying for something it has not received, when, in fact, the government has received equipment and installation of the equipment prior to the start of the payment stream. The government is provided the remedy of a shortfall in the guaranteed cost savings through the provisions of clause G.4 in the DOE Super ESPC contract based upon the annual Measurement and Verification Report.

U.S. Coast Guard Air Station Cape Cod Demonstrates Successful Fuel Cell

The U.S. Coast Guard began investigating the use of fuel cells in 1998 based on energy objectives implemented in 1997, directing them to realize a 20 percent reduction in facility energy costs from 1995 levels by 2005. The objectives further mandated Coast Guard facilities to "minimize the use of petroleum fuels in all its facilities and platforms … through investments in engineering." The Federal Energy Management Program, the Pacific Northwest National Laboratory (PNNL), and the U.S. Army Corps of Engineers' Construction Engineering Research Laboratory provided technical assistance in the form of project economics, analysis, and site selection.

FuelCell Energy Model DFC 300 natural gas fuel cell at Air Station Cape Cod

The U.S. Coast Guard Research & Development Center wanted to demonstrate that fuel cells are capable of providing power to operational units during power outages caused by adverse weather conditions such ice storms or blizzards. They chose to install a FuelCell Energy Model DFC 300 250-kilowatt natural gas fuel cell at Air Station Cape Cod, one of the largest U.S. Coast Guard air stations on the East Coast. In addition to electric power, the fuel cell provides heat for domestic hot water for the Bachelor's Quarters and an associated galley and, at full 250-kilowatt design output, has the potential to provide space heating for the entire building.

In its first 12 months of operation, the fuel cell averaged an operating availability of 96.2 percent above its first year's expected design availability, producing a total of 1,392 megawatt-hours of electricity. 1,250 megawatt-hours of total production powered the entire Air Station Cape Cod building loads, while the remaining142 megawatt-hours powered the internal fuel cell loads. Over the same year, approximately 1,832 million Btu of recovered heat was utilized for domestic hot water use, offsetting the purchase of nearly 26.3 million cubic feet of natural gas and resulting in a total net savings of almost $24,000 in operating expenses.

Demonstrating one of the main benefits of fuel cell technology, in 2003 the fuel cell at Air Station Cape Cod provided emergency power to the barracks and galley during a number of short grid outages, and in September 2003 was operated in a totally grid-independent mode as a precaution against a potential loss of commercial power during a hurricane. Although Cape Cod was not affected by the widespread blackout of the Northeast in August 2003, the fuel cell is poised to demonstrate its value in case of a major utility outage.

One important lesson learned from this demonstration is that site loads should be accurately determined prior to the design of a fuel cell project. Originally, the site expected to use the total fuel cell output, which provided cost savings by avoiding additional utility interconnection requirements. After installation, it was discovered that the fuel cell output exceeded site demand, resulting in part-load operation between 150 and 180 kilowatts. Had the loads been determined more accurately, additional buildings could have been connected to the fuel cell or provisions made to export power.

Because fuel cell economics are dependant on both electricity and gas prices, rising natural gas prices also had a negative impact on expected cost savings. If gas prices should continue to rise, it may become more economical to purchase electricity rather than generating it. Maintenance is another important factor to consider prior to procurement of a fuel cell, as restacking and preventative maintenance costs can be significant. While the first year's maintenance was included in the original procurement for this fuel cell, current negotiations will determine the long-term maintenance costs and ultimately the fuel cell's future.

continued on page 15

FEMP Investigates Cutting Energy Demand at GSA's Philadelphia Custom House

The General Service Administration's Custom House in center city Philadelphia is a stately art deco edifice that exemplifies the classic federal building. Seventeen floors and half a million square feet, the 1934 building is inhabited by several federal agencies ranging from the Food and Drug Administration to the National Park Service.

Though the Custom House has many energy system features typical of older office buildings – such as single-pane glass, constant volume air supply, and perimeter induction units for heating and cooling – GSA has consistently been attentive to its energy efficiency performance, both in the retrofits installed over the years and the tight operations regimen maintained by the building's staff. The Energy Star® designation the Custom House received in 1999 represented not only the first structure in Pennsylvania to achieve the award, but also the first historical building in the United States to meet that prestigious benchmark.

General Service Administration's Custom House, Philadelphia, Pennsylvania

Given this stellar energy performance, one might expect that the facility would have little opportunity for additional cost-effective utility savings. However, a 2004 investigation by FEMP into the facility's electric bills and rate structure revealed that the building was paying very large demand "ratchets" each year. A ratchet is a demand charge imposed by electric utilities that takes a facility's peak kilowatt draw during the year (often reached on a hot summer day), and imposes a charge based on this high-water mark during succeeding months. The rationale is to assess to the customer the full cost of having to build enough electric capacity to serve the facility, and then to spread that cost over the year (instead of applying it only to the one month in which the peak was reached).

The Custom House's utility, PECO Energy, bases its ratchet charges on a facility's June-September peak; if 80 percent of this peak is not reached during any of the subsequent eight months (October-May), this figure (80 percent multiplied by the summer peak kW) is set as the demand charge for that month. Since PECO charges more than $25 per peak kW for demand each month (roughly two to three times the national average for large facilities), the financial implications of the summer peak can be enormous. FEMP's analysis revealed that GSA pays on the order of $50,000 - $70,000 in ratchet charges each year for the Custom House.

With this in mind, GSA commissioned FEMP to conduct a study on the potential to cost-effectively reduce its peak demand. FEMP focused on two types of strategies. The first would suppress the building's energy demand throughout the summer months, and thus directly address the ratchet charges. The second was approaches that would allow the Custom House to participate in "demand response" programs offered by PECO or by the mid-Atlantic's regional transmission operator, PJM. Demand response programs permit large end-use customers like the Custom House to respond to either emergency system conditions on the grid, or high prices in the local electricity market, by shedding some of their electric load. The customer is then remunerated for its curtailed load by either a pre-determined floor price (e.g., $0.50/kWh for PJM's emergency demand response program) or one based on the market price of electricity during the reduction. Load shed can be accomplished through curtailment strategies such as adjusting HVAC system operations, letting space temperatures rise slightly, or shutting down lighting circuits. Alternatively, load can be reduced by turning on a distributed generation option, such as the 450-kW diesel generator the Custom House possesses.

continued on page 21

FEMP Analyzes Federal Energy Savings From Utility Service Programs

In the 1990s, federal agencies began using a powerful mechanism to obtain alternative financing for energy services from their local serving utility—utility energy service contracts (UESCs). In 1996 FEMP started tracking the federal use of UESCs, collecting specific information on projects across the country with support by members of FEMP's Federal Utility Partnership Working Group. To date, more than 1,000 projects have been implemented using the UESC mechanism, with a capital investment totaling more than $1.4 billion.

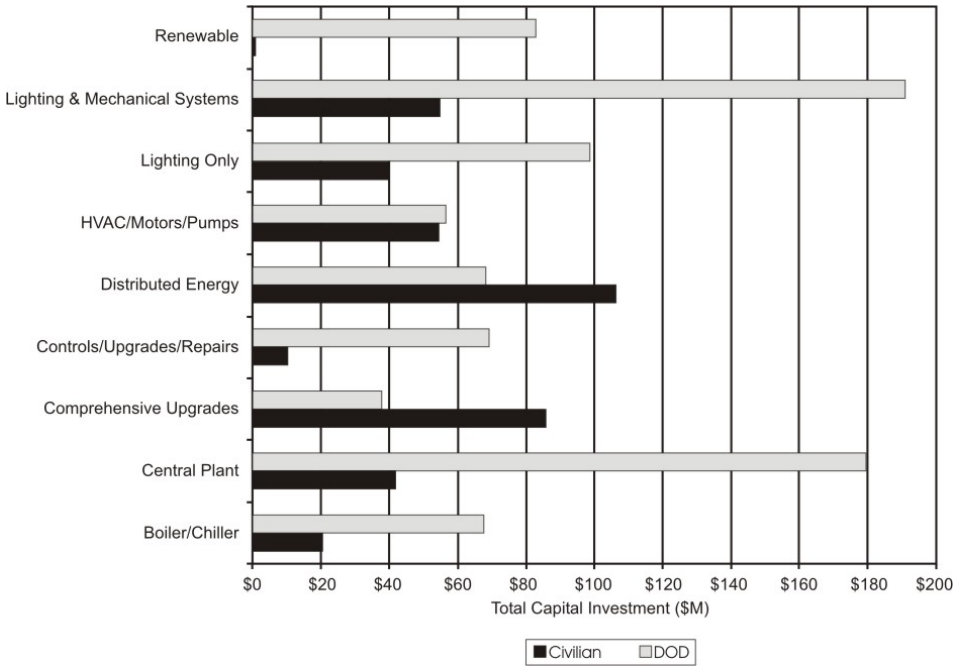
FEMP recently performed a rigorous analysis of this data to provide valuable information on the relative measure of energy reduction effectiveness of various installed technologies and the ability to test hypotheses regarding the effectiveness of installed measures across geographic regions and agencies. The findings of this analysis allow a better understanding of the overall value of utility programs in the federal sector.

The core of the analysis was a statistical examination that shed light on the relationship between annual energy savings and capital investments (Btu saved per dollar invested) for specific technology categories for both civilian agencies and the Department of Defense (DOD). The primary technology categories used to classify each project were:

- analysis;
- boilers/chillers;
- central plants;
- comprehensive upgrades;
- controls/upgrades/repairs;
- distributed energy;
- heating, ventilation and air conditioning (HVAC)/motors/pumps;
- lighting only;
- lighting and mechanical systems; and
- renewables

The analysis revealed that DOD is predominantly involved in large, multi-measure projects including lighting and mechanical system upgrades, and is heavily invested in central plant upgrades. Civilian agencies invested mostly in multi-measure and lighting projects, as well as a few large distributed energy projects. DOD has been the primary implementer of renewable projects to date. The chart below shows these relationships in total investment for awarded projects for each technology category by agency type (civilian and DOD).

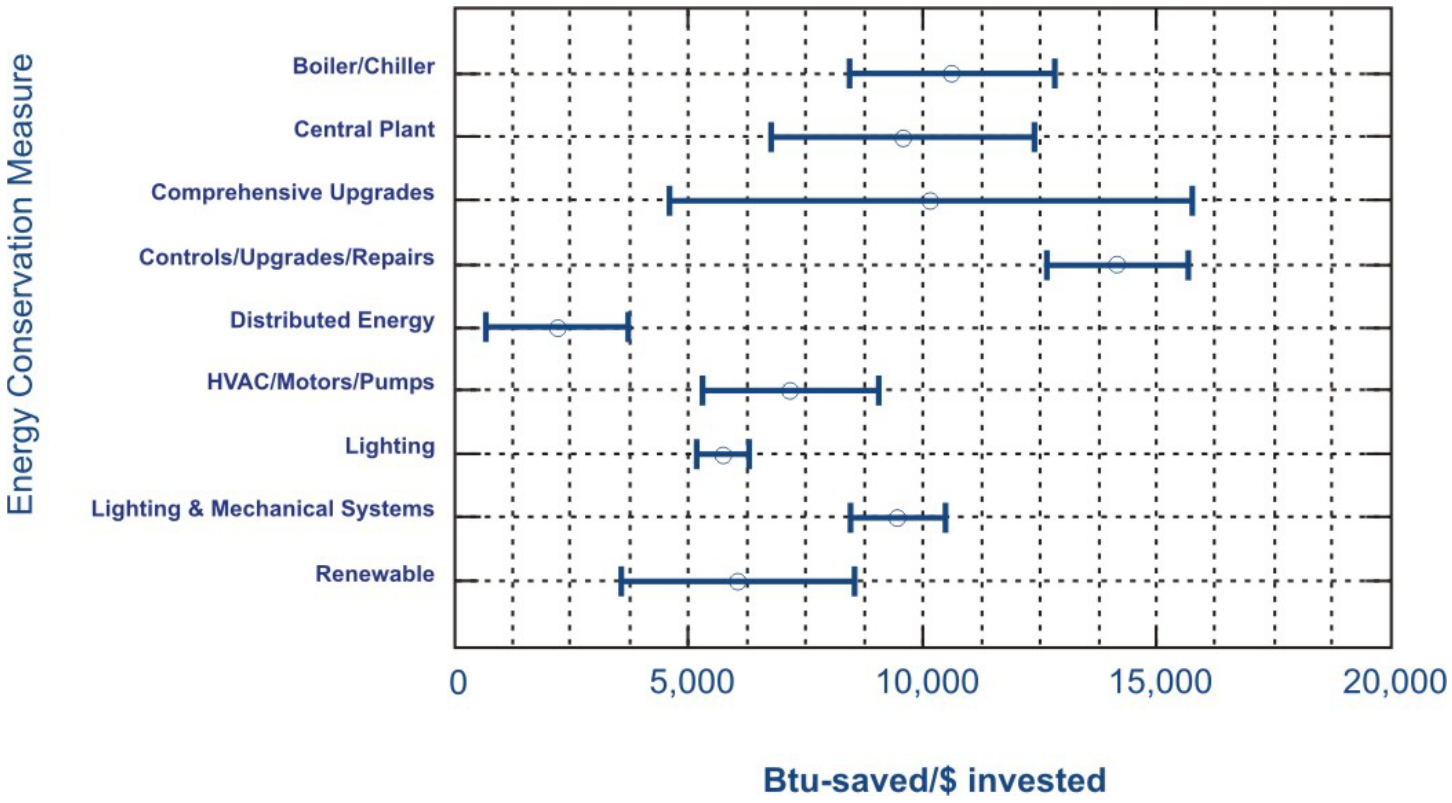
FEMP performed an analysis on annual Btu saved versus total capital dollar invested for each technology category, indicating the relationship between the amount of energy saved and the capital investment for the particular technology group. The figure below provides a visual comparison of the slopes and their uncertainties. The slope shows the typical energy savings per dollar invested for the technology category, and the standard error shows the range of values that can typically occur for this category.



Projects by technology category for DOD and civilian agencies.

The highest return on investment resulted from controls/upgrades/repairs projects (approximately 14,100 Btu per dollar of investment). These projects typically are operational efficiency improvements as opposed to equipment replacement, and require lower capital cost, resulting in a higher Btu per dollar ratio. The lowest return on investment resulted from distributed energy projects

continued on page 13



Estimated slopes and approximate 95% confidence intervals for simple linear model.

(approximately 2,100 Btu per dollar of investment). Distributed energy projects are not considered energy savings projects in and of themselves, but energy savings result from improved efficiency of the existing system, including eliminating previous energy losses or downsizing baseline energy requirements. They also require significantly larger capital investments than individual controls/upgrades/repairs projects, so the ratio of energy savings per dollar invested is expected to be lower.

Individual lighting projects provide lower energy savings per dollar invested than might be first expected. A large number of lighting projects were small capital cost projects focusing on constant-use lights that resulted in higher energy savings. The larger capital cost lighting projects may have combined constant-use lights with limited-use, less effective lights, yielding a lower overall energy savings.

The expected savings for projects that include both lighting and mechanical systems are markedly higher than lighting-only projects. This is expected since efficient lighting systems typically provide an opportunity to downsize HVAC system requirements. The magnitude of the standard error is about twice that of lighting-only projects, but is lower than the standard error for the controls/upgrades/repairs projects.

Both boiler/chiller and central plant projects have two of the highest returns on investment of the nine technology types studied. They have relatively high standard errors, indicating a large variance in expected savings, likely caused by the nature of these projects. Boilers/chillers and central plants tend to be very site-specific, and energy savings are dependent on a variety of factors that will differ from site to site. Comprehensive upgrades also have a similar return on investment, likely the result of the bundling of measures that occurs in this category. Many times a site will combine different projects to achieve an overall greater gain in dollar and/or energy savings.

The analysis results indicate that bundled projects tend to be more effective, and higher project savings per dollar invested may result from careful selection of these energy saving technologies and practices. The results also indicate that agencies may benefit from first investing in upgrades of existing equipment before considering large capital intensive retrofit projects, or consider bundling these activities to draw on the advantages of low-cost upgrades. Agencies should be careful not to retain existing equipment beyond its normal useful life, but focus on activities to ensure equipment is operating as efficiently as possible. In addition, central plant, boiler, and chiller upgrades have high energy savings per dollar invested, but also have a high uncertainty. These types of projects should begin with a thorough analysis to ensure the project will be cost effective.

For more information, please contact Bill Sandusky, Pacific Northwest National Laboratory, 509-375-3709 or bill.sandusky@pnl.gov or Kate McMordie Stoughton, Pacific Northwest National Laboratory, 865-483-9436 or kate.mcmordie-stoughton@pnl.gov.

FEMP Utility Management Web Site Identifies Energy Efficiency and Other Incentive Opportunities for Federal Customers

Energy managers at federal sites have a valuable tool in FEMP's Utility Management Web site, a key resource to help inform energy management decision-making. The Web site provides detailed information on incentives and technical assistance offered by utilities, independent system operators, and state-based public benefits administrators for energy efficiency, distributed energy, demand response, and renewable energy projects.

Energy managers may also use the site to keep current with utility restructuring in their state by browsing recent regulatory developments, learning how federal sites are affected, and considering the various electricity or gas supply options that may be available. Periodic updates to the Web site communicate the state-specific regulatory changes or proposals that could present opportunities or new challenges to utility managers. A concise historic overview of electricity and gas utility regulation within each state provides useful background, as does information related to electricity reliability within the different regions of the country.

What funding opportunities are available for energy efficiency, distributed energy, demand response, and renewable energy projects that can help federal facilities manage their costs, improve reliability, and reduce environmental impacts? How can federal customers stay informed about developments in electricity and gas markets and utility restructuring? **Visit www.eere.energy.gov/femp/program/utilityman.cfm.**

The Web site offers practical, cost-saving tips to managers contemplating the costs and potential benefits of demand-side management projects at their sites. Many of these tips are simple and easy to implement. In many states, for example, comprehensive analysis of facility energy use and recommendations for cost-effective energy efficiency improvement are provided at no cost by the servicing utility. More comprehensive information is available to help managers identify state- or utility-sponsored financing for energy efficient retrofits, and to help apply for public benefit funds to promote energy efficiency. Likewise, detailed information is available on utility or independent system operator programs that provide incentives to curtail demand and reduce load during peak periods in response to system reliability or market conditions.

For utility managers interested in purchasing renewable power, technical resources are available to identify opportunities and assist with decision-making. Either alone or with assistance from FEMP staff, these technical resources can help managers determine the best renewable power purchase option for a given area. Strategies covered by the Web site include "green" power pricing through a regulated utility, the purchase of renewable energy through a competitive supplier, or the purchase of renewable energy certificates as a proxy for delivery of actual green power.

Managers with an interest in on-site construction of distributed generation, including renewable energy projects, will find current information on state- or utility-sponsored programs that offer rebates or other financing. In many states—as well as a number of municipalities—significant funding is available for construction of mid- to large-scale photovoltaic, wind, and fuel cell energy sources. Where federal sites are eligible, the grants or rebates under these programs are described in detail.

Additional resources, including links to federal agencies and trade associations that can provide technical support, are provided to help utility managers take the next step. Specifically, managers can find contact information for FEMP's Utility Services Program and knowledgeable staff at DOE Laboratories throughout the country.

For more information, please contact Chuck Goldman, Lawrence Berkeley National Laboratory, 510-486-4637 or cagoldman@lbl.gov.

FEMP's interactive maps provide detailed, state-specific information on financial incentives available to leverage energy-efficiency, distributed energy and renewable projects at federal sites, coupled with status updates on utility restructuring in each state.

FUPWG Heads From Oklahoma City in May to Rapid City in October

The Federal Utility Partnership Working Group (FUPWG) recently held its spring meeting on May 12 and 13, hosted by Oklahoma Gas and Electric in Okalahoma City. The upcoming fall meeting will be held in the shadow of Mount Rushmore in Rapid City, South Dakota on October 18 and 19, 2005, hosted by Montana-Dakota Utilities.

FUPWG works to improve partnerships between the federal agencies and their local utility companies to encourage the implementation of energy efficiency and renewable energy projects, and provides federal agencies guidance on making wise utility management and acquisition decisions. FUPWG's total membership is approximately 400, representing the federal government, the utility industry, and related organizations.

FUPWG meetings are held twice a year (spring and fall) and are hosted by a utility member to provide information and guidance on issues of interest. These meetings typically have approximately 100 participants and address a wide range of related subjects.

Some meeting topics in Oklahoma included:

- Important issues when choosing the GSA Areawide Contract, Basic Ordering Agreement, or Model Agreement for Utility Energy Service Contracts;
- Partnering with the local utility to increase energy security;
- The latest on combined heat and power technologies;
- Utility billing and payment issues when working with the Defense Finance and Accounting Service; and
- How to use utility rebates when calculating a project's Net Present Value.

Proposed meeting topics for South Dakota include:

- The latest on facility lighting options;
- The Department of Defense (DOD) renewable energy assessment;
- Interagency efforts at promoting tribal wind power developments; and
- Discussing the impact of DOD housing privatization on utility contracts.

If you are interested in finding out more about FUPWG and its past and future meetings, please visit http://www.eere.energy.gov/femp/financing/uescs_fupwgmeetings.cfm or contact David McAndrew, 202-586-7722 or david.mcandrew@ee.doe.gov.

DOE Headquarters Increases Renewable Purchase to 100 Percent

FEMP is proud to announce that the Department of Energy (DOE) recently increased their headquarters facilities' renewable purchase to 100 percent. The 37 gigawatt-hour renewable energy certificate (REC) purchase covers the DOE Forrestal building in Washington DC, home of FEMP staff, and the DOE Germantown facility in Maryland. This purchase will help DOE meet their departmental goal of purchasing three percent of its total electricity needs from non-hydro renewable energy sources by 2005 and 7.5 percent of its total electricity purchases from green power by 2010. The purchase also increases DOE's standing in the EPA Green Power Partnership Top 25 list from number 25 to number 14.

The General Services Administration acted as the procurement agent for this purchase. Calpine is supplying the RECs from the expansion of their geothermal Geyser project in California.

For more information, please contact Michael Watkins, 202-586-6944 or michael.watkins@hq.doe.gov.

U.S. COAST GUARD AIR STATION CAPE COD DEMONSTRATES SUCCESSFUL FUEL CELL
(continued from page 10)

Air Station Cape Cod intends to operate the fuel cell as long as the economics are favorable. Funding was obtained for the design and installation of the utility interconnection needed to allow the fuel cell to operate at full power, and Coast Guard personnel are also working to reach agreement with their utility on export of excess energy. Finally, the economics of the long-term operation and maintenance costs will significantly impact cost-effectiveness.

In recognition of its superior performance and management, the Air Station Cape Cod Fuel Cell project was selected as one of only two winners in a new Energy Security & Reliability category of the 2004 Federal Energy and Water Management Awards.

For more information about this project or FEMP Technical Assistance, please contact Shawn Herrera, FEMP, Shawn.Herrera@EE.DOE.GOV, Mark Halverson, PNNL, mark.halverson@pnl.gov, or Bill Chvala, PNNL, william.chvala@pnl.gov. To monitor continuing operation of the fuel cell including meter readings, status reports, outages, and availability, please visit:

http://www.uscg.mil/systems/gse/energy/technology/technology.htm#Fuel Cells

Naval Station Great Lakes Uses UESC to Complete Base-Wide Upgrades

Naval Station Great Lakes (NSGL) relies on its utility energy services contract (UESC) program to upgrade infrastructure and meet energy conservation mandates. Supported by a strong relationship with their serving utility, Commonwealth Edison (ComEd), NSGL took advantage of the ease of using the contract vehicle and developed a Master Plan—a strategic roadmap outlining three key steps to base-wide energy savings to be accomplished in ten phases. The first step focused on the reduction of base loads through energy efficiency, upgrading all facilities, and installing a central energy management control system; the second step was an upgrade of the steam distribution system; and the third step modernized and optimized the central utility plant. Partway through the effort, Exelon purchased ComEd, and Exelon Services Federal Group led the technical efforts. Work resumed after Ameresco Federal Solutions (AFS) purchased Exelon Services Federal Group. Special credit is given to all the players who stayed the course, provided continuity, and helped insure success of the plan.

Workers at Naval Station Great Lakes place a direct fired absorption chiller and construct high efficiency cooling towers.

The initial phase, which included six buildings, began as a successful pilot in 1997. Since then, two phases per year have been developed and implemented. Step one was completed in 2002 with 635 energy conservation measures (ECMs) implemented in 153 buildings. Step two replaced 7,000 feet of steam and condensate lines to improve the utility distribution system. Step three includes rebuilding a major portion of the central plant to generate steam and electricity through a cogeneration system. AFS is currently implementing the final two phases of the plan.

Many creative and innovative ideas were integral to the Master Plan. For example, the buildings were classified by potential savings, and each phase was developed with 30 percent high, 50 percent medium, and 20 percent low potential buildings. Approval processes were streamlined. For example, all of the Hospital Command buildings were grouped in a single phase. As each phase was developed, AFS met with each building's Building Maintenance Supervisor (BMS) and the Public Works Center (PWC) maintenance staff in sequence to explain the program and include them in the development of ECMs. Upon project acceptance, the BMS, PWC staff, and operating personnel were trained on how to operate equipment and identify problems that reduce energy efficiency, assuring continued savings over the life of the equipment. AFS also guarantees the performance of the equipment and the projected savings for the first 12 months after acceptance operating through the four seasons.

Through this long-term technical and contractual partnership, NSGL has been successful in addressing the critical needs of aging infrastructure as well as the requirements of the Energy Policy Act of 1992 and Executive Order 13123. The more than $100 million in investments saved more than $22 million and 1.3 billion Btu annually from electricity, steam, natural gas, fuel oil, and propane. Current projects will add more than $12 million to the annual savings. NSGL has standardized systems with increased reliability; optimized training; a simplified spare parts inventory; capability to operate all critical functions if outside power is disrupted; improved quality of life for sailors, educators, support personnel and their families; and reduction in harmful greenhouse gas emissions. The base is on track to meet and exceed government energy efficiency requirements. Without this program, the base energy use would be 30 percent greater than it is today.

For more information, please contact David McAndrew, FEMP, 202-586-7722 or david.mcandrew@ee.doe.gov or Deb Beattie, NREL, at 303-384-7548 or deb_beattie@nrel.gov.

Oak Ridge National Laboratory Receives Second Energy Star® Award

The Mammalian Genetics Office Building at Oak Ridge National Laboratory (ORNL) was awarded Energy Star® recognition on September 24, 2004 by the Environmental Protection Agency, outperforming more than 90 percent of the office buildings across the United States in terms of energy efficiency. This is ORNL's second Energy Star® building and the first obtained under ORNL's new In-House Energy Management "Model Program" studies funded by FEMP's Departmental Energy Management Program. This building joins ORNL's Buildings Technology Center Headquarters and other federal buildings that have achieved the prestigious rating, and provides an excellent example of the energy efficiency that can be achieved with limited investments in technology and close attention to detail in operating the building's energy-consuming systems.

Constructed in 1992, the two-story, all-electric, 7,000-square-foot office building has about 30 occupants, many of whom utilize their offices to support research activities in nearby buildings. Significant electrical loads are for heating and air conditioning, personal computers, and office support equipment. An energy management system was installed at construction, and the building contains T-8 lighting and electronic ballasts. The building also includes numerous through-the-wall HVAC units controlled by the building occupants and by the energy management control system (EMS), which has over-ride timer controls in each room. The EMS turns the units off during non-occupied periods unless space temperature dictates a need to maintain the off-shift temperature or an occupant over-ride timer is activated.

Mammalian Genetics Office Building at Oak Ridge National Laboratory

Although the building does not contain occupancy sensors, Wayne Parker, ORNL's energy manager, states that contributing factors in enabling the award were not only the management of utilities when occupants are present, but also their dedication to the reduction in energy consumption when they leave the building to either conduct research work elsewhere or go home at the end of the day. This example demonstrates that the greatest energy savings are achieved by turning off lighting, equipment, and systems when they are not needed.

For more information, please contact Wayne Parker, ORNL, 865-574-8578 or parkercw@ornl.gov.

FEMP Regional Technology Manager Recognized for Outstanding Public Service

Arun Jhaveri, FEMP's Regional Technology Manager at DOE's Western Regional Office in Seattle, Washington, was selected to receive the Secretary of Energy's 2004 Community Service Award. Mr. Jhaveri was honored for his many years of community and volunteer services in the state of Washington, including: 1) former first mayor of the New City of Burien, from 1992 to 1998; 2) trustee of the Highline Community College, appointed by the Governor of the State of Washington, from 1998 to present; 3) member of the King County Governance Commission from March 2003 to March 2004; and 4) member of the Sustainable Schools Design/Construction Advisory Committee of the Highline School District from September 2003 to present. The award ceremony was held in DOE's Forrestal Building in Washington, DC on May 3, 2005.

For more information, please contact Arun Jhaveri, FEMP Regional Technology Manager, Western Regional Office, 206-553-2152 or arun.jhaveri@ee.doe.gov.

Marine Corps Base Camp Pendleton Shares the Keys to Their Successful Energy Program

Marine Corps Base (MCB) Camp Pendleton has surpassed the federal government's mandated energy reduction goal of 35 percent for 2010 six years early, achieving a noteworthy 44 percent reduction in energy intensity from the FY 1985 baseline. One of the primary reasons for their successful energy program has been strong support throughout the chain of command, in particular, the strategic vision of Colonel Russell Eve, Assistant Chief of Staff Facilities; Edmund Rogers, Base Facilities Manager; Lieutenant Colonel Gregory Thomas, Facilities Maintenance Officer; and Jay Bergamini, Deputy Facilities Maintenance Officer.

Camp Pendleton holds an advantage over many other installations—that is, senior management continues to employ a full-time, dedicated federal energy manager. At other installations, the energy manager position is a collateral duty along with other responsibilities, so attention may often be diverted from energy issues to the "fire drill" of the day. For MCB Camp Pendleton, full-time energy manager Jeff Allen is instrumental to their day-to-day operations and the resulting achievements of significant energy reductions and cost savings.

Another key management decision was to augment the energy manager's position with a contracted full-time Resource Efficiency Manager (REM), Randy Monohan. The REM provides the energy manager the latitude of calling upon the expanded resources of a consulting firm in order to leverage technical resources and capabilities and benefit from lessons learned at other installations. This collaboration has led to a true winning team effort.

Camp Pendleton also continues to use alternative financing approaches to fund capital-intensive energy efficiency projects. Plans are underway to award a $12 million utility energy services contract (UESC) in FY 2005 through the local utility provider. In FY 2004, Camp Pendleton executed UESC projects valued at $6.5 million. In FY 2003, they executed a UESC contract for $11.7 million as well a $5.7 million energy savings performance contract (ESPC) with a third party contractor. In FY 2002, the Base executed a UESC contract valued at $5.9 million. These UESC and ESPC contracts focus on a variety of energy projects, including:

- Natural gas reduction: retrofitted more than 120 boilers and de-commissioned a large steam plant;
- Electrical load reduction: retrofitted more than 700 traffic signal lights, 1,500 parking lot lights, 2,600 high intensity discharge lights, and 25,000 incandescent to compact fluorescent lamps; decommissioned 20,000 older fluorescent light fixtures and installed more than 1,200 skylights for natural daylighting.
- Renewable Energy: installed more than 200 solar-powered street lights and caution lights—an effort that led to the installation of solar-powered lighting at bus stops, carport electric vehicle charging stations, wastewater overflow detection stations, and notification and communication systems. Camp Pendleton also has several rooftop photovoltaic systems in the final design stages. Due to the success of and overwhelming demand for solar-powered streetlights, the Base is now installing 100 new streetlights at remote, off-grid locations. Given the high visibility of the solar-powered projects to the thousands of civilians and Marines that work and live at Camp Pendleton, these projects provide a great educational opportunity on the many applications of solar power.
- Advanced drive-by metering systems: This project will install and/or upgrade all master electric, gas, and water meters under the same platform and will allow information to readily be provided to Base personnel and end users for action. The next phase will install remaining electric and gas sub-meters in an effort to cover approximately 85 percent of the buildings on the Base with advanced meters with capabilities for drive-by data collection.

Through these projects and educational efforts, under the direction of a dedicated energy team, MCB Camp Pendleton was able to significantly reduce energy consumption in just a few years, even though the installation's facility space increased by 2 million square feet. Looking forward, MCB Camp Pendleton's strategic vision is to capitalize on project development and execution in combination with Base-wide energy education and awareness in order to further reduce energy consumption and costs.

For more information, please contact Jeff Allen, Base Energy Manager, jeff.s.allen@usmc.mil or Randy Monohan, Resource Efficiency Manager, monohanrj@pendleton.usmc.mil, or call 760-725-0566, DSN 365-0566.

Naval Air Station Whidbey Island's Conservation Program Recognized

Since receiving a gold level energy award from the Secretary of the Navy last year, the Naval Air Station Whidbey Island conservation program has completed or awarded a number of improvement projects. Upgrades at Naval Hospital Oak Harbor are anticipated to save approximately 8.4 billion Btu and $41,000 annually. Replacement of 400 hertz motor generator units at the Aircraft Intermediate Maintenance Detachment (AIMD) and North Air Starts are anticipated to save more than 900 million Btu annually, and HVAC upgrades for the AIMD, Flight Simulator, and Central Steam Plant will save almost 2.8 billion Btu and $33,600. The Facility Energy Improvements Energy Conservation Improvement Program (ECIP) project, completed in June 2005, identified potential savings of almost $730,000 and $238,000 in grants, rebates, and other cost avoidence. The Base is also implementing two innovative energy conservation options provided by an in-depth assessment completed by FEMP staff at Lawrence Berkeley National Laboratory: a bio-diesel initiative aimed at providing bio-diesel for the composting facility and the recycling center and two renewable (solar and geo-exchange) fuel cells.

The Air Station's Resource Efficiency Manager (REM) program is featured in a new guidebook available through FEMP to support the acquisition of REMs. The step-by-step guide is directed at those who seek practical advice on whether to hire a REM, drafting a contract, and gauging the REM's performance. The Guidebook was produced for FEMP by the Washington State University (WSU) Extension Energy Program through the Pacific Northwest National Laboratory, and may be found at http://www.energy.wsu.edu/projects/rem/guidebook.cfm.

The Air Station's standard-setting energy awareness program includes a weekly and monthly energy conservation column written for four Base newsletters. In 2003, the Energy Star® certification of Victory Park housing by the Washington State University Energy Office was recognized in multiple publications, illustrating the successful partnership between federal, state, and private sectors. The Air Station sponsors or participates in numerous events throughout the year to disseminate energy conservation awareness materials, including the annual Navy/Marine Corps energy awareness week in October, Earth Day in April, an energy fun run/walk, an energy awareness golf tournament, a children's energy coloring contest, the annual Safety Fair, "America Recycles Day," and a demonstration of rideshare and gas/electric hybrid vehicles. The energy conservation team continues to spread awareness through monthly indoctrination of newly arrived personnel and monthly training of Building Energy Monitors.

For more information, please contact Kevin Evans, Resource Efficiency Manager, NAS Whidbey Island, 360-257-1464 or kevin.d.evans1@navy.mil.

Energy conservation information materials are disseminated to Air Station residents at annual awareness events.

FEMP Conducts E-Learning Trial for Online Energy Courses

E-learning presents a potential opportunity for energy managers to get help on a variety of subjects when they are unable to travel to training locations. To test this relatively new learning medium, Ab Ream, FEMP's O&M Program Lead, selected Atlanta-based Apogee Interactive, Inc. to conduct a three month trial using their learning management system (LMS) and online energy courses.

Because Apogee had already developed a number of e-learning training modules for their utility customers, FEMP was able to select off-the-shelf classes for the pilot, avoiding most up-front development costs. Susan Gilbert, Apogee's President, explained, "While our training was designed for utility company employees needing to know how to help energy managers, the library of courses are a perfect fit for facility managers." The courses selected for the trial included:

- Fundamentals of Lighting Systems
- Energy Efficiency Improvements for Lighting Systems
- Cooling System Alternatives
- Fundamentals of Distributed Generation
- Basic Electricity
- Fundamentals of Natural Gas, and
- A series of courses on motors and drives and power quality.

Apogee's courses are all monitored through the LMS, so FEMP was easily able to track students' involvement in the training as well as the overall outcomes.

The pilot had three primary objectives: 1) to assess the receptivity of FEMP's training population to taking courses over the Internet; 2) to learn the technological and IT challenges trainees would face while trying to use the courses from their offices or homes; and 3) to find courses that were best suited for Internet-based delivery.

Several one-hour "Webinars" were conducted to inform facility managers and FEMP regional training representatives of this opportunity, and to provide study objectives, timeframes, and information on how to enroll in the courses. Although the test was planned to offer only 120 courses, more than 400 were actually used over the three month pilot period. "This rapid and wide acceptance of the online courses was our first indication that the pilot was going exceedingly well," said Randy Edwards, Apogee study manager. "In some pilots, we have to urge and remind people repeatedly to finish their course before the deadline, but in this case people were eager to get through the material. We had one of the highest completion rates of any pilot we've conducted."

As far as the pilot's primary objective of gauging trainee receptiveness, 84 percent reported being either satisfied or very satisfied with their e-learning experience. Tests concluded that the majority of unsatisfied participants were taking courses that were not well aligned with their experience levels or job knowledge needs. Additionally, according to pre- and post-test scores, participants learned much from their experiences. For all courses where pre- and post-tests were taken, scores increased by an average of 23 points—from a failing grade of 63 percent to a passing score of 86 percent. Other benefits reported in course evaluations were the ability to study anywhere at anytime, self-paced learning, and taking courses without lost time due to travel and related expenses (with many participants noting this as the primary advantage of online learning). Susan Gilbert, who has led the firm's distance learning initiatives for more than ten years, said, "As pilots go, we feel this was one of the most successful we've conducted. Participants really appreciated the easy access and hard work that has gone into making these courses interesting and meaningful."

Ab Ream stated, "We learned a great deal in the pilot. Our challenge now is to apply what we've learned and put online learning to work for FEMP's O&M Program where it fits." The online learning portal is still available for use through FEMP's O&M online learning site at www.study-center.com/femp. One-half day to multi-day courses are available at a discounted fee of $135.00 each, which can be paid using a major credit card. A customized Building Commissioning course is scheduled for release during the third quarter of 2005.

For more information on FEMP's O&M online learning program, please contact Ab Ream, 202-586-7230 or ab.ream@ee.doe.gov.

"I would like to see more of this type of learning available. We are located in Nevada and our opportunities for attending FEMP training are limited. Funding is not always available for travel. E-learning seems like the answer." — Pilot Participant

FEMP Training Reminders

FEMP Lights
August 29 – December 12
Web Course
916-962-7001

World Energy Engineering Congress 2005
September 14 – September 16
Austin, TX
www.energycongress.com

Solar Decathlon
September 19 - October 8
Washington, DC
www.eere.energy.gov/solar_decathlon

Implementing Renewable Energy Projects
October 11 – October 12
or
October 13 – October 14
Washington, DC
303-384-7553

High Performance, Low-Energy Laboratory Design
October 17
Portland, OR
www.labs21century.gov

Laboratories for the 21st Century Annual Conference
October 18 – October 20
Portland, OR
www.labs21century.gov

DOE Department Energy Management Awards
October 26
Washington, DC
202-586-7632

Presidential and Federal Awards Program
October 27
Washington, DC
202-586-7875

FEMP Lighting and Health
November 15
Washington, DC
916-962-7001

FEMP INVESTIGATES CUTTING ENERGY DEMAND AT GSA'S PHILADELPHIA CUSTOM HOUSE
(continued from page 11)

FEMP's preliminary recommendation to GSA involves a two-part strategy:

1) Pre-cool the building on hot summer days by turning on the chilled water system earlier in the morning (typically the start time is about 6 A.M.). This will serve to de-humidify the building more thoroughly, yielding greater occupant comfort. But more importantly, it will allow the massive structure's thermal mass to act as an energy storage medium, which can then serve as a heat sink and emit cooling radiation throughout the day, lowering the need for further air conditioning. The expectation is that this will avoid or at least delay the high peak electric draws the building usually experiences; these generally occur in the early afternoon.
2) Turn on the diesel generator whenever a certain demand threshold is reached (expected to be about 1,500 kW; the Custom House's summer monthly peaks tend to reach about 2,000 kW). Although this strategy would have resulted in around 600 hours of generator operation in recent summers, the expectation is that the pre-cooling strategy will considerably lessen this since the high kW draws will be avoided or delayed. FEMP has also advised two possible emissions control strategies, bi-fuel conversion and selective catalytic reduction, to reduce emissions to acceptable limits for the increased hours of operation entailed in peak shaving (currently the generator is only used for emergency back-up).

FEMP estimates that these two measures can jointly net GSA about $70,000 annually in reduced summer demand and winter ratchet charges. However, not only is there a one-time capital investment to hook up the generator in parallel with the electric grid and the facility's energy management control system, there is also the fine-tuning of the pre-cooling strategy and the programming of the control system that need to occur.

GSA evaluated the plan this spring and decided to move forward initially with the pre-cooling approach (#1 above). There was insufficient time for installation of the necessary generator modifications (for emissions reduction and parallel grid connection) to allow for any peak-shaving by that means during this summer. However, moving forward with the pre-cooling alone will allow GSA to more accurately assess both the pre-cooling's effectiveness and the value of incorporating the generator into the demand reduction plan in the future.

For more information, please contact Phil Coleman, Lawrence Berkeley National Laboratory, 610-604-0170 or pecoleman@lbl.gov.

ENERGY MATTERS

Facts & Tips from the U.S. Department of Energy

Tips To Take The Sting Out Of High Gasoline Prices

(NAPS)—When gasoline prices are high, nobody wants to be fuelish. It's bad for your pocketbook and the nation as well. According to the Department of Energy, passenger cars and light trucks account for almost 47 percent of U.S. oil consumption and are a major source of air pollution. Luckily, there are plenty of ways to reduce gas mileage.

Driving Tips

• Idle as little as possible—idling gets you 0 miles per gallon. The best way to warm up a vehicle is to drive it. You need no more than 30 seconds of idling on winter days before driving away. Anything more simply wastes fuel and increases emissions.

• Aggressive driving (speeding, rapid acceleration, and hard braking) wastes gas. It can lower your gas mileage by 33 percent at highway speeds and by five percent around town.

• Avoid high speeds. Each five mph you drive over 60 mph is like paying an additional $0.10 per gallon for gas.

• Use air-conditioning only when necessary.

Car Maintenance Tips

• Keep tires properly inflated and aligned. Properly inflated tires can improve your gas mileage by around 3.3 percent.

• Get regular engine tune-ups and car maintenance checks. Replace clogged air filters—this can improve your car's gas mileage by as much as 10 percent, and it will also protect your engine. If your car has a faulty oxygen sensor, your gas mileage may improve by as much as 40 percent.

WEIGHTY MATTERS: Avoid carrying unneeded items in the trunk. Extra weight decreases gas mileage.

• Combine errands into one trip. Several short trips taken from a cold start can use twice as much fuel as a longer multipurpose trip.

$ Long-Term Savings Tip

• Consider a highly fuel-efficient vehicle for your next car, SUV, or truck purchase. Buying a standard vehicle, with high fuel efficiency, a hybrid vehicle, or an alternative-fuel vehicle for your next purchase, could save you a lot at the gas pump and help the planet at the same time. Vehicle emissions are a major source of U.S. air pollution today.

For some A to Z energy tips that include buying a new car or truck, what's on the energy horizon and fuel cost calculators to find and compare costs, visit www.energy.gov and click on "energy saving tips" and select "cars."

This article was written for the Department of Energy by the North American Precis Syndicate (NAPS). Other planned NAPS article topics include: home energy-saving tips; energy awareness; solar energy; ethanol; and ENERGY STAR®. If you are interested in including NAPS articles like this one in your agency newsletter, please contact Lani Macrae of the Department of Energy at lani.macrae@ee.doe.gov.

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Energy Awareness Month 2005 Encourages Smart Energy Choices

October is Energy Awareness Month, and this year's theme, "Not in Use? Turn Off the Juice!" continues and reinforces the messages of the Department of Energy's Smart Energy Choices awareness campaign. To spread the message, FEMP is developing outreach materials that remind federal employees to switch off unnecessary lights; unplug equipment that drains energy even when not in use; use efficient Energy Star® products; and walk, bike, or take public transportation to work. Please call the EERE Information Center at 877-337-3463 to request a limited supply of Energy Awareness Month materials. Posters and other items will be available to order after September 12, 2005. A Power Kit CD ROM with high resolution graphics for creating and printing your own materials is available to order now. FEMP has also designed a number of animated energy awareness messages that promote the campaign themes and can be attached to E-mail messages as a simple, cost-free way for agencies to spread the word to employees and others. The animated GIF files will be available to download from the FEMP Web site at http://www.eere.energy.gov/femp/services/energy_aware.cfm.

For more information, contact annie.haskins@ee.doe.gov or visit the Energy Awareness Month Web site at http://www.eere.energy.gov/femp/services/energy_aware.cfm.

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