

METERING AND THE NEW FEDERAL REQUIREMENTS OF ENERGY POLICY ACT 2005

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ABSTRACT

Section 103 of the Energy Policy Act of 2005 (EPAAct 2005) (1) mandates the installation of meters and advanced electric meters on all Federal Buildings by 2012 using guidelines developed by the US Department of Energy in consultation with other agencies and organizations. This paper examines the impact of this legislation, its implementation by Federal agencies, development of the guidance, the agency planning process, and the multiple benefits to be derived from metered energy data. This paper does not provide technical guidance for implementation nor is it intended to be a cookbook of “how to” meet the intent of the EPAAct 2005.

INTRODUCTION

The Energy Policy Act of 2005 included a requirement for all federal agencies to meter electricity use in all federal buildings by Oct. 1, 2012 using advanced meters or metering devices that provide data at least daily. Six months after the enactment of EPAAct, DOE’s Federal Energy Management Program, or FEMP, established clean guidelines (2) for federal agencies, in consultation with a broad spectrum of stakeholders in accordance with the enabling legislation. The guidelines are meant to set the overall direction of federal advanced metering and provide a framework/guidance for agencies to proceed.

This legislation will have a significant positive impact on the abilities of federal energy managers, facility managers, and building operators to improve the operating efficiencies of federal buildings. Considering that most federal buildings are currently not individually metered, it follows that measuring and managing energy usage at the building level is a difficult challenge. Moving from the current state to a situation where all buildings are being monitored on an hourly basis where practicable, and coupled with appropriate uses of the data coming from those meters, can only lead to increases in efficiency and reductions in energy expenditures for federal agencies.

The overall impact of mandatory electric metering is difficult to predict, but if applied in a meaningful and systematic fashion, advanced metering systems, combined with analysis methodologies that make full use of metered data, will have a profound and dramatic overall effect on federal building energy management

The installation of advanced metering systems with minimum capabilities to collect hourly data and report at least daily represents almost an epic change in the way we now approach building energy management. Further, advanced metering systems currently on the market have far greater capabilities than called for in EPAAct. But, are federal agencies focused on just

getting meters installed to meet the basic legal requirements, or are they ready to take advantage of the full capabilities that advanced metering systems have to offer? Efforts by the Department of Defense, the General Services Administration and others, would indicate agencies intent on not only installing meters but also using the data to manage energy costs.

WHAT WILL WE DO WITH ALL OF THE DATA?

During the development of the DOE guidance on electric metering, there was universal agreement among the stakeholders that meters, by themselves, will not be of any use whatsoever, unless we make every effort to take advantage of the data they provide to help us improve our energy management capabilities. There are many ways to use data to our advantage once advanced metering systems are properly installed and fully employed. Some of the potential uses include:

- Energy billing and procurement including measuring tenant energy use, verifying utility bills, identifying best utility rate tariffs, and participating in demand response programs.
- Measurement, verification, and optimization of performance including diagnosing equipment and systems operations; benchmarking utility use; identifying potential retro-fit/replacement projects; and monitoring, diagnosing, and communicating power quality problems.
- Manage utility use including monitoring existing utility usage and utility budgeting support.
- Development of baselines and measurement and verification (M&V) of savings in energy savings performance contracts (ESPC) and utility energy services contracts (UESC).

- Promotion of energy awareness for building managers and occupants.

Clearly, the more effectively we measure and analyze energy consumption, the better we can manage it. Ultimately, numerous benefits from these metering uses will be realized:

- Reduced operating costs from reduced energy use and increased equipment life
- Optimized building and equipment performance— including improved systems reliability and increased occupant comfort.
- The ability to apply retro- and Continuous Commissioning® techniques to all federal buildings.

Perhaps even more, the ability to finally get detailed measurements on building subsystems will provide building operators with vastly improved information on many aspects of energy efficiency that today present severe challenges.

EPA 2005 also requires that within 18 months of its enactment that states investigate and decide whether to mandate utilities to offer each customer a time-based rate schedule under which the rate charged by the electric utility varies during different time periods and reflects the variance, if any, in the utility's costs of generating and purchasing electricity at the wholesale level. The time-based rate schedule would enable the electric consumer to manage energy use and cost through advanced metering and communications technologies. If the states mandate time-based rate schedules, each electric utility would provide each customer requesting a time-based rate with a time-based meter capable of enabling the utility and customer to offer and receive such a rate, respectively.

So, all of the data we can collect through advanced meters, if properly analyzed and combined with active energy management, can have a dramatic impact on energy usage in federal facilities.

HOW WILL FEDERAL AGENCIES GET STARTED?

Recognizing the important benefits that advanced metering systems have to offer to federal facilities managers, it's also important to recognize that metering every building in a given federal agency is an enormous challenge, especially since no funding was provided for implementation. In the guidance document, DOE/FEMP provided some methodologies for determining where advanced metering systems would be cost effective and how

agencies might prioritize their buildings based on several factors:

- the cost to:
 - design,
 - purchase,
 - install,
 - maintain,
 - store data,
 - operate the meter/metering system,
 - analyze the data output, and
- the resulting energy cost savings.

There are, of course, many variables in determining cost effectiveness, and a large part of the answer lies in how well the data are used. FEMP included in the guidance a broad estimation of how much savings can be expected from varying uses of metered data, as illustrated in the following table.

Metering Savings Ranges (2)

Action	Observed Savings
Installation of meters	0 to 2% (the "Hawthorne effect") ^a
Bill allocation only	2-1/2 to 5% (improved awareness)
Building Tune-up	5-15% (improved awareness, identification of simple O&M improvements,
Continuous Commissioning [®]	14-45% (improved awareness, O&M improvements, project accomplishment, and continuing management attention)

To get started, agencies should assume an estimated savings benefit of at least 2 percent, which seems reasonable and conservative, although agencies should consider using the higher estimated savings per the cited examples. This depends, of course, on each agency's commitment to making the best use of metered data. As more meters are installed in federal buildings, experience will provide agencies better examples of reasonable energy savings expectations.

START WITH A PLAN

EPAct 2005 requires agencies to develop a plan to show how they intend to approach metering their facilities. These plans are due on August 3, 2006. DOE/FEMP's guidance provided a template for these plans, and a number of planning workshops for agency energy program managers. The elements of the agency metering plan include the following:

- **Goals** – Agencies should formalize their metering program goals. An example of an overall goal for an agency might be to fully implement advanced electric metering at all facilities wherever practicable, by 2012.

- Identify and confirm the objectives and target dates of the users/stakeholders. Objectives should relate to the various uses of metered data, such as bill allocation, demand management, Continuous Commissioning®, etc., with the ultimate goal being to reduce electricity usage and costs. An example of one possible objective might be to fully enable energy bill allocation at all agency branch levels.
 - Prioritize objectives as near-term, mid-term, and long-term.
 - Formalize the outcomes of each objective. For example, if an objective is to enable full bill allocation, an outcome of this might be a reduction in overall electric costs of 10 percent.
- **Metering program structure**
 - Data needs – Once clear goals and objectives have been identified and agreed upon by all users/stakeholders, how exactly will the agency go about implementing its plan? The starting point would be to identify data needs that will support the goals and objectives. For example, if an objective is to fully enable bill allocation at all agency branch levels, then a minimum data requirement would be to collect kWh and kW data at those buildings or portions of buildings inhabited by the various branches, and to have the ability to identify and notify each organizational unit of its electric consumption and demand on a periodic basis.
 - Analysis methodologies – Data, by itself, isn't of much use without some analysis to determine what it means.
 - Equipment needs – based on the data requirements and analysis methodologies identified in the previous steps, what types of metering/monitoring equipment and hardware/software tools would be most appropriate to provide that data?
 - Existing infrastructure – do a cross-walk of equipment and analysis needs with the existing agency infrastructure to identify where existing meters and metering systems can be put to better use, and to identify where the gaps are. Tie into existing EMCS wherever practicable and cost effective.
 - Staffing requirements – make sure the lines of responsibility and commensurate authority are clearly in place for successful implementation of the plan.
- **Criteria for evaluation of metering costs, benefits, and impacts to existing systems, infrastructure and staff**
 - Determine the relative economics of metering and advanced metering systems.
 - Justify with cost/benefit, life-cycle cost, ROI or payback metrics. For example, basic use of metered data might provide a 2-5 percent savings on the cost of electricity, while comprehensive continuous programs might result in 30-40 percent savings.
- **Prioritized implementation plan**
 - Screen opportunities based on success potential. Generally

speaking, the largest energy users will most likely net the best results in terms of the cost of meter installation. The 80-20 rule might well apply to your agency. In other words, eighty percent of the opportunity might lie in 20 percent of the buildings. Develop a prioritized list of your buildings/facilities that reflects the cost of metering, the potential benefits based on your objectives, and the best available data on building/facility energy use. At some point in prioritizing your building inventory, you will most likely find a cutoff line where advanced metering no longer makes sense economically.

- Develop a timeline for full implementation of advanced metering installation at all buildings and subsystems wherever found to be practicable.
 - Provide for periodic updates of economic criteria/ evaluation so that your plan is up to date with current technology and energy costs.
- **Performance measures**
- Provide performance measures to track your progress towards full implementation of Section 103 of EAct. Performance measures can take a number of forms, but should relate to the overall goal of installing meters and advanced meters wherever found to be practicable.

FUTURE ASHRAE GUIDANCE

It should be noted that in January 2006, a Scoping study by an ASHRAE committee was developed to determine technically how best to measure and report performance of

new and existing buildings. If and when ASHRAE guidelines are developed, federal agencies will have a good technical tool to guide and supplement their efforts to meet the metering intent of EAct2005.

A LOOK AHEAD

Imagine a world in which any federal energy manager can sit at his or her computer, log onto the internet, and check the energy performance of any building anywhere in the agency's inventory. Imagine a building manager who knows exactly what's going on with every aspect of the boiler system, the chiller, the economizer, the steam distribution system, and gets regular automatic feedback and diagnostic reports which enable full optimization of all aspects of the building's energy systems. Imagine a world where everything is in a state of being fully commissioned, operating exactly as the building owner/operator/occupants desire and at optimum efficiency. That world is not even remotely possible without the capabilities of advanced metering systems.

Given the ever increasing complexity of buildings, and the interactions of systems within those buildings, the increasing volatility of energy prices and supplies, and the constant pressure to increase energy efficiency in our buildings, advanced metering systems are here to stay.

SUMMARY

Section 103 of EAct 2005 mandates the installation of meters and advanced electric meters on all Federal Buildings by 2012 using guidelines developed by the US Department of Energy in consultation with other agencies and organizations. The Department of Energy developed guidance in February 2006

(http://www.eere.energy.gov/femp/pdfs/adv_metering.pdf) for federal agencies to

develop a metering and implantation plan by August 3, 2006.

This guidance clearly defines the planning process, the various approaches to metering, benefits and provides planning templates. This legislation will enable Federal energy managers to better conserve energy and resources, given the ever increasing complexity of buildings, and the interactions of systems within those buildings, the increasing volatility of energy prices and supplies, and the constant pressure to increase energy efficiency in our buildings. If the reader needs additional information on how these guidelines were developed, they should contact the FEMP program manager in Washington, DC. (3)

REFERENCES

1. http://energy.senate.gov/public/_files/ConferenceReport0.pdf
2. http://www.eere.energy.gov/femp/pdfs/adv_metering.pdf
3. Haberl, J., Case, M., "Scoping Study: Protocols for Measuring and Reporting on the On-Site Performance of Buildings Except Low-Rise Residential Buildings." *ASHRAE Study – Protocols for M&V*, January, 2006