

A PRIMER ON SMART METERING

WHERE SMART METERS MAKE \$ENSE

FALL 2003

Evolving energy markets have brought many changes, among them an expanded capability for tracking energy use on a real-time (or near real-time) basis. This is known as interval or “smart” metering. This primer is designed to help energy users in New York State understand the value of smart meters and make well-informed decisions about buying and using them. As regulations and technology continue to evolve, so does the role of smart meters.

Transition from a regulated utility structure to a competitive market has led to wholesale market price volatility. Smart metering can supply the types of energy data, and ways to analyze them, that customers need to control their costs in this evolving market.

As the value of better energy use data rises, the cost of smart metering to access it is dropping. For participants in demand response programs, the New York State Energy Research and Development Authority (NYSEDA) offers incentives to aid in the adoption and deployment of this technology.

REASONS FOR USING SMART METERS

- Identify and implement operational strategies to control load factor and peak-load requirements and to reduce energy waste
- Expand the capacity to manage operations in response to potential price volatility
- Understand and improve consumption patterns to secure better pricing from the retail

- Participate in demand response programs that pay end users to manage loads as needed to improve grid reliability during peak demand periods
- Measure and verify anticipated energy savings from energy-efficiency modifications, and
- Help monitor and address complex issues such as power quality.

GETTING STARTED

Begin by assessing metering needs and goals, such as facility cost allocation, monitoring/verification of savings, data acquisition and analysis, integrating with present energy management systems and procedures, and meter maintenance. If reading or maintaining existing meters has been an issue in the past, you may wish to include (in your metering design) automated meter reading and routine maintenance through an outside contractor. A wide range of options is available to help customers acquire and successfully use smart meters:

- Buy and install your own meter
- Buy only the data others obtain for you from the smart meter
- Build your own system for tracking and using your new information, and
- Select consultants to interpret the data for you.

You may already have a smart meter at your facility. If your utility bill is based on time-of-use, your present electric meter could provide you with

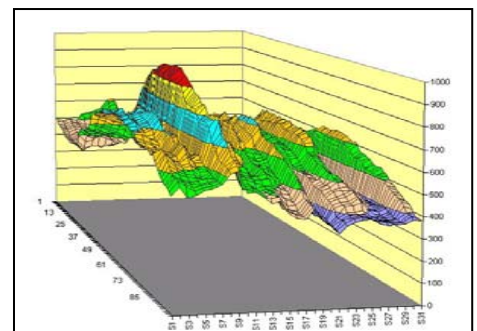
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DEFINITION

Smart Metering – a concept embracing two distinct elements: **meters** that use new technology to capture complex energy use information and **communication systems** that can *capture* and *transmit* energy use information as it happens, or almost as it happens.

TYPES OF METERS

Consumption meters measure flow of a commodity, *e.g.*, gallons of water, cubic feet of gas, or kilowatt-hours of electricity. More advanced meters can quantify how fast such commodities are being consumed, thereby determining peak demand (*e.g.*, kilowatts). Today’s smart meters can capture (and depending on configuration) record more detailed data, such as the time usage occurred, power quality, power factor, spikes, individual power phases, grounding, load shape, and other variables.



Smart meter data may be formatted to create 3-D load profiles.

interval data, either directly through the meter's pulse outputs (with permission of the utility), or through the utility's records. Ask your utility service representative about this.

While no one specification will fit all customer needs, a good starting point is the University of New Mexico metering spec documents available from the Association of Higher Education Facilities Officers (APPA). See "Other Resources" on page.4.

GETTING THE DATA

Standard electromechanical meters function much like a hatch mark used to record repetitive events. They count each kilowatt-hour of electricity as it passes through the meter and typically retain only the value of the highest peak. They are unable to record when that peak actually took place.

By contrast, smart meters quantify energy use during defined time intervals and record data on consumption, demand, and time of use. Such meters also calculate the maximum rate of use (demand) in fixed or rolling time intervals (e.g., 15 minutes). They can capture and communicate this information on a real-time (or nearly real-time) basis to a broad audience (e.g., energy managers, utilities, power marketers, ISO). Many smart meters are able to communicate through a variety of means including radio, telephone, wire, local computer networks, and the Internet.

CAPTURING THE VALUE

The value of smart meters is only as good as the decisions they bring about. Such decisions may include buying and using electricity more intelligently. With standard meters,

the cost of commodity power was based mainly on the volume purchased. Today, there is recognition that peak-system requirements and customer load shapes have a significant impact on the costs of generating, transmitting, and distributing electricity. Including facility-specific interval load data in a request for bids may secure a more competitive price than using only monthly utility billing data.

Smart meters can allow customers to identify and assess, on a near real-time basis, the fiscal impact of individual electric load profiles. The market prices of electricity change every 15 minutes. Customers who know their actual use during those intervals are better prepared to understand (and, through their actions, reduce) their real-time cost for electricity. By integrating smart metering with building management systems (BMS), automatic functions may be enabled, or operators may be warned as peak use approaches critical price thresholds or system constraints.

Data from smart meters (both real-time and near real-time) can help highlight anomalies, identify energy-wasting equipment, and may be used to diagnose solutions. Such data can help quantify baseline energy use profiles and load shapes before, during, and after the installation of consumption and demand-reduction technologies. Such independently validated and verified data that meets vendor requirements for billing reliability is critical to documenting demand reductions and energy savings.

DATA DISTRIBUTION

Advanced metering supports direct access to critical consumption data. It

offers the customer ready access to usage data when needed (instead of incurring the delay that may occur with monthly bills) and may provide the ability to view, manipulate, and share it in a useful format via software. This information may be shared internally within your organization (or with others) to assess load profiling details as they occur, providing the opportunity to modify operations accordingly.

When data is available through an Intranet or secure Internet connection, a broad range of options becomes available, including automated changes to mechanical/lighting systems that are integrated with real-time market conditions.

MODIFYING OPERATING PRACTICES

A good example of such change is the avoidance or reduction of use during high cost times. At such times, customers employing smart meters could choose to:

- Reduce electric use at times of high short-term market pricing
- Shift loads to off-peak times
- Turn on an on-site generator, or
- Switch to equipment that relies on a different energy source, such as absorption chillers.

When practical from an environmental, economic, and engineering perspective, various distributed (on-site) generation technologies can be useful for shifting loads away from short-term high-market prices.

On the other hand, one may simply choose to pay premium prices to continue using electricity. Smart metering will help quantify the dollar impact of that choice. (continued)

DISCLAIMER

The field of smart metering is changing rapidly, and this primer only offers a point-in-time snapshot of this dynamic industry. This informational brochure was prepared for NYSERDA by ARAMARK FACILITY SERVICES as an introduction to this complex issue. Neither NYSERDA, its members, nor any person acting on their behalf: (a) makes any warranty, express or implied, with respect to the use of any information, apparatus, method, or process contained, described, or referred to herein; or (b) assumes any liabilities with respect to the use of, or for damages resulting from the use of, any information, apparatus, method, or process contained, described, or referred to herein.

The power marketplace is not the only source of pricing signals. Short-term generation, transmission, and/or distribution constraints can trigger rewards for adjusting operating practices. The NYISO's Emergency Demand Response Program (EDRP), Day Ahead Demand Response Program (DADRP), and Special Case Resources (SCR) all offer incentives that support better management of peak electric loads.

Attention to opportunities to modify load is essential to maximize the value of the information obtained from advanced metering technology. Smart metering will help customers understand both the cost and the value of such actions. Information on programs may be obtained from your

utility, the NYISO, energy service companies (ESCOs), energy marketers, and from NYISERDA at: www.nyserda.org/demandresponse.html

IS THERE A RISK TO INSTALLING SMART METERS NOW?

Metering technology is rapidly evolving, and not all smart meters are compatible with each other or with a single communications system. The American National Standards Institute (ANSI) has established a broad range of new metering standards, but the metering industry has not yet adopted a single communication standard or protocol. Likewise, translating metering data

into a format readily useable by an existing BMS may involve additional software or equipment. Utility rules for keeping this data secure and free from tampering may also limit or impact data accessibility.

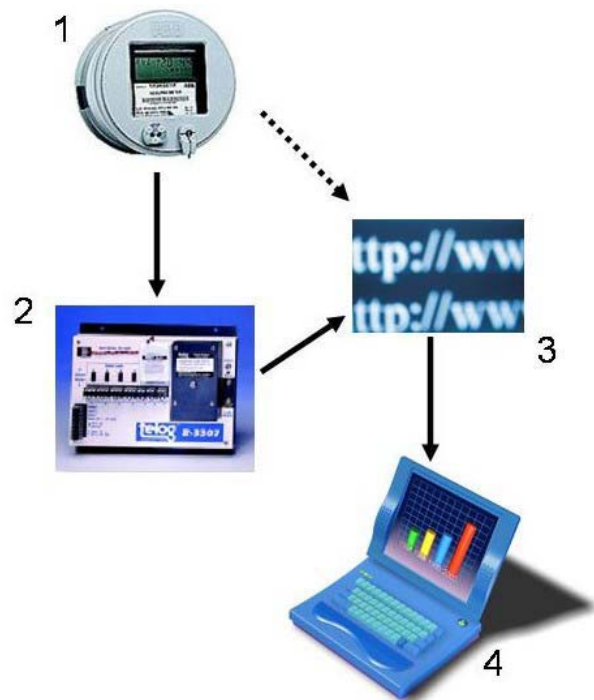
Attention is also needed with regard to a meter's general functionality and the capability of the microprocessors that form the backbone of new smart meters. Unless carefully specified, some meters may become obsolete before they have completed their useful life cycle. Expert engineering guidance (independent of vendors) may be needed. To reduce customer risk in migrating to newer systems, NYISERDA offers incentives to cover such costs.

TYPICAL METER DATA ACCESS SYSTEMS

A critical element of smart meters is the ability to communicate data. Though not all meters can communicate directly with microprocessors, some meters can emulate smart-meter technology by transmitting "pulse" outputs to a datalogger. These dataloggers transmit load data directly to a personal computer on site or, via modem, to a remote database. It is important to note, however, that each communication point can represent a potential opportunity for data degradation. Customers and other designated parties can gain access to this data on site or remotely, depending on communications configuration.

The diagram (at right) outlines consumption data as it travels from the meter (1) through a datalogger (2) [or directly, if the meter is so equipped] through an intranet, internet, or modem (3) to a remote PC (4).

To get the most value out of his metering, the customer needs to be able to analyze and evaluate the information as it is received and respond in near real-time.



METER APPROVAL PROCESS

The New York State Public Service Commission approves primary electric meters in response to recommendations from the State's utilities, ESCOs, certified MSPs, or large commercial/industrial TOU customers. Two examples of smart meters that have been approved are shown here. At left is the A3 model of ABB's Alpha meter—one of the first smart meters approved by the Commission. The Power Measurement Ltd. ION 8000 series meter (at right) and software system are integrated to avoid the need for third-party involvement in accessing or analyzing data. To learn more, go to: <http://www.pwrm.com/products/>



FOR ADDITIONAL INFORMATION

NEW YORK INDEPENDENT SYSTEM OPERATOR

The New York Independent System Operator (NYISO) manages New York’s deregulated wholesale electricity markets, handling financial transactions in both the day-ahead and real-time markets. It is responsible for ensuring that supplies match actual loads across all 11 regional transmission zones in New York State. It also works closely with:

- adjacent ISOs in New England, New Jersey, and Pennsylvania
- the Federal Energy Regulatory Commission and the New York State Public Service Commission (PSC), and
- the New York State Energy Research and Development Authority (NYSERDA)

to ensure that New York State can continue to maintain its high level of reliability

NYISO metering requirements for participation in its Day-Ahead Demand Response Program and its Emergency Demand Response Program may be found at www.nyiso.com.

NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY

NYSERDA helps ensure that New York State uses its energy resources wisely, economically, and in an environmentally sound fashion. It offers a variety of programs, including Peak-Load Reduction and Technical Assistance (for load control and energy efficiency), to facilitate participation in new demand-reduction initiatives and other conservation programs.

It offers incentives for the installation of smart meters and for systems and software to read them through the Internet.

For additional information on the following programs contact the individuals listed in the table at the bottom of this page.

NEW YORK STATE PUBLIC SERVICE COMMISSION (PSC)

The PSC has authority over approval of meters used in customer billing, commonly called “revenue-grade” meters. The PSC also accredits firms that offer advanced electric metering services.

Firms certified by the PSC as Meter Data Service Providers (MDSPs) are authorized to provide meter reading,

meter data translation, and customer association (with data), validation, editing and estimation. They may also install and read “shadow” meters which, while not revenue-grade, may be sufficiently accurate to provide the data needed to monitor and control loads in real-time. MDSPs may format and provide such data to customers, ESCOs, and appropriate government agencies (e.g., NYSERDA). MDSPs, however, are not authorized to install revenue-grade meters.

Many of New York State’s local distribution companies have developed or are developing systems that allow customers to access their own load profile data from the utility company’s database. MDSPs may also assist with that process.

Firms certified as Meter Service Providers (MSPs) are authorized to provide metering and metering services, and the sale, installation, maintenance, testing, and removal of meters and related equipment. MSPs are authorized to install revenue-grade meters used by utilities in the electric billing process. All utilities are already certified as MSPs.

Information on certified New York State-approved Meter Data Service Providers (MDSPs) and Meter Service Providers (MSPs) may be found at: http://www.dps.state.ny.us/MSP_MDSP_Certified.html

NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY

Toll-Free at 1-866-NYSERDA (1-866-697-3732) – www.nyserda.org/funding.html

| PROGRAM | PROJECT MANAGER | E-MAIL | NYSERDA EXTENSION |
|--|-----------------|--|-------------------|
| Peak-Load Reduction Program (including metering) | Chris Smith | cjs@nyserda.org | 3360 |
| Technical Assistance | Greg Lampman | ggl@nyserda.org | 3372 |
| Commercial/Industrial Performance Program | Eric Mazzone | efm@nyserda.org | 3371 |

OTHER RESOURCES

www.nyserda.org (NYSERDA)
www.dps.state.ny.us (Public Service Commission of New York)
www.nyiso.com (New York Independent System Operator)
www.amra-intl.org (Automated Meter Reading Association)
www.eere.energy.gov/femp/newsevents/pdf/draft_adv_utility_%20metering.pdf (FEMP Advanced Metering Guide)
www.appa.org (enter ‘Energy CIMMS’ [without quotes] into the Search field to access metering specifications)
www.metering.com (Metering International magazine)