



Facility operators are discovering the value of submeters for accurate metering of electrical usage and demand for tenant cost allocation and billing, energy management, load shedding and verifying compliance with LEED, Green Globes, Energy Star and other private and public-sector energy initiatives.

Submetering for LEED v3 and Other Commercial and Public-Sector Energy Initiatives

The myriad of commercial and public-sector energy policies, while at times complicated, provides fertile ground for submeters as energy profilers and program verification tools. This white paper briefly overviews the main policies now in effect, with an eye to their potential for submeter usage.

In response to rising energy costs and tightening budgets, the last few years have seen a raft of new public and private-sector energy policy initiatives designed to micro-manage existing resources, reduce greenhouse gases and encourage, whenever possible, the move toward renewable, non-fossil fuel energy sources. Although similarities exist in many of these programs, the common thread in all of them is the clear need for advanced submetering hardware and automatic meter reading (AMR) software solutions to cost-effectively benchmark, measure and verify compliance with whatever program guidelines the facility is pursuing.

Submeters at a Glance

Unfortunately, the level of profiling needed by high-volume energy consumers is simply unobtainable using the standard utility meter found at the main electrical service entrance. That's why more facilities than ever are using submeters as first-level data-gathering tools to literally save thousands of dollars in reduced energy costs. First introduced in the early 1980s, submeters are metering devices with monitoring capability that are installed on the facility side of the master meter to provide any or all of the following:

- Usage analysis and peak demand identification;
- Time-of-use metering of electricity, gas, water, steam, BTUs and other energy sources;
- Cost allocation for tenant billing;
- Measurement, verification and benchmarking for energy initiatives, including LEED Energy & Atmosphere (EA) and Water Efficiency (WE) credits;
- Load comparisons;
- Threshold alarming and notification;
- Multi-site load aggregation and real-time historical monitoring of energy consumption patterns for negotiating lower energy rates, and more.

Of the three main submeter types shown below, the first two—feed-through and current transformer (CT)-based—are socket-type meters. CT-style socket meters are used with loads of 400A and above. In commercial applications, they may be specified but will take up a lot of space in the electrical room due to the need for CT cabinets and the meter bases. The extra space requirement cuts into the available rental space, which is undesirable in the commercial marketplace. Another major disadvantage in many jurisdictions—socket meters are not UL listed. The third type is the electronic submeter, a non-socket device that provides clear advantages over the previous two, as shown below.

SPECIFICATIONS	SUBMETER TYPE		
	Socket Type Electromechanical/Solid State		Electronic Non-socket Type
	Feed-thru Type	Current Xfmr Type	
INSTALLATION			
Installed Cost (estimated)			
Stand alone, up to 320A, 3Ø	\$1,000	Not Applicable	\$700
Stand alone, over 320A, 3Ø	Not Applicable	\$2000 - \$5000	\$800
8-Meter Unit, 200A, 3Ø	\$16,000	Not Applicable	\$5,500
Installation Time	2–3 Hours	6–8 Hours	1 Hour
Power Interruption	2–3 Hours	6–8 Hours	None
Amperage Limitations	320 Amp, Max.	None	None
Space Requirements	2 Square Ft	11.7 Square Ft	0.25 Square Ft
Installation Location	Utility Room	Utility Room	Anywhere
FEATURES			
Multiple Meter Units (MMU)	Yes	Yes	Yes
Size of 8-Unit Cabinet	18.1 Square Ft	18.1 Square Ft	2 Square Ft
Digital Readouts	Optional/Yes	Optional/Yes	Standard
Reset Capabilities	No/Yes	No/Yes	Standard
Multiple Load Monitoring	No	No	Yes
Subtractive Load Monitoring	No	No	Yes
Monitor Specific In-Panel Circuits	No	No	Yes
Amperage Modification in Field	No	w/ CT Change	Yes
Meter UL listed	No	No	Yes
ENHANCEMENTS			
Digital-to-Analog Profiles	Yes	Yes	Yes
Pulse Outputs	Yes	Yes	Yes
Timed Metering	Yes	Yes	Yes
Software Monitoring	Yes	Yes	Yes
Upgradeable in the Field	No	No	Yes
Power Quality Functions	Available	Available	Yes
Net-Metering Capability	Yes	Yes	Yes
Form C Control Relay Output	No	No	Yes

Source: E-Mon, LLC

Non-socket-type electronic submeters are less expensive initially, quicker and easier to install and offer superior performance and options compared to other types.

Since their introduction to the market, submeters have grown dramatically in functionality and usefulness, providing great value to facility owners and operators as “front-line” energy data gathering tools in an era of rising utility costs and tightening budgets. Today submeters are coming out of the electrical room onto the factory floor and into building lobbies to give users, tenants, employees and others visibility on actual energy usage and its impact in terms of CO₂ emissions, kWh dollars and other parameters easily understood by

laymen. Submeters not only improve the facility bottom line, but facilitate compliance with major energy initiatives while also encouraging every level of the enterprise to become a stakeholder in the energy management and conservation process.

Leading Commercial Sector Energy Initiatives

Following are five of the leading private-sector energy initiatives impacting the industrial, commercial, institutional and multi-family facility landscape. In all cases, it is easy to see how submetering solutions from leading suppliers like E-Mon—readily available through most electrical wholesalers and distributors—can directly facilitate compliance with these policies in specific application areas.

LEED v3

Since its establishment in 1993, the U.S. Green Building Council's "Leadership in Energy and Environmental Design" (LEED) building-performance rating system has moved into virtually every U.S. commercial and industrial building sector. In the process, LEED has gone far toward generating industry-wide awareness and acceptance of green design, operations and maintenance through deployment of guidelines to help facility professionals navigate through complex sustainability projects.

Released in April 2009, LEED version 3, also called LEED 2009, poses increasingly stringent requirements compared to previous revisions, including a 10 percent reduction versus ASHRAE 90.1-2007 for new buildings, as well as an Energy Star performance rating of at least 69 for existing facilities. Alternative energy use, metering, commissioning and other energy-efficiency strategies that reduce carbon-dioxide emissions are weighted more heavily in LEED 2009. For example, in the new version of LEED for Existing Buildings-Operations and Maintenance (EBOM), facilities can obtain up to six points for using renewable energy, as opposed to only four under the previous LEED version.

Another key difference in terms of credit requirements in LEED for New Construction (NC) is a 20 percent reduction of in-building water use that is now a prerequisite, not an optional credit as before. Additionally, the USGBC is now asking project teams to upload building energy and water data for a minimum of five years, via a free online tool, to create a database for analyzing sustainable versus traditional building water and energy use over time.

An important LEED v3 change occurred in the rating system itself. Credits have been realigned along a 100-point scale that allows six more points for innovation and four for the newly added regional priority subcategory. In LEED v3, certification levels are based on the following points structure: 40-49, Certified; 50-59, Silver; 60-79, Gold; 80 or above, Platinum.

LEED v3's energy section offers some of the building assessment system's most targeted guidelines for decreasing energy consumption and increasing alternative energy use. LEED v3 also provides guidance on commissioning, so that facility executives can be sure their systems are functioning at peak efficiency. The backbone of the measurement and verification (M&V) process required for LEED certification at every level is the electric submeter. As the following charts show, the primary building performance category in which submetering plays a key role is the Energy & Atmosphere (EA) subset that runs all of the major assessment categories, including Commercial Interiors (CI), Existing Buildings-Operations & Maintenance (EBOM), New Construction (NC) and others.

**LEED 2009 New Construction and Major Renovations
(NC) Submetering Points Chart**

Section Title & Credit	Credit Description	Points	Credit Intent
Energy & Atmosphere (EA) Prerequisite 1	Fundamental Commissioning of Building System	0	Verify project's energy-related systems are installed and calibrated according to project documentation.
EA Prerequisite 2	Minimum Energy Performance	0	Establish building's minimum energy-efficiency level.
EA Credit 1	Optimize Energy Performance	Up to 19	Achieve higher energy-efficiency levels to reduce economic impact of higher energy use on environment.
EA Credit 2	On-site Renewable Energy	Up to 7	Recognize increased levels of self-supplied on-site energy production reducing impacts of fossil fuel use.
EA Credit 3	Enhanced Commissioning	Up to 2	Begin commissioning process early in design phase, execute additional activities after performance verification is complete.
EA Credit 5	Measurement & Verification (M&V)	Up to 3*	Provide for on-going accountability of building energy consumption over time.
EA Credit 6	Green Power	Up to 2	Encourage development and use of grid-provided renewable energy sources on a net zero pollution basis.
Regional Priority Credit 1	Regional Priority	Up to 4	Provide an incentive for achieving credits that address geographically specific environmental priorities.

*Up to 2 in LEED for Schools system

Source: E-Mon, LLC

Submeters contribute directly toward points under several LEED green building certification categories. Any energy initiative that requires measurement and verification of program guidelines—and they all do—is fertile ground for submetering.

**LEED 2009 Existing Buildings Operations & Maintenance
(EBOM) Submetering Points Chart**

Section Title & Credit	Credit Description	Points	Credit Intent
Water Efficiency (WE) Credit 1	Water Performance Measurement	Up to 2	Measure building and subsystem water performance over time to identify consumption patterns additional water savings opportunities.
WE Credit 3	Water-Efficient Landscaping	Up to 5	Limit or eliminate irrigation use of potable water or other natural surface/sub-surface resources on or near the project site.
WE Credit 4	Cooling Tower Water Management	Up to 2	Reduce potable water consumption for cooling tower equipment through effective water management and/or use of potable makeup water.
Energy & Atmosphere (EA) Prerequisite 2	Minimum Energy Efficiency Performance	0	Establish minimum energy-efficiency performance level relative to similar-type buildings to reduce economic impact of higher energy use on environment.
EA Credit 1	Optimize Energy Efficiency Performance	Up to 18	Achieve higher energy-efficiency levels relative to similar-type buildings to reduce economic impact of higher energy use on environment.
EA Credit 2.1	EB Commissioning: Investigation & Analysis	Up to 2	Develop processes to (a) understand the building's major energy-using systems, (b) optimize energy performance and (c) achieve energy savings.
EA Credit 2.3	EB Commissioning: On-going Commissioning	Up to 2	Address changes in facility occupancy, use, maintenance and repair by periodically adjusting/reviewing operating systems and procedures to optimize energy efficiency and provided services.
EA Credit 3.2	Performance Measurement: System-Level Monitoring	Up to 2	Provide accurate consumption data to support energy management and identify opportunities for additional energy-savings improvements.
EA Credit 4	Onsite & Offsite Renewable Energy	Up to 6	Encourage development and use of renewable energy sources to reduce environmental and economic impacts of fossil fuel energy use.
Regional Priority Credit 1	Regional Priority	Up to 4	Provide an incentive for achieving credits that address geographically specific environmental priorities.

Source: E-Mon, LLC

LEED 2009 Commercial Interiors (CI) Submetering Points Chart

Section Title & Credit	Credit Description	Points	Credit Intent
Energy & Atmosphere (EA) Prerequisite 1	Fundamental Commissioning of Building System	0	Verify project's energy-related systems are installed and calibrated according to project documentation.
EA Prerequisite 2	Minimum Energy Performance	0	Establish minimum energy-efficiency level for tenant space systems to reduce economic impact of higher energy use on environment..
EA Credit 2	Enhanced Commissioning	Up to 5	Verify and ensure that the tenant space is designed, constructed and calibrated to operate as intended.
EA Credit 3	Measurement and Verification (M&V)	Up to 5	Provide for on-going accountability of building energy consumption over time.
EA Credit 4	Green Power	Up to 5*	Encourage development and use of grid-based renewable energy sources on a net zero pollution basis.
Regional Priority Credit 1	Regional Priority	Up to 4	Provide an incentive for achieving credits that address geographically specific environmental priorities.

*Up to 2 in LEED for Retail system

Source: E-Mon, LLC

LEED 2009 Core & Shell (CS) Submetering Points Chart

Section Title & Credit	Credit Description	Points	Credit Intent
Sustainable Sites Credit 9	Tenant Design & Construction Guidelines	1	Educate tenants about using sustainable design and construction features in tenant improvement build-outs.
Energy & Atmosphere (EA) Prerequisite 1	Fundamental Commissioning of Building System	0	Verify project's energy-related systems are installed and calibrated according to project documentation.
EA Credit 3	Enhanced Commissioning	Up to 2	Begin commissioning process early in design phase, execute additional activities after performance verification is complete.
EA Credit 5.1	Measurement and Verification (M&V)—Base Building	Up to 3	Provide for on-going accountability of building energy consumption over time.
EA Credit 5.2	Measurement and Verification (M&V)—Tenant Submetering	Up to 3	Provide for on-going accountability of building energy consumption over time.
Regional Priority Credit 1	Regional Priority	Up to 4	Provide an incentive for achieving credits that address geographically specific environmental priorities.

Source: E-Mon, LLC

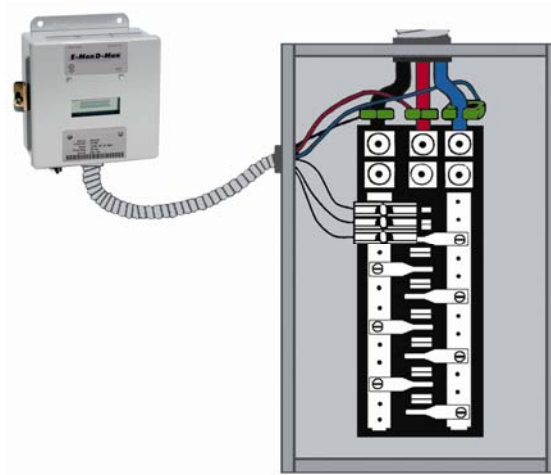
LEED for Schools 2009 Submetering Points Chart

Section Title & Credit	Credit Description	Points	Credit Intent
Energy & Atmosphere (EA) Prerequisite 1	Fundamental Commissioning of Building System	0	Verify project's energy-related systems are installed and calibrated according to project documentation.
EA Prerequisite 2	Minimum Energy Performance	0	Establish building's minimum energy-efficiency level.
EA Credit 1	Optimize Energy Performance	Up to 19	Achieve higher energy-efficiency levels to reduce economic impact of higher energy use on environment.
EA Credit 2	On-site Renewable Energy	Up to 7	Recognize increased levels of self-supplied on-site energy production reducing impacts of fossil fuel use.
EA Credit 3	Enhanced Commissioning	Up to 2	Begin commissioning process early in design phase, execute additional activities after performance verification is complete.
EA Credit 5	Measurement & Verification (M&V)	Up to 2	Provide for on-going accountability of building energy consumption over time.
EA Credit 6	Green Power	Up to 2	Encourage development and use of grid-provided renewable energy sources on a net zero pollution basis.
Regional Priority Credit 1	Regional Priority	Up to 4	Provide an incentive for achieving credits that address geographically specific environmental priorities.

Source: E-Mon, LLC

Demand Response

As the name implies, *Demand Response* programs allow utilities and consumers to manage electrical demand, measured in kilowatts or kW, in response to supply conditions. For example, by reducing consumption (kilowatt hours or kWh) in times of high prices or limited supply, pressure is relieved from the grid which keeps costs down. Many utilities provide incentives for users to voluntarily curtail their demand by monitoring their electrical usage and shaving peaks to provide a flatter energy profile. Submeters are effective in *Demand Response* scenarios, due to their ability to track kW and kWh for the purpose of shedding load, for verifying compliance with program regulations and other functions. Time-of-use (TOU) or real-time metering is especially useful where tariffs are tiered according to on-peak, mid-peak and off-peak schedules.



Whether designed in or retrofitted, submeters are installed on the “building side” of the main utility meter to measure energy usage from the enterprise level all the way down to a single device or circuit panel, as shown above. Sold through distribution, electric submeters are easily integrated with water, gas and other pulse-output utility meters, and energy intelligence software, to provide a total facility energy snapshot.

Energy Star

Introduced in 1992, the joint EPA/DOE *ENERGY STAR* program has expanded beyond office equipment products to major appliances, lighting, new homes and even commercial and industrial buildings. The *ENERGY STAR* building performance rating system has already been implemented in more than 60,000 buildings, and provides fertile ground for submetering-based performance assessment through:

- Data collection and management;
- Establishing performance baselines;
- Auditing and analyzing energy patterns and trends;
- Normalizing energy data for fair and accurate comparisons.

Green Globes

The Green Building Initiative’s (GBI) *Green Globes* building rating system claims to be a simpler, more user-friendly process for assessing and integrating green design principles for buildings. Submitted in 2006 to an independent review committee of more than 100 representatives from various green building interest groups, *Green Globes* is currently on final approach for acceptance as the first ANSI standard (GBI 01-200XP) for commercial green buildings. GBI also works with local chapters of the National Association of Home Builders (NAHB) to develop green building programs in the community, and is engaged in educating consumers on the value of green building techniques. As with other programs, submeters will provide the basic energy monitoring tool for measurement and verification in compliance with policy guidelines.



Submeters acquire the energy data using 0-2V output split-core current sensors that are installed non-invasively around the electrical feeds being metered. This eliminates having to power down the load and makes for a safer, faster install for the electrical contractor.

Standard 189P

Known as the “Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings,” *Standard 189P* claims to be the first green building standard in the U.S. developed for inclusion in building codes. Still under development as a joint proposal of the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE), the Illuminating Engineering Society of North America (IESNA) and the U.S. Green Building Council (USGBC), *Standard 189P* will provide minimum guidelines for green building practices for new commercial buildings and major renovation projects. Energy efficiency goals will include a minimum 30% reduction in energy cost (and CO₂ equivalent) compared to *Standard 90.1-2007*.

A Sampler of Public-Sector Energy Initiatives

Following are only four of the many leading energy initiatives now impacting the federal sector, as well as the industrial, commercial, institutional and multi-family facility landscape. In each case, it is easy to demonstrate how submeters—readily available through most electrical wholesalers and distributors—can directly facilitate compliance with these policies in specific application areas.

1. The *Energy Policy Act of 2005 (EPAAct)* contains several sections pertaining specifically to metering, including:

- Section 103—all Federal buildings must be metered by 2012;
- Section 1251—net metering;
- Section 1331—\$1.80 per square foot tax deduction for the design and construction of energy-efficient buildings. Note: Originally slated to expire at the end of 2008, the Emergency Economic Stabilization Act of 2008 (H.R. 1424) extended the “Energy-Efficient Commercial Buildings Deduction” to December 31, 2013, per Section 303.)

2. The *Energy Independence and Security Act of 2007 (EISA 2007)* is an omnibus energy policy designed to strengthen existing energy reduction goals and energy management requirements not only in government buildings, but throughout business and industry, as outlined in Title IV, Subtitles A-G. Section 543 states that energy consumption per gross square foot of Federal buildings shall be reduced—compared to 2003 levels—from 2% in fiscal 2006 to 30% in FY 2015. Section 434(b) further states that by not later than October 1,

2016 each agency shall provide for equivalent metering of natural gas and steam, in accordance with established guidelines. For the electrical contractor, this is easily and inexpensively accomplished, since advanced metering products from E-Mon and others provide an easy, economical way to interface existing water, gas, steam and other pulse-output utility meters into the AMR system—including inexpensively upgrading them to wireless capability.

3. The EPA's *Green Power Partnership* is a renewable energy awareness program that is designed to incentivize high-volume power users to offload part of their energy needs to renewable (non-fossil fuel) sources. The agency provides its customers with expertise in technology issues, identification of green products and services and promotional awareness. Participation levels are based on the amount of green power purchased from renewable energy sources constructed after Jan. 1, 1997, as a percentage of the using organization's total annual base load in kWh. For example, a facility that uses 1-10 million kWh per year would have to buy 6% of its energy from green power sources to qualify as a "Green Power Partner." To qualify as a "Green Power Leadership Club" member, 60% of the facility's annual power buy would have to come from renewable sources. Whatever renewable energy source is used, the electrical load still has to be monitored and reported to verify compliance, an ideal application for submeters and AMR software.

4. The DOE's Industrial Technologies Program (ITP) launched *Save Energy Now* to improve industrial energy management through no-cost energy assessments in partnership with national supply chains, industry associations, state and local agencies, utilities, etc. Energy assessments focus on process heating, steam, pumps, fans, compressed air, HVAC and others. *Save Energy Now* also offers a portfolio of resources, including training and education on best practices and tools, to help users become smarter on industrial energy conservation issues. Submetering opportunities in this environment include benchmarking equipment performance, diagnostics, tracking individual processes to isolate electrical loads, and more.

Bottom Line Considerations

Dramatic changes are afoot in the facility world, driven by the need to save more and more energy and cut operating costs even further. Building professionals will note in the bewildering array of energy programs now proliferating, obvious ways in which submeters and automatic meter reading (AMR) systems can help them measure, verify and report compliance with whatever requirements they may encounter. The old energy adage—"you can't manage what you don't measure"—is particularly true in today's energy-conscious, automated facility environment. The good news is, submeters offer an accurate, cost-effective tool for doing exactly that—while providing true scalability and the flexibility to quickly adapt to evolving operational requirements.

For Additional Information

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