Advanced Metering Primer

In addition to the energy information system (EIS) requirement, this credit also requires you to evaluate advanced metering for significant energy end uses. “Significant” end uses in this case means those greater than 20% of your building’s total annual energy use, minus plug loads. Advanced metering must also be in place for all energy types used at the building level.

The most likely energy end uses to constitute at least 20% of annual energy are heating systems in colder climates, lighting, cooling systems in warmer climates, domestic hot water in residential and hotel applications, ventilation systems, and data center energy use.

The following information can assist your investigation into advanced metering. This information is pulled from the US Department of Energy’s Metering Best Practices: A Guide to Achieving Utility Resource Efficiency, Release 3.0 published in March 2015.

Staffing resources

Getting the most out of EIS and advanced metering systems requires a hands-on approach from the building engineering team. Staff will need to receive training on system operations and functionality, and will need to dedicate time during ongoing operations to review and analyze data. Additional time will be needed to perform preventative maintenance to ensure systems are operating correctly.

The following examples from the Department of Energy guide provide guidance for estimating the amount of staff time needed for training and data analysis, as well as system maintenance. The time estimates in these examples are based on the following sample system:

- System assumption: A building with a total of 50 building-level and end-use meters serving electric, natural gas, and steam loads
- System analytical outputs: Daily plots of energy use presented as times-series metrics in engineering units in a dashboard environment
    - Daily time series electric, natural gas, and steam plots
    - Alarm sets enabled to highlight out-of-range values
    - Exception report comparisons, day-of-the week, month-of-the year
    - Drill-down capability to 15-minute reporting

Training and Data Analysis

- Resource commitments: System training (one time)
    - Staff training on system design, access, and applications: 1-2 days
    - Staff access and system navigation mastery: 1 week
    - Daily access for system review and assessment: 2 hours
- Resource commitment: System use (weekly for 50-meter system)
    - Commitment for data access, review, and assessment: 10 hours/week

Notes: The initial set-up of the analytical outputs will take additional time to develop and make useful for your organization's analysis needs. Once developed, the analytical outputs can be reused. Actions resulting from data assessments will require additional time and resources.

System Maintenance

- Resource commitments: System training (one time)
    - Staff training on metering technology and function: 2-4 hours per meter type
- Resource commitments: Functional inspections (monthly for 50-meter system)
    - Monthly commitment for preventive maintenance activities: 5 hours/month

Notes: With the advent of solid-state components and meters, routine system maintenance has been reduced—but not eliminated. Maintenance requirements will vary with meter type and should be included in standard preventive maintenance routines.

Metering system costs

Metering system costs will vary greatly depending on the systems to be metered, existing facility infrastructure, and site-specific design conditions. The costs include capital costs associated with the equipment, labor for the installation, and recurring costs.

- Capital costs include the purchase cost of the meter plus ancillary devices and the meter communication module.
- Installation labor includes time for a crew to install all of the hardware, connect the communications module, perform operational testing, and inspect the functionality of the metering system.
- Recurring costs include monthly communication fees, data collection, data storage, data analysis, and O&M costs.

When discussing pricing with providers, make sure that all of the costs above are addressed.

Meter performance criteria

The required performance of advanced meters will vary depending on the application and the needs of your facility. For example, revenue-grade meters are appropriate for applications such as tenant billing and to double-check the accuracy of utility bills. These meters will have the highest level of accuracy and reliability. On the other hand, revenue-grade meters are not necessary for monitoring energy end uses in the building or other meters applied purely for energy management purposes. Another consideration is that advanced metering must record data at a rate of 1 hour or less to comply with the LEED criteria.

Additional common performance metrics include accuracy, precision and repeatability, turndown ratio, resolution, ease of installation, straight pipe run requirements, and installation versus capital costs. Each of these metrics is described briefly below.

- A meter's accuracy is the difference between the measured value and the actual value and is often listed as a percentage of reading (+/- 2%). Make sure that the accuracy of your meters is appropriate for the application as higher accuracy meters are typically costlier and more restrictive to the application.
- Precision details a meter's ability to reproduce the same measured value under the same conditions.

- Turndown ratio refers to the flow rates over which a meter retains the stated accuracy and precision.
- Resolution is the smallest amount of energy consumption or flow that can be incrementally registered by the meter.
- Straight pipe runs apply to meters that measure fluids such as gas, chilled water, and hot water. To measure flow accurately, these meters must have a minimum length of unobstructed straight pipe required leading up to and immediately following the flow meter's location. This characteristic may impact which meters are feasible to install or may impact the cost of the project to provide the required straight run.

Meter technologies and communication

Advances in metering technology are reducing overall costs of meter installation, improving communication between meters and building automation and energy information systems, and increase the feasibility of capturing a finer resolution of energy data for energy end uses. Look for the following meter types to support your energy management system.

- Advanced (solid state/digital) Electric Meters: Advanced meters require no moving parts and include on-board memory and communication technology, making them good candidates for energy management and meeting the LEED criteria.
- Ultrasonic Flow Meters: For fluid applications, such as domestic, chilled, or hot water, ultrasonic flow meters are advantageous choices because they are non-intrusive to the fluid flow, can be externally mounted to the pipe, and can be used both for temporary and permanent metering.
- Communication: Ensure that advanced meters are capable of communicating data to the EIS via open-source communication protocol such as Modbus, LonWorks, or BACnet.