High-Level Requirements

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Introduction

This document is intended to provide a short, easily reviewable summary of what UtilityAMI members consider important for an Advanced Metering Infrastructure. These are the currently foreseeable requirements for AMI systems. AMI vendors should consider taking the information in this document into account when designing or developing AMI Systems or components. Each utility will be making its own independent decision on infrastructure and technology; consequently specific requirements will vary from utility to utility, but the members of UtilityAMI have produced this document to provide to vendors some general guidelines as to currently desired AMI system functionality.

Definition of Advanced Metering Infrastructure

An advanced metering infrastructure is a comprehensive, integrated collection of devices, networks, computer systems, protocols and organizational processes dedicated to distributing highly accurate information about customer electricity and / or gas usage throughout the power utility and back to the customers themselves.

Such an infrastructure is considered "advanced" because it not only gathers customer data automatically but does so securely, reliably, and in a timely fashion while adhering to published, open standards and permitting simple, automated upgrading and expansion.

A well-deployed advanced metering infrastructure enables a variety of utility applications to be performed more accurately and efficiently including time-differentiated tariffs, demand response, outage detection, theft detection, network optimization, and market operations.

Requirements

Requirement	Description	Benefits	Expected Features
Standard Comms Board Interface	A recognized open standard for the interface between a meter and its comm-unications board.	The ability to mix and match communications protocols and meters and prevent being locked into a single vendors' solution.	• Physical and environmental specs • Electrical specs • Protocol specs • Compatibility with existing form factors • Automatic identification of comms board to meter and network
Standard Data Model	A recognized open standard for the data to be exchanged between meters and the clients of metering data.	The ability to use multiple vendors' equipment in the same system without the cost of specialized adapters and gateways.	• Usable with multiple protocols • Usable over multiple media • Clear requirements for enforcing interoperability • Guidelines for extension
Security	Protection from impersonation, modification, replay, man-in-the-middle and eavesdropping attacks throughout the *whole* metering infrastructure using open standards.	The ability to protect customers' personal information in accordance with all applicable legal and regulatory requirements, including, without limitation, private usage information and billing data and prevent unauthorized actions.	• Encryption • Authentication • Credential Management • Intrusion Detection • Logging and auditing of all changes to data and configuration • Applied in all parts of the network • Applied to meter maintenance port
Two-Way Communications	The ability to reliably send data to the customer site and from the customer site over the same network.	The ability to receive confirmation that key commands such as curtailment requests, remote disconnects and meter program changes have been received and will be obeyed.	• Open standard protocols • Bandwidth sufficient for remote download • Easily extended • Secure • Does not interfere with other networks • On-demand reads with the ability to get consumption, load and voltage promptly (i.e. while on the phone with a customer).

Requirement	Description	Benefits	Expected Features
Remote Download	The ability to remotely update the metering settings, configuration, security credentials and firmware of all devices in the AMI System.	The ability to correct defects, enable new features and applications, change recording and reporting intervals, refresh security, and optimize network operation without the cost of sending personnel to the customer site.	• Version control • Minimal impact on operation • Secure • Auditable
Time-of-Use Metering	The meter can record what usage occurs within predefined intervals during the day.	Permits utilities to provide customers with information about their own usage and to implement advanced tariffs proposed by regulators.	• Remotely programmable down to 5 minute intervals • Remotely programmable number of rates and billing periods • Time synchronization to within 1.5 minutes across multiple time zones. • Time and date stamping of all measurements and logs.
Bi-Directional and Net Metering	The meter can record energy flow in either direction and calculate net usage.	Permits utilities to monitor and control distributed generation.	• Delivered and received energy consumption • Demand • Interval Data
Long-Term Data Storage	Storage of all data within the meter for at least 45 days, a minimum of two channels	Permits the network to accurately recover data after major failures.	• Expandable memory in meter • Longer-term storage (60 days) in concentrators • Concentrators only store data - may validate, but do not estimate
Remote Disconnect	The ability to disconnect or reconnect a customer's electrical service remotely. This capability may not be deployed to all meters in the AMI, but the AMI must permit it to be deployed at any customer site.	Cost savings from quicker switchover of customers and from not having to send personnel to site. Improves safety for field personnel when disconnect is for lack of payment. Forced load curtailment when disconnected.	• Integrated in meter • Switch position on display • Meter transmits confirmation of commands

Requirement	Description	Benefits	Expected Features
Network Management	The ability to remotely diagnose meters and network components, and to monitor and control the status of the AMI communications network.	Cost savings from not having to dispatch crews to diagnose problems and from earlier discovery of problems. Increase in overall availability of the network for more accurate billing, demand response, and reliability purposes.	• Remote self-tests • Statistics gathering • Trouble alarms sent spontaneously when necessary • Remote link enable/disable • Signal strength monitoring • Periodic gathering of event logs • Auditing of time synchronization • Detailed daily reports on the status of the network and changes to its configuration.
Self-healing Network	The ability of the network to detect and repair network problems automatically.	Increase in overall availability of the network for more accurate billing, demand response, and power system reliability purposes.	• Redundant signal paths • Switchover algorithms • Traffic balancing • Data and configuration are not lost over power failures • Greater than 98% of meters successfully respond to each read
Home Area Network Gateway	The AMI System acts as a communications gateway to devices at the customer site.	Permits applications such as remote load control, monitoring and control of distributed generation, in-home display of customer usage, reading of non-energy meters, and integration with building management systems.	• Open standard protocol • Customers can buy own equipment • Secure • Ability to read non-energy meters
Multiple Clients	The AMI System can permit multiple authorized clients within the utility and external to the utility to access the metering data.	Enables business cases for prepayment, flexible billing, online usage display, third-party aggregators, reading of other utilities' meters, real-time market operations, and other flexible means of providing service.	• On-demand, off-cycle polling • Individual addressing of meters • Aggregation of meters into arbitrary groups • Security, especially authentication and authorization checking of users

Requirement	Description	Benefits	Expected Features
Power Quality Measurement	Measurement and reporting of power quality information by the customer meter.	Efficiency and optimization of the distribution network using highly accurate data supplied by the AMI System.	• Voltage min/max/profile • Total Harmonic Distortion • Sags/Swells/Interruptions • Harmonics • Phase Voltage RMS • Close to real-time monitoring capability
Tamper and Theft Detection	The AMI System can detect and report tampering with the meter case or theft of energy.	Recovery of lost energy, repair and replacement cost reduction, cooperation with law enforcement.	• Inversion detection • Removal detection • Inactivity detection • Blink counts
Outage Detection	The AMI System can detect and report failures of meters due to power outages.	Faster response and recovery from outages.	• Reports of outage • Reports of restoration and the interval of outage • Standardized open protocol interface to outage management systems • Per phase outage detection
Scaleability	The growth of the AMI System is not limited by the constraints of any particular component.	Permits capital costs to be recovered and enables growth to be incremental rather than requiring large-scale component replacements.	• Modularity • Distributed (non-hierarchical) processing • Automatic detection of new additions • Configurable resource limits • Open standard interfaces
Self locating	The ability to use GPS, signal strength or triangulation to geographically locate the meter	In large utilities, meters may be installed but not recorded into the system. This requirement allows the utility to locate every meter either geographically or within a short distance of a geographically known device, such as a radio tower or transformer.	• Report latitude and longitude or nearest known communication d.