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Advanced Metering Infrastructure (AMI)

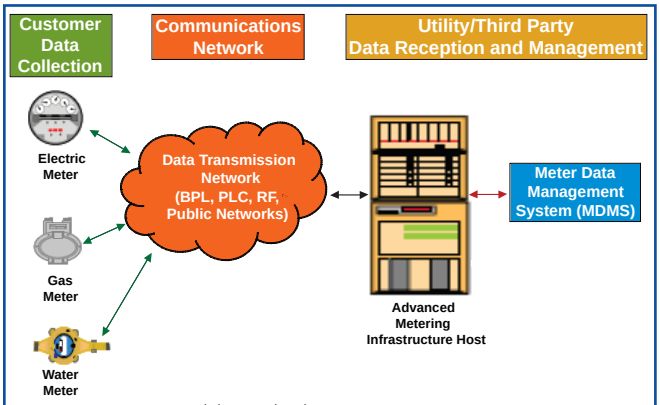

Figure 1: AMI Building Blocks[1]

Overview of AMI

Advanced metering systems are comprised of state-of-the-art electronic/digital hardware and software, which combine interval data measurement with continuously available remote communications. These systems enable measurement of detailed, time-based information and frequent collection and transmittal of such information to various parties. AMI or Advanced Metering Infrastructure typically refers to the full measurement and collection system that includes meters at the customer site, communication networks between the customer and a service provider, such as an electric, gas, or water utility, and data reception and management systems that make the information available to the service provider.

AMI Components

Figure 1 shows the building blocks of AMI. The customer is equipped with advanced solid state, electronic meters that collect time-based data. Meters include all three types—electricity, gas, and water meters. These meters have the ability to transmit the collected data through commonly available fixed networks such as Broadband over Power Line (BPL), Power Line Communications (PLC), Fixed Radio Frequency (RF) networks, and public networks (e.g., landline, cellular, paging). The meter data are received by the AMI host system and sent to the Meter Data Management System (MDMS) that manages data storage and analysis to provide the information in useful form to the utility. AMI enables two-way communications, so communication from the utility to the meter could also take place.

AMI Costs and Benefits

Costs

The total capital costs of deploying AMI include the hardware and software costs (meter modules, network infrastructure, and network management software for the AMI system), as well as installation costs, meter data management, project management, and information technology integration costs. Figure 2 shows the breakdown of AMI system costs based on an electricity use meter.

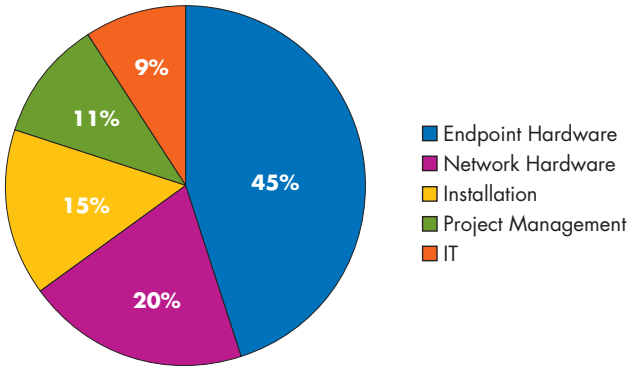

Figure 2: AMI System Cost[1]

AMI hardware costs have declined by more than a fifth over the past decade. By 2005-06, the average hardware cost per meter was estimated to be $76. The capital costs related to communications infrastructure installation ranges from $125-150 per meter.

Benefits

Benefits associated with AMI deployment can be broadly categorized as:

- System Operation Benefits
- Customer Service Benefits
- Financial Benefits

System Operation Benefits - primarily associated with reduction in meter reads and associated management and administrative support, increased meter reading accuracy, improved utility asset management, easier energy theft detection, and easier outage management.

Customer Service Benefits - primarily associated with early detection of meter failures, billing accuracy improvements, faster service restoration, flexible billing cycles, providing a variety of

time-based rate options to customers, and creating customer energy profiles for targeting Energy Efficiency/Demand Response programs.

Financial Benefits - these accrue to the utility from reduced equipment and equipment maintenance costs, reduced support expenses, faster restoration and shorter outages, and improvements in inventory management.

Market Penetration and Examples of AMI Deployment

Recent estimates indicate that AMI currently has a low market penetration of less than 6 percent in the U.S. The highest deployment is by electric cooperatives with a penetration close to 13 percent, followed by investor-owned utilities with close to 6 percent penetration. AMI installation varies widely across states too – the five states with the highest penetration of advanced meters are Pennsylvania, Wisconsin, Connecticut, Kansas, and Idaho.

Applying EPRI's IntelliGrid® Architecture for AMI Projects

EPRI offers an industry-developed set of tools, processes, and best practices collectively known as IntelliGrid® Architecture. Adaptable to individual company needs and reliant on open, standards-based systems, the IntelliGrid® Architecture makes it possible for utilities to design and deploy an advanced metering infrastructure that can be more easily integrated into a utility's enterprise systems, outage management, asset management, customer management, and other functions.

An AMI that follows IntelliGrid® principles will be

- More easily integrated with existing and future systems
- Flexible enough to adapt to new uses as they are discovered
- Lower in cost due to the use of standard interfaces that avoid "vendor lock-in"
- Secure and reliable because it was designed with those principles in mind from the start
- Resistant to obsolescence due to changing technologies

Issues That Require Further Considerations

There are a number of issues that need to be addressed for increasing deployment of AMI systems. These issues primarily pertain to metering systems for electricity, which is most frequently discussed in the industry. Some of the issues are:

AMI Specifications

Consistent specifications for AMI systems may be difficult to achieve in the short-term due to variations in interval data requirements, based on billing and settlement requirements in wholesale markets. Developing consistent specifications will be critical for supporting investments in AMI.

AMI and Demand Response Networks

In the context of Demand Response (DR), there is a need to develop a consistent approach for integrating the communication backbone for providing price signals or notification of system emergencies with the AMI system.

Interoperability and Standard Interfaces

AMI systems offered by different vendors will be required to conform to standards established by the American National Standards Institute (ANSI). Also, there is a need to develop standard interfaces between systems, such as between the host AMI system and MDMS, between MDMS and other utility data systems, as well as interfaces with DR networks and systems.

Security

Security issues associated with meter data transmission from the customer meters to the AMI host system will need to be addressed to ensure that only authorized devices provide and receive meter data.

Cost-Benefit Assessment

Uniformity in cost-benefit assessment across different business case assessments for AMI is essential. This will enable regulators to compare proposals and deployments across utilities under their review, and also allow electric utilities to comprehensively judge whether they should deploy AMI.

References

1. Assessment of Demand Response and Advanced Metering – Staff Report, FERC Docket AD06-2-000; August 2006

For More Information

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

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