

# AMI/Smart Grid: The Centerpiece of the Intelligent Utility

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AMI/Smart Grid initiatives have taken center stage as the principle strategy for meeting key regulatory requirements to improve network reliability while at the same time implementing new programs to reduce peak system demand. As states such as Ohio, Michigan and North Carolina begin to impose new demand response and energy efficiency guidelines, utilities are responding by introducing Smart Grid initiatives that combine the operational improvements of the intelligent grid with the data gathering capabilities of advanced metering infrastructure.

Webster tells us that the definition of intelligence is an ability to learn or understand from experience and to acquire and retain knowledge in order to respond quickly and successfully to a new situation. This definition pretty much characterizes the direction that utilities are taking today as they attempt to respond to increasing regulatory pressures by upgrading or adding new systems capable of acquiring and interpreting information.

Today's intelligent utility is all about gathering and processing large amounts of customer and operating data for improved network diagnosis and customer service. As utilities begin to harness the benefits of new smart grid technologies and AMI, they will be better able to meet the challenges of containing costs while improving service by increasing operational efficiencies. With many enterprise level systems such as geospatial information systems (GIS), customer information systems (CIS) and outage management being implemented to take advantage of this growing availability of information, AMI/Smart Grid technologies are becoming the principle source for acquiring important operating information on customer energy consumption, outage conditions, voltage and power quality issues, circuit loading and other key characteristics affecting network operation. AMI and the smart grid are increasingly becoming the heart beat and pulse of the intelligent utility.

## Central Role of AMI

Although the term smart grid covers a wide range of technologies, Advanced Metering Infrastructure (AMI) has often been described as the foundation or enabling technology for many technologies comprising the intelligent grid. At the heart of most AMI systems is the use of a two-way open standards based communications system connecting customer meters with the utility's enterprise level data management systems. Since AMI vendors have been working for years on solutions to communicate with large numbers, even millions, of smart meters for advanced metering purposes, it is not surprising that utilities have begun looking to their AMI solutions to supply the communications infrastructure needed to support operation of remote network devices such as switches, reclosers, line sensors and capacitor banks.

Cooper Power Systems, for example, has signed an agreement with Sensus Metering to license its FlexNet communications technology for transmission and distribution applications. This agreement will permit Cooper to use the FlexNet licensed frequency band for switching operations while the FlexNet system provides the necessary meter data collection functions. And S&C Electric has begun integrating its IntelliTEAM Automatic Restoration System with Silver Spring Network's Smart Energy Network to provide distributed, fault tolerant

communications over the SSN network to conduct remote switching operations. These and other similar arrangements underscore the potential for utilities to leverage one communications network for combined network operations using open standards and protocols that support a wide range of AMI, distribution network and substation automation functions.

So in a real sense the many years of AMI development have laid a foundation for what will likely be a much more rapid adoption of smart grid technologies and home area networking solutions that will be needed to improve utility operations and help address projected electric capacity shortages over the next 10-15 years. Utilities will increasingly rely on an AMI supported intelligent grid to accommodate the growing and often conflicting demands of customers, regulators and shareholders for improved reliability, operating efficiency and customer service.

### Increased AMI Deployment

If AMI is expected to play such an important future role in smart grid deployment, what is the state of AMI implementation in North America today? Recent research conducted by the Sierra Energy Group points to an increasing number of utilities that are studying, piloting or installing AMI solutions. Figure 1 below provides some insight into the level of AMI penetration that exists in the investor owned utility sector according to a recent SEG survey:

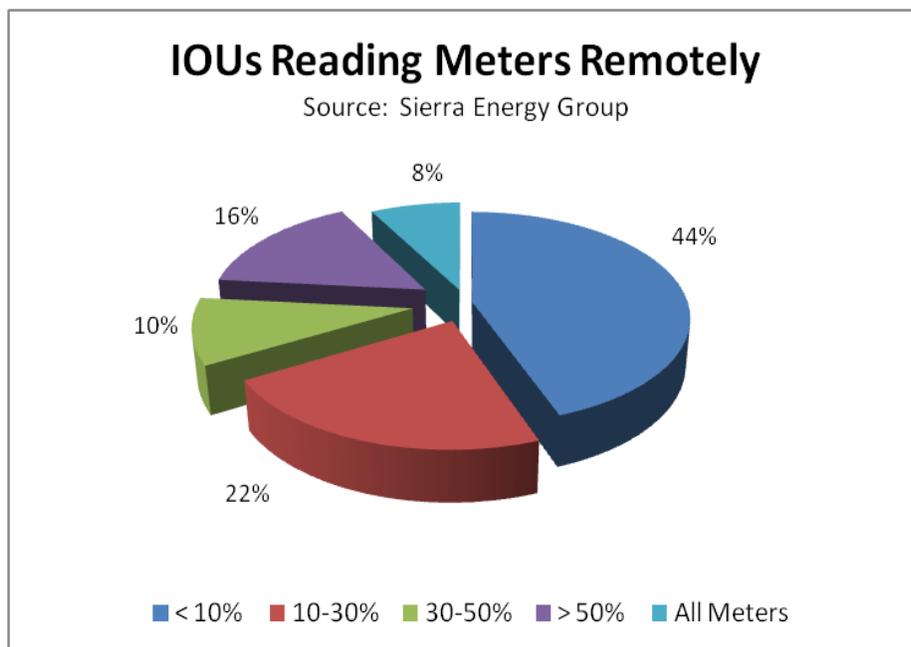


Figure 1

As Figure 1 indicates, fewer than 25% of the surveyed investor owned utilities have 50% or greater penetration of automated meters. This is partly attributable to the use of multi-year implementation schedules and extensive reliance on pilot deployments as prerequisites for AMI technology selection. In the next few years, this percentage should substantially increase as a number of large, full system deployments at utilities such as Pacific Gas & Electric, Southern

California Edison, the Southern Company and Portland General to name a few begin to make significant progress with their installation programs.

A common theme among these upcoming large deployments is their choice of AMI vendors such as Sensus, Silver Spring Networks and Itron's OpenWay that offer scalable, interoperable solutions capable of accommodating other smart grid technologies. It is clear from their selections that utilities have become aware of the potential that AMI holds for integration with the smart grid, as they are increasingly making open metering and communications standards an important requirement when preparing vendor RFPs.

Leveraging the capabilities of a single communications network is also being looked at by many utilities as a way to implement new smart grid technologies while spreading out a major component of AMI operating cost across many operating departments. As the number of utilities with less than 10% AMI penetration decreases, and as their AMI selections become known, it is likely that the trend toward open standards based solutions using a common communications network will become even more apparent.

### AMI/Smart Grid Drives Other Enterprise Solutions

While AMI and smart grid systems are receiving much attention, other enterprise solutions are being implemented that will continue to require their share of increasingly scarce capital dollars. Sierra Energy Group has conducted extensive research into the relative importance of AMI and smart grid solutions among a wide range of other intelligent utility solutions. As Figure 2 illustrates, AMI/Smart Grid technologies which include SCADA, substation and distribution automation, and outage management rank very high among investor owned utility initiatives.

| Importance of Enterprise Solutions<br>Within the Intelligent Utility<br>Source: Sierra Energy Group |                |       |              |              |              |                   |
|---|----------------|-------|--------------|--------------|--------------|-------------------|
| System  | 1<br>(Minimal) | 2     | 3            | 4            | 5<br>(High)  | Rating<br>Average |
| Outage Mgmt System  | 2.2%           | 1.1%  | 7.7%         | 36.3%        | <b>52.7%</b> | 4.36              |
| SCADA   | 2.2%           | 2.2%  | 15.4%        | 27.5%        | <b>52.7%</b> | 4.26              |
| Substation Automation   | 2.2%           | 3.3%  | 18.7%        | <b>40.7%</b> | 35.2%        | 4.03              |
| AMI/AMR   | 1.1%           | 3.4%  | 28.7%        | 26.4%        | <b>40.2%</b> | 4.01              |
| Distribution Automation   | 1.1%           | 2.2%  | 28.6%        | <b>36.3%</b> | 31.9%        | 3.96              |
| Customer Info. System   | 2.2%           | 7.8%  | 22.2%        | 33.3%        | <b>34.4%</b> | 3.90              |
| Demand Response   | 1.1%           | 11.1% | 26.7%        | 25.6%        | <b>35.6%</b> | 3.83              |
| Mobile Workforce Mgmt   | 3.3%           | 7.7%  | 30.8%        | <b>33.0%</b> | 25.3%        | 3.69              |
| Distribution Management System  | 2.2%           | 11.1% | 24.4%        | <b>44.4%</b> | 17.8%        | 3.64              |
| Asset Mgmt System   | 1.1%           | 15.4% | <b>35.2%</b> | 33.0%        | 15.4%        | 3.46              |

Figure 2

As utilities continue to develop Integrated Resource Plans and grapple with regulations requiring increased use of renewable energy sources, new energy efficiency and demand response programs are being developed that will require significant customer participation to achieve desired results. Many of the enterprise solutions highlighted in the SEG research are designed to improve operational efficiency and increase network reliability. However, AMI is increasingly being seen as a technology that can support energy efficiency and demand response programs by providing the advanced metering and communications necessary for load control and time differentiated rates.

The interval meter data and two way communications features provided by AMI systems support a growing number of customer-centric energy management functions that will create a new relationship between utilities and their customers. Home Area Networking (HAN) systems that integrate AMI with customer equipment over ZigBee, HomePlug and other network protocols are expected to play a prominent role in reducing energy use in the future. Time based energy rates, thermostat controls, in-home displays and other energy saving devices supported through these HAN networks will increase the customers' ability to control their energy consumption while helping utilities to shift peak system demand. Utilities' reliance on these shared benefits to achieve their IRP goals will change the relationship between utilities and their customers forever.

### **Increasing Customer Role in the Intelligent Utility**

The growing importance of customer energy management programs will change the utility/customer relationship by acknowledging a shared responsibility for meeting the nation's energy needs into the future. As states such as Ohio, Michigan and California adopt renewables targets that require utilities to become increasingly more reliant on customer energy efficiency and demand response programs, customer participation in these programs is essential and cannot be taken for granted. Utilities must therefore change their historic go-it-alone culture in favor of a more collaborative management philosophy that recognizes the important role of customers in meeting their energy objectives.

**About the Author:** Ed Finamore is Founder and President of Valutech Solutions, a management consulting firm specializing in utility automation and AMI. With over 30 years of utility industry related experience, Mr. Finamore has participated in many utility automation projects and has authored many articles on automation systems including AMI. He is a licensed professional engineer in Pennsylvania, and can be reached at 412 299-5684 or [EFinamore@valutechsolutions.com](mailto:EFinamore@valutechsolutions.com).