

Today's Smart Metering

The Challenges and Key Benefits of AMI, Demand Response and Smart Grid

A Call to Action

In the near future, all North American utilities will adopt smart metering and the supporting advanced metering infrastructure (AMI) at some level or another.

Some utilities will inevitably take a bare bones approach, doing just enough to meet the minimum requirements set forth in the Energy Policy Act of 2005 and other regulatory mandates. The more visionary companies, however, will use smart metering as an opportunity to positively influence their destinies, and ultimately, the direction of the North American electrical system. Encouragingly, it appears that most utilities favor the latter option based

on the innovative programs being initiated at large utilities throughout North America.

Until recently, utilities often undertook metering or demand response projects separately. Today most utilities embark on Advanced Metering Infrastructure (AMI) projects which include both metering technology as well as Demand Response (DR) functionality and often advanced in home devices such as In Home Displays (IHD's) and Programmable Communicating Thermostats (PCT's).





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These are often further integrated with other infrastructure improvements building toward the highly capable Smart Grid. Leading North American examples of these efforts are Hydro One's Smart Zone Project in Ontario, Duke Energy's smart grid effort, the Exelon/ComEd led work in Chicago and the Pennsylvania utilities emerging response to Pennsylvania Act 129.

The only sure thing is that doing *nothing* is not an option. The current state of the electrical infrastructure in North America is not sustainable. To change its course, utility companies must embrace a fresh approach to managing peak demand and system security—one that will drive market efficiency while supporting economic, environmental and social priorities.

Certainly this is a tall order. But Capgemini believes utilities can meet all of their priorities (and likely realize a host of other benefits) if the approach they adopt in managing peak demand and system security includes:

- Benefits that motivate consumers to embrace conservation and load management
- Business cases that look beyond the meter-to-cash process for benefits to justify investments in advanced meters, communications and data management infrastructure
- Transparency in the market that enables consumers to align in blocks of load that system operators dispatch more effectively as part of an efficient economic dispatch model

Though the utility industry is often accused of being slow to adopt and change-resistant, studies conducted by Capgemini continue to suggest otherwise. When 120 senior executives from utilities across North America were surveyed by Capgemini and Platts, the majority of the respondents cited AMI as the leading “new technology interest.” This interest has continued to build momentum. In fact, an extensive survey of North American regulatory executives conducted by Capgemini in collaboration with the National Association of Regulatory Utility Commissioners (NARUC) and the Canadian Association of Members of Public Utility Tribunals (CAMPUT) found that two out of three (67 percent) of the surveyed executives either viewed AMI as fundamental to their energy future or were actively reviewing the issue.

The State of the Market

The compliance-based industry in which utilities operate simply doesn't offer enough incentive for consumers, regulators or utilities to take the difficult steps necessary to make electrical energy markets operate efficiently. For example:

- Consumers want lower prices, higher quality service and absolutely expect the power to flow 24x7
- Some regulators impose long-term rate caps in an attempt to please consumers

- Regulated rates are not tied to wholesale markets where utilities purchase all or a portion of the power they sell
- In some wholesale markets, prices are set based on the rate of the high-cost producer
- Incentives for consumers to conserve are not significant enough to change their behavior
- Regulators impose conservation program requirements on utilities, and as a result, utilities suffer from decreased revenues which are directly tied to consumption

Despite these current realities, a number of factors are converging that will encourage and enable utilities, regulators and consumers to adopt innovative approaches to demand management and market efficiency. Among these enablers, a well crafted

AMI program that emphasizes a positive and impactful customer experience will be a key driver.

Convergence in the Marketplace

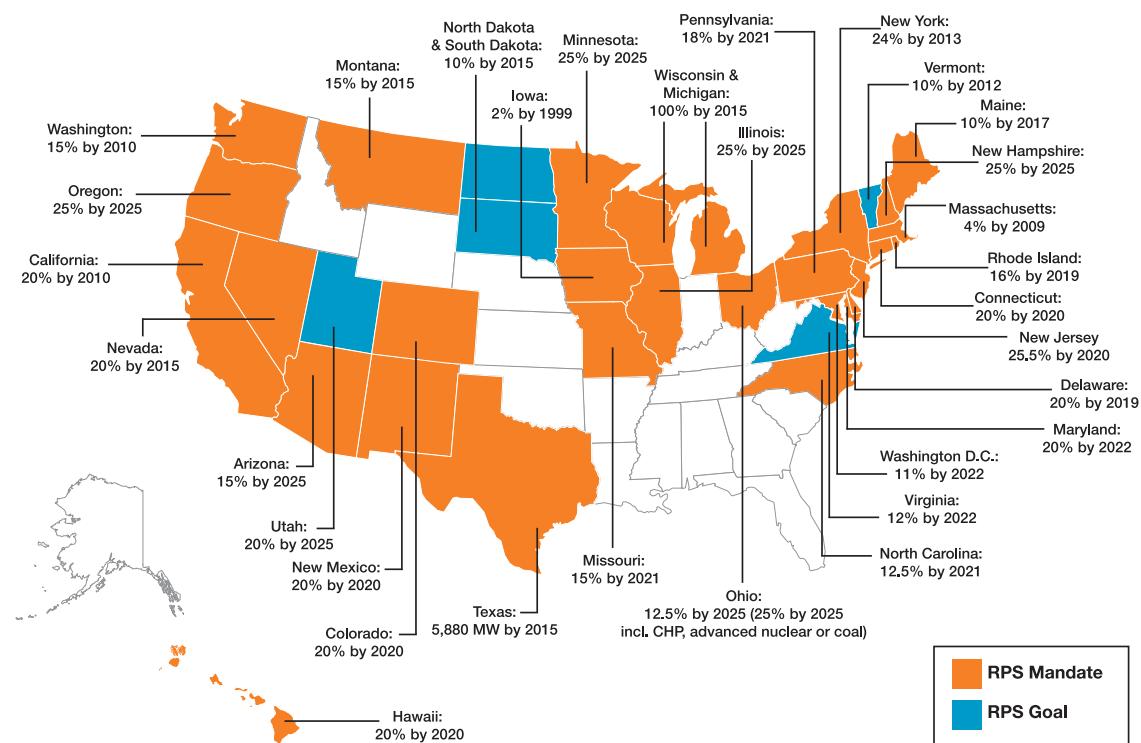
Utilities face a range of converging issues that will have a profound impact on their futures.

Regulation and Legislation

Governments around the world are making energy conservation, energy independence and global warming top-of-mind issues. A wide range of taxes, legislation and other policies designed to reduce the combustion of fossil fuels are being considered across the globe.

Among the most prominent examples are the increasingly prevalent Renewable Portfolio Standards (RPS) enacted by many North American jurisdictions.

U.S. Renewable Portfolio Standards





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Global Climate Change

As a society, we increasingly recognize how burning carbon-based fossil fuels adversely affects the environment. Momentum is building on many fronts to limit carbon emissions. Government, major corporations, citizen groups and utilities alike are promoting environmentally-friendly, green solutions. Many are insisting that behavior must change and that adoption of a conservation culture is critical.

Customer Expectations

As household electricity consumption increases year over year, peak loads are increasing and changes in consumption patterns are causing load factors to decrease. At the same time, consumers expect higher quality power to operate the increasing number of digital devices that we amass each year. Finally, consumers are demanding this improved quality at the low, stable price levels of the past while, at the same time, wanting a voice in how the power they consume is generated.

Aging Infrastructure

Much of the transmission and distribution infrastructure in North America is more than 50 years old and was designed to provide power in a different era. For many years, utilities typically underinvested in the grid infrastructure or neglected to make the significant, ongoing investments required to sustain the infrastructure over the next decade. As a result, most utilities are now at a crossroads—facing a decision that will be crucial to their futures.

The Opportunity

Make smart metering programs the foundation of Smart Grid or Intelligent Network initiatives. Look beyond the meter-to-cash process to generate value for all participants in the electrical energy market (including generators, system operators, transmission and distribution service providers, retailers,

energy service companies, consumers, regulators and legislators).

The investments required to implement smart metering are substantial. They usually cannot be justified based solely on the benefits realized from the elimination of manual meter reading, efficiency improvements in the revenue management process, improved control over tampering and theft, and improved outage notification and restoration.

These investments must be leveraged to support a broader set of benefits such as:

- Aggregating demand response and allowing it to be dispatched to reduce the need for peak generating capacity and ancillary services
- Refining grid planning processes to improve the efficiency and effectiveness of investments in the grid
- Improving grid monitoring and control processes to improve reliability, power quality and reduce losses
- Providing new value-added services to consumers that generate new streams of revenue and income

In addition to leveraging investments over a larger benefits base, performance measures for market participants must be better aligned; we must create a “win-win” environment. Good examples of this include the decoupling underway in a number of areas to allow distribution companies to separate their revenue from consumption. Decoupling gives distribution utilities incentives to truly embrace conservation and demand response programs without jeopardizing their ability to earn a return on their investments in distribution grid infrastructure.

The Challenge

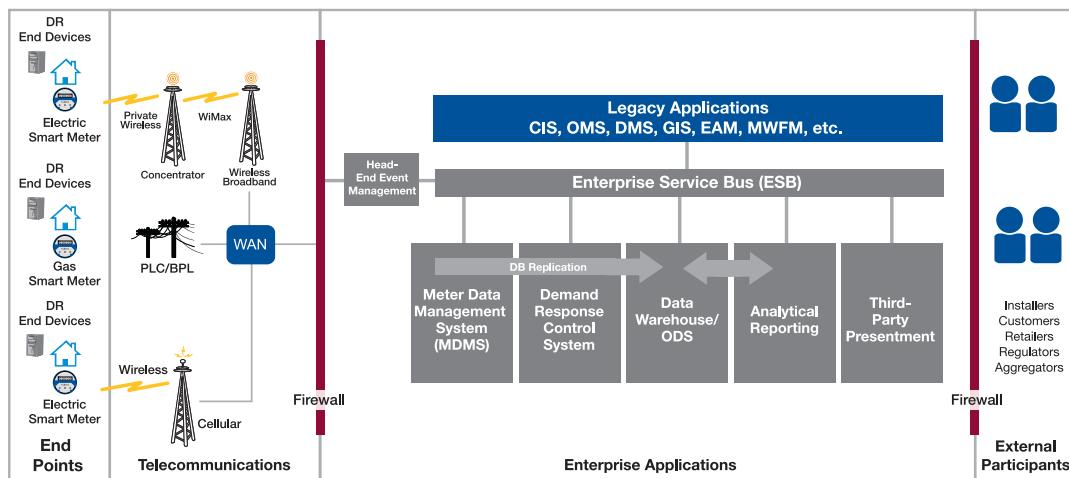
Utilities that structure their smart metering programs strictly from a revenue management perspective are selling themselves short. There's much more to smart metering programs than interval reads and time-of-use (TOU) rates.

Utilities should leverage their smart metering programs to make near real-time, point-of-use consumption data available to all participants in electrical energy markets. Access to data improves transparency in the market, and as a result, drives market efficiency. Efficient markets offer incentives to both generators and consumers that stimulate balanced investment and consumption decisions and in turn, support economic, environmental and social priorities. But today's utilities need to look beyond the technology into the opportunities and incentives the technology unlocks. Indeed, utilities must take a more comprehensive view of smart metering. More important than the technology itself is the role it plays in enabling system operators, retailers, load serving entities, aggregators and customers to use near real-time load data to improve market efficiency.

Another key challenge is influencing the behavior of consumers. When programs provide meaningful and rewarding incentives, customers can, and will, embrace conservation, and as a result, loads can be more effectively and efficiently managed.

In addition to the business and strategy challenges, implementing Smart Metering creates unique technology issues. New technology always involves unknowns, but the greater challenge in implementing Smart Metering is the potential impact on legacy applications such as CIS, OMS, DMS, GIS, etc. The legacy applications will often require both software upgrades and data refreshes. For example, with Geographic Information Systems (GIS), many utilities are realizing that they want to relate the new smart meters to the network grid model which is normally stored in GIS. The GIS may have developed the electric network as either an electric model or an asset model. If it was developed as an asset model and not as a detailed electric model, the utility may find it very difficult to relate the meters to the network or to use the resulting data for network operations applications. This often creates a need to upgrade the GIS software to enable complex electric network modeling and then a data refresh to establish the network model.

End-to-End Smart Metering Solution





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The other legacy applications will have similar challenges depending on the advanced business applications planned. A system inventory will need to be conducted on each legacy system to determine any shortcomings in functionality, architecture and data.

Capgemini believes the strategy for utilities should be proactive and that programs for action should include:

- A long-term approach around smart metering and its linkages to operational improvements, conservation programs, demand response, capacity planning and new revenue opportunities
- Providing end-user customers best-of-breed technology to enable maximum conservation/demand response with minimal adverse customer impact
- Engaging other stakeholders in their markets and developing consensus around synergies, critical success factors, required incentives and alignment of performance measures

- Formulating a business solution that is capable of meeting today's requirements while being scalable to deliver on future demand
- Organizing a team capable of implementing the chosen business solution

The Smart Solution

In Capgemini's view, effective smart metering solutions share a number of key components:

- **Meters:** Standards-based, two-way communication, remote connect/disconnect and interoperability with in-premise networks and devices
- **In-premise data presentation and control:** Near real-time display of usage and cost, receives market rate signal, supports customer demand response interaction
- **Meter data collection systems:** Two-way standards-based communication, multi-vendor solution compatible
- **Backhaul communications system:** Two-way, high bandwidth, utility or third-party owned
- **Event management system:** Interprets, filters and transfers event data to stakeholder systems which typically include OMS, DMS, CIS, and MDMS
- **Service-oriented integration architecture:** Standards-based, reusable service accommodates changing source and target applications
- **Meter data management system:** Asset management, data validation, editing and estimation (VEE), and publishing of billing determinates
- **Decision-support system:** Load forecasting, revenue protection, asset analysis and rate design

The Power of Partnership

Before embarking on a smart metering initiative, utilities should seek out partners who will work collaboratively with them to ensure the success of the initiative. Partners should have a proven track record, be prepared to sign up for end-to-end responsibility and be willing to have a stake in delivering results. For superior results, utilities should look for partners with deep industry experience in these critical areas:

- **Program Management:** Complex, multi-year, multi-program management experience with established methods and tools
- **System Integration:** Expertise in developing and managing data models, service-oriented architecture, interface design and development, configuration management, solution documentation and end-to-end testing
- **System Inventory:** Strong capability to perform thorough end to end system inventories and collaboration to develop system integration and upgrade plans

■ **Operational Services:** Ability to manage all field installation and activation procedures including meters, meter data collection, communications and in-premise data presentment and control elements

■ **Business Process Outsourcing (BPO)**

Hub Services: Extensive experience with billing and revenue management, meter data management, revenue assurance, demand response, distribution asset management, call center support, call center overflow and technology services, delivered from hub centers in the right locations

Ultimately, the utilities that are able to build a strong team of partners ready and willing to share their vision in managing peak demand and system security will be the utilities that lead the way in driving market efficiency—delivering a positive and sustainable impact not only on utilities but also on the North American electrical system.



About Capgemini and the Collaborative Business Experience

Capgemini, one of the world's foremost providers of consulting, technology and outsourcing services, enables its clients to transform and perform through technologies. Capgemini provides its clients with insights and capabilities that boost their freedom to achieve superior results through a unique way of working—the Collaborative Business Experience—and

through a global delivery model called Rightshore®, which aims to offer the right resources in the right location at competitive cost. Present in 36 countries, Capgemini reported 2007 global revenues of US \$13.6 billion and employs over 88,000 people worldwide.

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