DAVID MAYNE, DIGI INTERNATIONAL

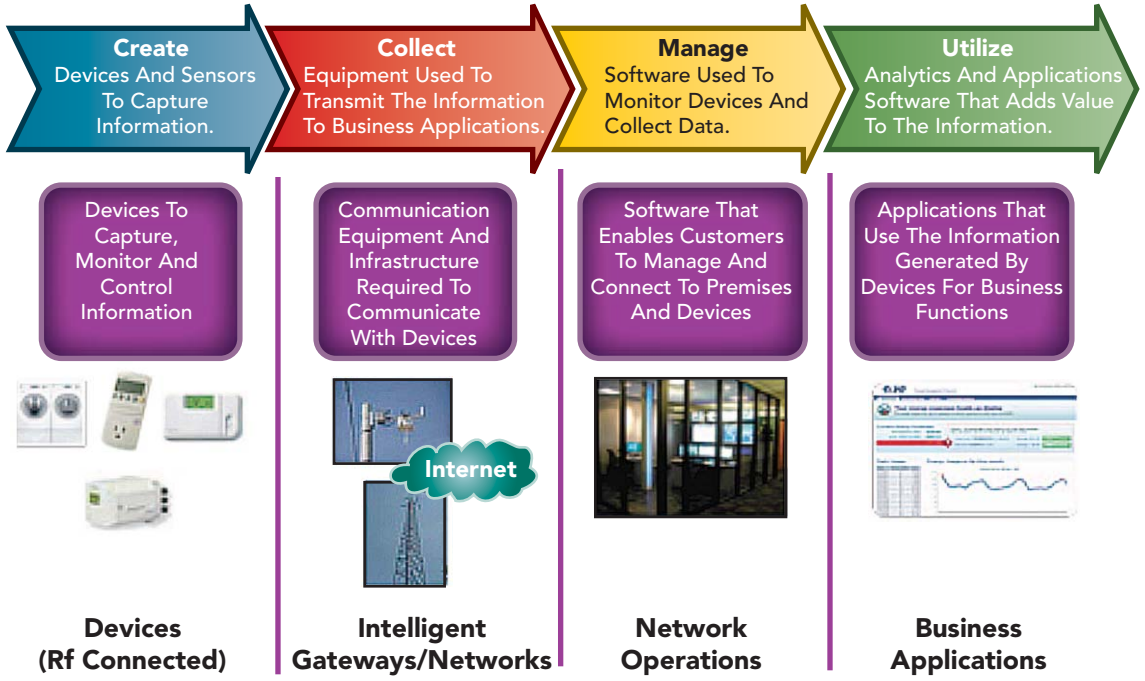
Merging Legacy Systems and the Smart Grid

Smart grid is a term that is now recognized by people who have never worked at a utility or related business. Stock indices exist that follow businesses developing products and services that enhance the grid. Legislation focused on investment and research in energy generation and distribution has been created, and consumers are beginning to recognize that the way they view and manage their energy usage in the future will be dramatically different from today. These factors are driving many analysts to predict more than $200 billion will be invested in new grid technologies between 2008 and 2013. Pike Research predicts that more than $53 billion will be spent in the U.S. alone.

These new investments cover a broad range of products and services, but virtually all are focused on enabling enhanced monitoring and control across the electrical distribution network. This includes capturing more granular information related to power quality, consumption and grid performance by facilitating two-way communication and generation capabilities throughout the distribution system.

It is becoming increasingly clear that the smart grid is not defined by new devices, but rather by the services enabled by adding secure and reliable two-way communications

FOUR CAPABILITIES ARE REQUIRED TO DRIVE THE BENEFIT GOALS OF THE SMART GRID 1



to as many points on the distribution grid as possible. Clearly this will require some new equipment, but it will also require innovation that minimizes stranded assets for the utility industry.

Four capabilities are required to reap the benefits of smart grid (see Figure 1):

- **Create** devices and sensors to capture information and provide control services.
- **Collect** communication devices and networks that allow data and control services to happen.
- **Manage** a network operating environment that includes all connected devices.
- **Utilize** business applications that turn the data into actionable information and drive benefits.

Several interesting observations can be made from reviewing these capabilities. The first is that they do not define a specific network technology, device or sensor. These capabilities must enable all devices (new and old) that are part of the energy distribution framework. They are needed for devices in the substation, down the feeders, at the metering points and even into the extended grid inside a home or business.

A second observation is that value is not defined by the device, but rather by the business application using this communication and control capability. In other words, these capabilities drive benefits whether this is a new asset or an investment that was made five years ago. The benefits are almost universally defined by business functions rather than the device itself. Once gird operators and owners recognize this, it is much easier to evaluate technology gaps that need to be filled. These gaps tend not to be specific devices or protocol, but rather machine-to-machine management platforms that can easily connect these devices to the appropriate business applications. Making the right decisions at this level drives accelerated deployments of smart grid technologies that can leverage new and old distribution equipment.

As stated earlier, over $200 billion is expected to be invested globally in the smart grid by 2013, but the existing grid assets far exceed this number. Is it possible to enhance these solutions to make them viable in supporting bi-directional communications, control and generation services? Can utilities (and rate payers) achieve an adequate percentage of projected smart grid investment benefits without replacing the current asset? A growing number of communication companies are trying to address these questions and accelerate deployment of smart grid services, as well as service the varying business case drivers being presented by utilities of all sizes.

SMARTER AMR WITH CONSUMER ENGAGEMENT

The industry is closely watching early adopters of smart metering technology, with several utilities now announcing deployments exceeding one million units. While this progress is impressive, nearly 150 million meters are already automated with automatic meter reading (AMR) communication technology. These devices do not provide interval data collection, remote disconnect capabilities or other enhanced communication services that are envisioned for the final smart grid deployment. It is possible, however, to add communications over public networks (cellular, broadband, etc.) that deliver consumer engagement and energy management services with full home area network (HAN) support. These capabilities allow utilities to deliver a broad range of demand-side services to their customers leveraging their existing metering investment.

Digi International for example recently launched a series of electronic receiver/transmitter (ERT) gateways enabling the owners of more than 40 million ERT meters to communicate over IP networks. This allows the utilities to leverage their existing metering assets to provide customer energy management services, verify demand response measurements or view coincidental load across a set of meters for load forecasting purposes. While this is not a smart metering platform, it facilitates a suite of services consistent with many smart grid business cases.

In addition, products are available that convert AMR devices to industry standard protocols such as the Zigbee smart energy profile. This minimizes stranded asset risk by connecting these ERT

modules to a wide range of certified smart energy devices, presenting a smooth migration from AMR to the smart grid.

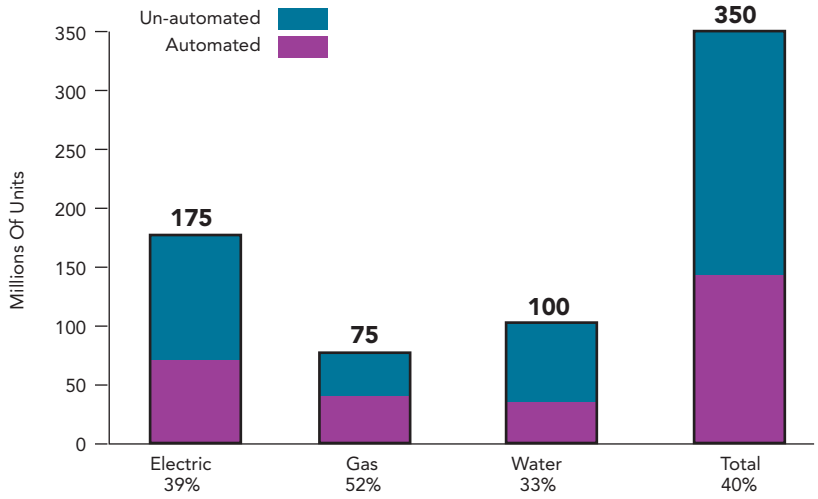
The industry will continue to develop and expand ways to use these new technologies, but providing tools that can provide flexible deployments to future-proof the distribution grid are essential in driving early technology adoption. These AMR gateways are made possible by leveraging machine-to-machine management services that connect utilities' applications (consumer energy management portal, demand response platform, etc.) with their customers' metering device—a key development in making this technology commercially viable.

RESPONDING TO NETWORK AND OTHER TECHNOLOGY CHANGES

On Feb. 18, 2008, carriers were no longer required to support the advanced mobile phone system (AMPS), better known as analog cellular network. This change forced the industry to figure out new ways to communicate with thousands of metering and distribution devices—most deployed at commercial utility customers across North America. The industry did not respond with a singular approach, but rather architected innovative solutions that met the needs of their respective businesses. For some utilities, this helped accelerate smart grid deployments, while others worked hard to avoid any meter change-outs by identifying technologies that could IP enable dial-up modems.

These decisions were not based on the best technology, but rather on business drivers. This is true for smart grid deployments as well.

NORTH AMERICAN AMR PENETRATION 2



Source: IMS Meter Report 2007 Edition

No single software or communication solution works for all utility business functions. The reality is that many communication solutions—public, private, wired and wireless—can and will contribute to the overall smart grid ecosystem. Each technology provides a unique set of performance, cost, reliability and security goals that differentiate, but do not diminish, their contribution to the overall system. The challenge for the industry is not identifying the communication solutions required, but developing efficient, secure and scalable connectivity over a broad range of networks. This middleware management platform will be critical to the smart grid, and must provide not only support for the new technologies, but also manage devices and technologies that are already deployed. Most importantly, many machine-to-machine (M2M) management platforms isolate utilities' applications from the specific communication networks allowing new technologies to be deployed without disrupting existing systems.

DEVICE MANAGEMENT IS KEY TO BEING FUTURE PROOF

All networking technologies used in smart grid are aimed at time-sensitive energy consumption data collection. Whether using power-line carrier, fiber, cellular or proprietary wireless communications, the goal is to determine what energy is being used, and more importantly, when it's being used. If s a commuter drives to the office during rush hour, he uses far more gas than he would driving in the middle of the day;

hence his costs (environmental and economical) are much higher if he doesn't shift his driving patterns. The same is true for energy consumption. If a consumer uses electricity during the "electrical rush hour," the utility's cost is significantly higher—yet in most cases it cannot pass that extra cost on to the consumer.

The smart grid is the first broad reaching initiative enabling utilities to better map costs to price, which in turn will strengthen support and adoption of time-based rates. This will greatly increase the need for energy dashboard tools that communicate rate and consumption data to consumers, and will rapidly expand the number of people actively participating in load shifting programs.

These challenges do not define a specific networking technology, but rather an information and control ecosystem that will utilize many networks—both wired and wireless—to promote an interactive, reliable and efficient energy delivery grid. A software service that allows applications to operate independent from the communication network will maximize the utility's ability to leverage existing assets while helping to future-proof the investments.

David Mayne is director of business development at Digi International.

Five Common Integration Pitfalls and the Lessons Learned

TONY GIROTI, BRIDGE ENERGY GROUP INC.

Energy generation, transmission and distribution has been operated and managed by non-IT systems for years. IT as an afterthought—especially around application integration—continues to be the norm for most smart grid pilots across North America. For example, most utilities are focused exclusively on deploying smart meters, communication infrastructure and meter data management (MDM) products in their pilot phases and few have developed a strategic integration architecture that ties MDM data with other enterprise applications such as outage management system (OMS), customer information system (CIS), geographical information system (GIS), distribution management system (DMS) and supervisory control and data acquisition (SCADA).

In addition, the popular approach of connecting MDM with CIS in a point-to-point manner may work for low-volume and low-transaction pilots, but might not scale to production quality volumes and bi-directional communication models. If CIS is ever to be replaced, MDM integration with CIS will require redesign and rework. In the absence of a strategic IT approach, current integration practices provide little value to achieving the larger smart grid and demand response objectives from an IT perspective. In fact, some early warning signs from those who have embarked on the journey indicate that integration complexity has been grossly under-estimated and cannot be ignored. Many projects have been delayed due to technical challenges brought about by the lack of strategic IT planning.

As a result, power companies must, at a minimum, address the IT integration challenges related to interoperability with applications and systems within and outside their organization. Below are five common pitfalls that companies are facing when addressing these challenges.

PITFALL NO.1: Grossly underestimating the IT integration effort

Lesson learned: Integration is complex and has many moving parts. You will need the appropriate budget, resources, time, IT experience and trusted guidance.

PITFALL NO. 2: Blaming the service-oriented architecture (SOA) integration tool or