“Smart grid” is one of those terms like “business process reengineering” or “Web 2.0.” They start as clearly defined concepts but become so hyped and misappropriated that soon no one can agree on their meaning.

But a smart grid is emerging, and not just for electric power. The natural gas industry is actively deploying intelligent technologies to make the gas infrastructure smarter, safer, and more reliable. That’s bringing benefits to gas producers, transporters, distributors, and ultimately customers.

The smart grid is all about capturing, communicating, and analyzing data, in as close to real time as possible, to improve the safety, reliability, and operations of the energy infrastructure. That might involve providing information to end customers to help them make smarter energy decisions. It might pertain to managing the quality of gas to ensure optimum service to industrial users. It might mean optimizing the transmission pipeline to get the most out of investments in those assets.

None of those objectives is new. What’s changing is that more and more measurement, communications, and analysis capabilities are available to achieve those goals.

For the smart grid to deliver on its promise, intelligence needs to be embedded throughout the gas infrastructure, not intermittently at one point or another. Just as important, there probably needs to be a single smart energy infrastructure, not incompatible efforts by various players in the industry, and not separate communications systems, for example, for gas and electricity.

With those considerations in mind, *American Gas* asked industry experts to share their perspectives on the technologies, standards, and strategies that will deliver a truly intelligent energy infrastructure. —Eric Schoeniger
Integrating Gas into the Smart Grid

By Jim Marean

When most people hear “smart grid,” they think electricity, not natural gas. Yet natural gas plays a crucial role—not only in the generation of electric power, but also as a fundamental component of America’s overall energy infrastructure.

The technologies and strategies that will make the grid smart differ for the electric and gas industries. As a consequence, the two industries have pursued grid intelligence separately. That risks gaps or unnecessary redundancy in capabilities, and ultimately a less integrated, less intelligent energy infrastructure. The goal should be seamless communications and data management for both infrastructures—expanding the concept of a smart electric grid to an energy infrastructure that will enable a smart energy future.

The needs of the natural gas industry are twofold: First, an investment in the right devices in the right locations, and second, interoperability both among those devices, and especially between the gas and electric industries.

Distributed Automation

On the electric side, the primary driver of a smart grid has been demand response. Smart meters allow electric utilities to encourage customers to adapt their electricity usage in response to price signals.

Demand response could become an issue for the gas industry, but it hasn’t to date. As a result, the gas industry has less need for smart meters. But it does recognize the value of improved communications and more intelligent devices in places that can improve safety, reliability, and operations. Those locations are primarily in the space between the city gate and the customer meter.

I refer to this capability as distributed automation. The approach involves creating or enhancing remote monitoring capabilities for regulators, valves, odorant stations, and other components that make up the distribution system. It also includes the use of two-way communications and data collection and analysis to provide information to operators in the back-office or operating the SCADA system.

Smart Is as Smart Does

Investment in distributed automation can empower gas utilities with a broad range of new capabilities. With the right intelligence, they'll be able to:

- Automate leak detection and notification
- Detect the loss of gas through leakage or theft
- Remotely disconnect/reconnect and automate the shutoff of a location for safety
- Detect and predict third-party damage
- Monitor and control gas pressure and flow based on network demand to ensure reliable service
- Continuously monitor cathodic protection systems
- Monitor and manage gas quality and Btu composition at custody exchange points
- Improve decision making during emergencies
- Improve asset management
- Lower operating costs

Development and deployment of many of these capabilities is already underway by a variety of industry vendors. For example, the Gas Technology Institute and Itron Inc. recently collaborated in the development of a telemetry module for cathodic protection that’s now commercially available.

Leveraging Investments

Communication is at the heart of attaining a smart energy infrastructure. Smart devices can deliver on their promise only if they can communicate with those responsible for operating the system. Leveraging and optimizing the capabilities of the advanced metering infrastructure (AMI) will provide the basis for an integrated energy delivery system.

The electric industry is already investing substantial sums in implementing a communications backbone to support smart meters. Arguably, there’s no need for the gas industry to duplicate that investment. Wherever there’s a gas customer, there’s undoubtedly an electric customer.

There will be financial and regulatory issues to hammer out to ensure that one customer base isn’t subsidizing another, but there’s no technological restriction that would prevent the gas industry from using the AMI communications infrastructure.

Enabling that integration will require standards. As information is captured and communicated, gas utilities shouldn’t have to worry that the data could be lost, delayed, or compromised because of the lack of interoperability.

GTI is in the second phase of a collaboration with the National Institute of Standards and Technology, with funding from the nonprofit Operations Technology Development, to develop smart grid standards that include natural gas. A Gas Technology Domain Expert Working Group has been created under the Smart Grid Interoperability Panel to help ensure that the gas industry has a seat at the table as smart grid standards are developed.

Integration of the gas and electric smart grids will benefit both industries. The natural gas system will be expected to accommodate emerging local and regional sources of supply as well as emerging technologies, increases in peak demand, the effects of energy-efficiency programs, and the increasing use of natural gas for power generation.

Real-time communication between the sectors will be increasingly necessary in order to ensure the reliability of both systems. Integrated communications will speed the emergence of a truly smart grid that promotes the safe, reliable, and efficient operation of the entire energy infrastructure.
The natural gas industry has always taken a prudent approach to technology, adopting the innovations it needs at the times and places it needs them.

For example, it hasn’t been as aggressive as the electric industry in deploying smart meters. That’s in part because the gas industry isn’t as time-of-use sensitive and doesn’t stand to reap the same benefits from the investment. But the industry is beginning to recognize opportunities for improving the capture and flow of information to enhance system integrity and get more out of the existing pipeline.

On the transmission side, between the wellhead and the city gate, a broad range of smart technologies are already in place. Now, new investments in additional pipeline intelligence are being driven by market changes, including the ongoing shale boom and the surge in gas-fired power generation. That has implications for transmission companies and local distribution companies (LDCs) alike.

Life After 636

In 1992, the Federal Energy Regulatory Commission issued Order No. 636, which required that transmission pipelines unbundled their services. The intention was to allow pipeline customers to select their gas sales, service, transportation, and storage from any provider.

The resulting complexity drove transmission companies to invest in a range of new technologies. Prior to Order No. 636, a large pipeline might have 150 customers each requiring two or three transactions a month. Today, that same pipeline might have 10,000 transactions a day across many parties.

Keeping track of that activity requires data capture, communications, and analysis. As a result, most delivery points are now electrically metered and even remotely managed, and pipeline operators increasingly have access to real-time information. In addition, SCADA operating systems continuously feed operating data into the system to keep track of flow, pressure, compressor operations, and more.

Talkin’ ’bout Generation

Market changes are driving additional investment in smart technologies. For starters, the use of gas for power generation has increased substantially, and that growth will continue. And power generation tends to be volatile. Gas-fired generation can switch on and off unexpectedly with demand, and the loads involved are sizable.

Gas needs to be supplied to power generators in a way that doesn’t result in low pressure or interrupted service to LDCs and end users. That will require a new level of sophistication in pressure sensing and load anticipation. It also calls for a new level of standardized, real-time communication with generators and other customers.

Investing in the technologies that will enable that information capture, flow, and analysis will benefit both transmission companies and LDCs. Pipeline operators will be better equipped to anticipate load changes and move assets around in preparation for surges in demand. Pipeline customers will have hour-by-hour visibility and greater ability to manage their businesses.

Boom-Time Technology

Another market development driving smart technology is the shale boom. The quality of shale gas isn’t as consistent as that of traditional supplies. Yet power generators and industrial users have specific quality requirements. That will necessitate the precise monitoring and blending of gas from multiple supplies to meet specifications.

As a result, technologies that improve gas-quality management will become a priority.

Shale gas is also being produced in nontraditional locations. The biggest shale play right now is the Marcellus in Pennsylvania and nearby states. Not long ago, a significant amount of gas was moving from Louisiana to the Northeast. Now it’s being produced in the Northeast, and starting to move in the opposite direction.

The more transmission companies can understand capacity, relative direction of flow, and the hourly fluctuations they can support, the greater return they’ll be able to realize from their existing pipeline assets. That’s a whole set of inquiries they didn’t have to worry about before, and it will require new levels of integration and analytics to support decision making.

These are issues for transmission companies, but they directly affect gas distributors and large industrial users. The more LDCs can ensure gas quality and provide information about the flow of gas in their system, the better service they can provide their customers. And if transmission companies can optimize flow configuration and operate their pipelines more efficiently, LDCs that were limited to one pipeline pattern may have more options. For example, they might benefit from shorter-term contracts or a portfolio of contracts.

Smart transmission is only one piece of the smart grid puzzle. But the more effectively smart technologies are deployed in the transmission pipeline, the more the advantages accrue both upstream and down.

Smart Meters and Beyond

While some leading U.S. gas utilities have invested in smart meters, others remain skeptical. They may recognize the advantage of investing in advanced meter reading...
(AMR)—typically analog meters augmented with a communications device. But they need convincing that additional investment in advanced metering infrastructure (AMI)—in smart meters—will deliver worthwhile returns.

Each utility will have to make its own decisions based on its own market perceptions and realities. But the fact is that smart meters can deliver tangible benefits to both utilities and their customers. Just as important, smart meters are a crucial component of an end-to-end natural gas smart grid.

Without smart meters, infrastructure intelligence goes only so far. It’s a bit like running fiber-optic cable to a building and then connecting it to a computer network based on copper wires. The network will always be constrained by the least advanced technology.

With smart meters in place, however, the industry can benefit from an intelligent energy infrastructure that fully lives up to its promise.

Meeting Challenges

Many gas utilities that have implemented AMR have realized clear returns on that investment. They can reduce staffing costs and lower the cost and risk associated with truck rolls. But what’s the next step?

Utilities face some complex new challenges. The emergence of new gas sources, rising customer expectations for information and service, an ongoing focus on identifying and eliminating non-revenue gas, a renewed need for improvements in operational efficiency—all these add new business pressures. Meanwhile, utilities continue their primary mission, which is the safe and reliable delivery of gas to their customers.

As a consequence, unlocking value from investments in network infrastructure is more important than ever. And key to that objective is optimizing value at the meter and beyond. In particular, utilities need to implement the solutions that improve network operations today—ideally, from the back office to the end users—but that are flexible enough to meet future requirements.

Future Focus

That’s where AMI comes in. Deployed effectively, an AMI network can help system operators better understand operational processes. As a result, they can eliminate redundancies and improve efficiencies across the system.

The data utilities can capture through AMI can pave the way for a range of process improvements. Automating meter reading, asset management, and data processing can increase the safety and productivity of field technicians. Capturing and analyzing meter data can improve system reliability, safety disconnects, time billing dates, and the delivery of usage data to customers.

Data analytics can also help utilities transform raw data into useful information and added value, from identifying non-revenue gas to enhancing customer service. In fact, look for providers of AMI solutions to offer more and more analytics and other capabilities that increase the value of AMI investments over time.

That future focus is perhaps the key implication of smart meters. Existing analog meters, even if enhanced with AMR capabilities, will never be more than meters. The inherent intelligence of AMI, on the other hand, ensures a metering network that can adapt to changing requirements and deliver new value.

Emerging AMI innovations include remote-disconnect devices; proactive maintenance; event avoidance; monitoring of system performance to assess field conditions such as methane detection, cathodic protection, and pressure monitoring; and customer-facing applications that extend value to homes and businesses.

How quickly and to what extent utilities invest in AMI will vary. But by beginning that investment, utilities can start taking advantage of the customer service, operational efficiency, and safety benefits now available. And they can position themselves to unlock new value in the future.

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