

BUILDING INTELLIGENCE FOR REAL

+ A CLOSER LOOK AT PPL ELECTRIC UTILITIES
By H. Christine Richards



Illustration by Jürgen Mantzke, enfineitz.com

Meet Bob Geneczko. He started his PPL career in 1974 as an engineer and is now vice president of customer services for PPL Electric Utilities. Geneczko took some time to discuss PPL initiatives to learn more about its grid, which included upgrading more than 1.4 million meters. For Geneczko and others at PPL Electric Utilities, the initiatives have not been so much “smart grid” as building more grid intelligence.

INTELLIGENT UTILITY PPL decided to invest in smarter meters in 2001. Have you seen anything change since then as to why utilities should make such an investment and build this intelligence?

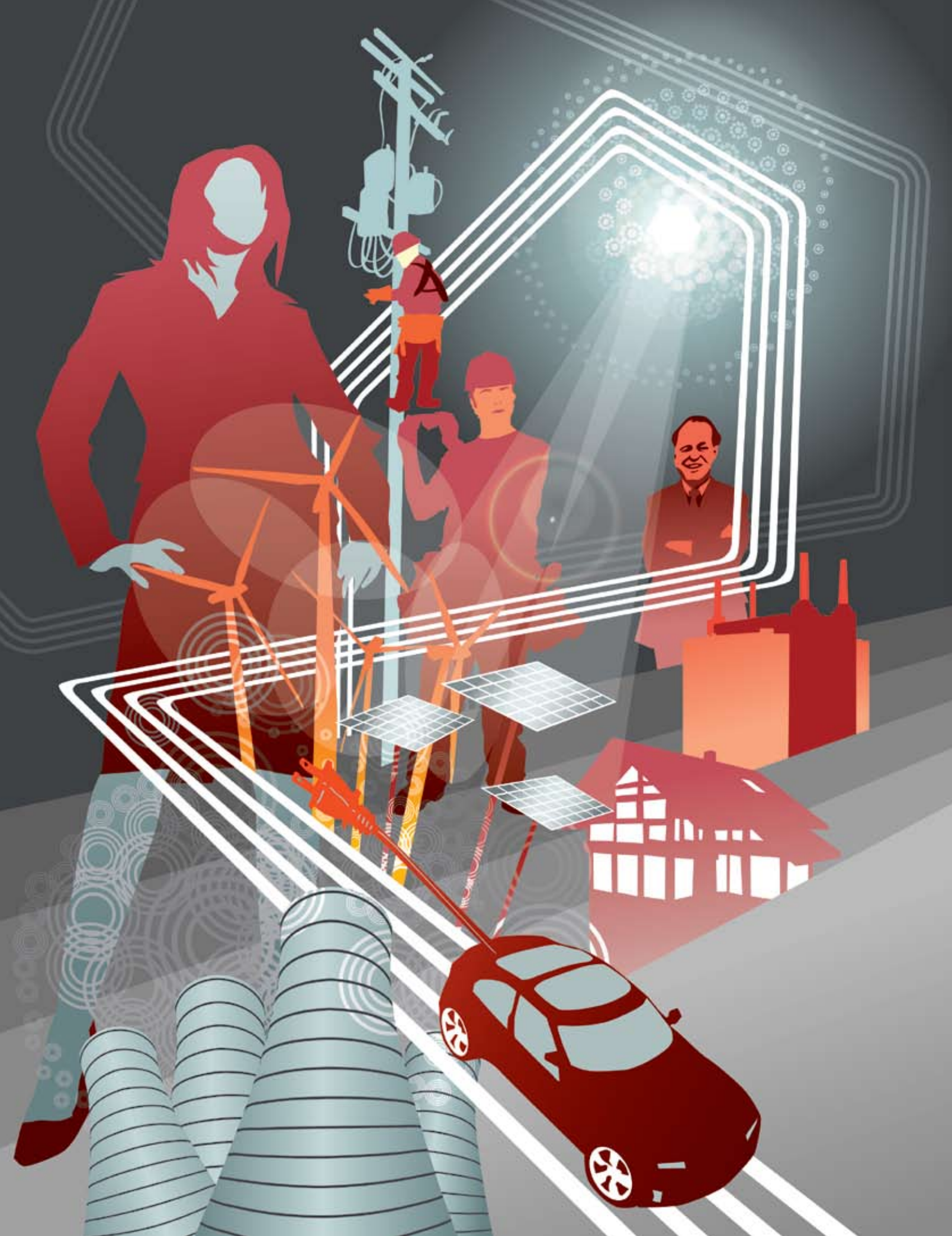
GENECZKO Absolutely. When we invested in it, we understood that there were potential customer benefits, but the original justification was the operational benefits—things like reducing meter readers and the vehicles that they drive and a couple of other opportunities, such as theft detection and loss calculation. If we were to look at it

today, certainly the customer benefits would take a much bigger role. We are focused on maintaining customer satisfaction, which is a real challenge because electricity prices in the market around us are increasing substantially. So to maintain satisfaction, we need to provide customers with information about how they use electricity and how they can use it more wisely, and that information

can help them through changing times.

INTELLIGENT UTILITY Who at PPL drove the decision to make this investment?

GENECZKO It was a group of people that included one of my predecessors, who was a head of customer service, and a few of the people who reported to him. These people had been watching it for years and the technology and pricing finally got to a point where they could make a strong business case for it.



INTELLIGENT UTILITY So PPL had people who drove that initial investment. Did other people come in to deploy the system and monitor it?

GENECZKO Yes, at that point, the project was assigned to an individual whose sole job was to do the solicitation and ultimately the conversion installation. That person was given the budget to do it as well as a staff of a dozen plus people devoted strictly to the project to make sure it got done.

INTELLIGENT UTILITY A big part of having a smarter grid and a more intelligent utility is not just about deploying those technologies, but distributing that knowledge to the people and the systems that need it to make more intelligent decisions. Which parts of the company does the meter data touch?

GENECZKO It touches many areas—let's begin with what we call our revenue assurance group. They look at things like theft of service or situations where customers' equipment is not necessarily working. For example, a meter may not be working and you can detect it by looking for changes in use patterns. So that's an easy one. It plays a significant role in outage detection and service restoration. We've integrated the AMI [advanced metering infrastructure] with our OMS [outage management system], so we can more quickly identify where likely trouble spots are located and dispatch crews with more precision to make repairs and restore service to our customers. It also will provide the raw data, which will be the basis for our distribution planning. That group will now be able to look at data hourly and understand how much capacity they have left on a line, whether they need to upgrade the line, put in a second feed, that sort of thing. The technology also enables us to offer customers new billing rates, such as TOU [time-of-use] rates, so customers can better manage their energy use.

One benefit of the technology that we had not fully anticipated was the effect on customer service, which has also become a whole heck of a lot easier as a result. That's because now there's a lot of data in front of the customer service reps that they can actually use to help educate customers or answer customer questions. Now, here's a specific example. We had a customer who called and complained about high use at her vacation home. She could not understand why it was so high. Well, our customer service rep pulled up her load data and found it was very high during one particular weekend. At this point, the customer remembered that her son had come home from college and taken friends up to the cabin that weekend.

So right there you've satisfied a customer's complaint just by having the data in front of you. Another thing that you can do through customer service is better route the more difficult questions to the customer service reps, but make the easy stuff available to customers without ever having to talk to anyone. This is one of the most exciting applications by having meter and billing data available. Right now, our customers can access their

daily and hourly usage information on the Web, they can see bill balances and can track their charges to date between billings. The availability of this information heads off many calls that might otherwise have been made to our contact center.

INTELLIGENT UTILITY Do you have any steps that you plan on taking to expand the use of this information?

GENECZKO We'll be working on a direct load control pilot and potentially home energy displays. But when it comes to expanding uses, we're focusing on customers' needs. We want to give our customers more choices and information that can help them adjust to rising energy costs. With more information easily accessible to them, customers can understand how and when they use electricity and then they can make better decisions about controlling their usage.



▲ Bob Geneczko

INTELLIGENT UTILITY So, once you have that basic infrastructure in place, now it seems like you have some flexibility and it seems like it has spawned a lot of different possibilities. Would that be an accurate statement?

GENECZKO Definitely.

INTELLIGENT UTILITY What advice do you have for other utilities that are considering taking a leap and building more intelligence, but are still hesitant about it?

GENECZKO First of all, you don't have to wait for development of technology at this point. It's there, it's commercially available and it's reasonably priced. That's number one. Number two is that given the times that we're in, the fact that energy prices are going to increase, this gives utilities a tool to help your customers understand how they're using energy. So to me, the so-called smart systems are ways that utilities could help the customer become energy smart and environmentally sensitive. Finally, when utilities look at smart grids and smart meters, they tend to get caught up in the hype. But don't get caught up in the hype. Think of these as long-term investments. Utilities don't have to do it all overnight. Look at it as a technology investment that may take years to do. Utilities are going to continually add to their systems and technology is going to change. So attack it with a longer-term vision of what you want to achieve and figure out how you can best afford it and what you want to achieve by when. I get concerned with the term "smart grid." Said another way, if we're not investing in things to match a

so-called smart grid, does that mean we have a dumb grid? The answer is no. For years and years and years we've had different forms of intelligence. As we get more applications and more electronics available, we're just stepping up the pace at which we add intelligence to our networks.

INTELLIGENT UTILITY So is it just getting smarter?
GENECZKO That's exactly right. It's getting smarter all the time. But again, you don't have to do it all at once and remember that every utility has different needs and so one size may not fit all.

The technology backdrop

NOW MEET KIM GOLDEN, SUPERVISOR OF INFORMATION SOLUTIONS, PPL Electric Utilities. Golden has spent her entire IT career with PPL Electric Utilities and began working with the company's AMI/meter data management (MDM) project in 2005. She took some time to chat with *Intelligent Utility* about the technology behind the initiatives.

METERS FIRST

The PPL Electric Utilities meters are on a power line carrier (PLC) and the utility can communicate back and forth with the meter. Even though PPL has two-way communication, since PPL completed its meter upgrade in 2004, its meters do not have some of the latest gadgets available. "Our generation of meter does not have Zigbee, so the meter would not be the hub that connects the consumers with us. We're piloting consumer technologies that don't rely on the meter as the hub," Golden said. For example, PPL Electric Utilities is piloting a load control program where the company puts a device inside the home that it can use to intelligently control a customer's devices—like a hot water heater. The company will use the same communication infrastructure for these devices that the meters use, but there is no need to connect through the meter. "With the home energy display devices we plan on testing, you plug the device into an electrical outlet and can communicate to the device through the same power line infrastructure that we use to communicate to meters. With some of the load control devices you have to wire them in the home, but then we communicate to the device through the same power line infrastructure," she said.

MAKING USE OF THE DATA

The key function of the company's MDM system is as a repository that loads meter reads (including daily and hourly reads for 1.4 million customers) and other supporting data for downstream uses (including pertinent customer information and mapping data). An important piece of the repository

during this load is the VEE (validate, estimate and edit) application. "For those gaps where we don't get reads, we use the VEE to fill the gaps so we can have a complete set of data. The application also checks for spikes, since meters can send back erroneous data. If we are looking for usage data, we don't want a spike to skew results," Golden said.

In addition to the modified data, PPL Electric Utilities also stores the actual data or the data that directly comes in from the meter. "This data is then presented to all customers through the Web to support efforts we're making to promote energy efficiency and help customers understand how they use electricity. It is also used for our revenue assurance program. Here, we are checking for usage that goes to zero for a certain number of intervals each day, so we wouldn't want those hours filled in," she said.

The MDM repository implementation went smoothly and finished on time. The real challenge has been with the ongoing use of the system. "We want all of the data, so we have to aggregate a huge amount of data. We have to focus our efforts on tuning and monitoring performance," Golden said. "We also have a challenge from the acceptance standpoint. We are introducing new processes and new patterns on how you're going to use information that was never before available in your work. Some people can see the value and how they are going to use it. For example, customer reps find definite value in it. Though I wouldn't characterize who sees value by group, but by personality. Some can see the value and others still look at how they have done it in the past."

GETTING THE PROJECT DONE

The project's core team includes both IT and business personnel. On the business side, the AMI operations group owns the repository and includes subject matter experts for the business functions that are being implemented. "When a new application is added to the system, we then bring business representatives and subject matter experts for that area into the project team," Golden said. The IT and AMI operations groups are colocated in the same facility. So they work together day in and day out. "In customer services, Bob [Geneczko] owns it and the project started there because the initial benefit of the AMI was in the meter reading. Now, we expand the use of data and the project starts to span many departments—like the distribution planning and load forecasting worlds—which are not in the customer services organization at all," Golden said.

In addition to the technology and business process aspects of the work, one core project responsibility continues to be change management. "People need to understand how they're going to change with the new information," Golden said. "We have a specific person assigned to the change management aspect. She was on the business side first, but not part of the AMI operations group. She continues to be a part of the project, but now sits in IT."

ADVICE FOR UTILITIES

Golden offers this advice for other utility companies: “We use technology, but it is really about implementing new business capabilities. We don’t do IT just to do IT. We do IT to add business value. We took on a big vision, which is wonderful, but you can’t make the data and technology do everything, including clean the kitchen sink. Technology will continue to evolve. It’s like going to buy a PC. You buy a PC to use it and get the benefits now and then upgrade and transition as technology allows.”



Don't just think Nashville. Think Nirodha, too.

+ A QUICK LOOK AT SMARTER GRIDS AND MORE INTELLIGENT UTILITIES
By H. Christine Richards

➔ PPL ELECTRIC UTILITIES IS A CLASSIC EXAMPLE OF increasing intelligence about the grid through improved metering capabilities. Although smarter meters enabled data communication, PPL had to turn that data into intelligence and enable groups both inside and outside of the utility to acquire the knowledge they need to ensure reliable, affordable, efficient and sustainable energy. PPL is building a smarter grid, in fact you could say a “smart grid,” but most smart grid discussions inevitably lead to these questions:

- ▾ How do we get to a smart grid?
- ▾ When do we know we are there?
- ▾ What is a smart grid again?

These are not easy questions. Many groups define the smart grid, but how can you tell when your utility has one? Better understanding this challenge requires an unusual, but useful comparison: Nashville, Tenn. and Nirodha—a state of mind in yoga. Let’s say you are traveling to Nashville. In Nashville, you would see landmarks that you could only find in Nashville, such as the Grand Ole Opry, B.B. King’s Blues Club and the BellSouth Tower. Smart grid landmarks, however, are harder to come by. Utilities can install smart meters and other smart sensors on their grid, but having these technologies does not necessarily mean they have arrived at a smart grid.

To add to the confusion, other “smart grid” components such as demand response, distribution automation and automated meter reading (AMR) have already been around for years.

Although such technologies can support a smarter grid, the smart grid is more than just acquiring certain technology landmarks. A smart grid also requires integrating both new and existing technologies and ultimately transforming business processes to enable better decisions about the grid’s operation. So, although it is a nice place, you shouldn’t just think Nashville when you think smart grid, think Nirodha. For those of you who aren’t yoga enthusiasts, Nirodha is a state of mind in yoga in which you become more focused and aware of an object. In the case of a utility, the object is primarily the transmission and distribution (T&D) network. As a utility becomes more aware and ultimately more knowledgeable about its network, the utility can make better decisions about its operation. Furthermore, as a company builds more knowledge about its grid, it develops not only a smarter grid, but also a more intelligent utility. We will discuss the difference between smart grid and intelligent utility in a moment, but first let’s consider why utilities are interested in building this intelligence.

WHY THIS INTELLIGENCE IS IMPORTANT

Regardless of today’s turbulent times, utilities must continue providing customers with reliable, affordable, efficient and sustainable energy. Many issues—both today and ones that are on the horizon—are threatening utilities’ ability to provide this sort of energy (*see sidebar: Issues at a glance*).

ISSUES AT A GLANCE

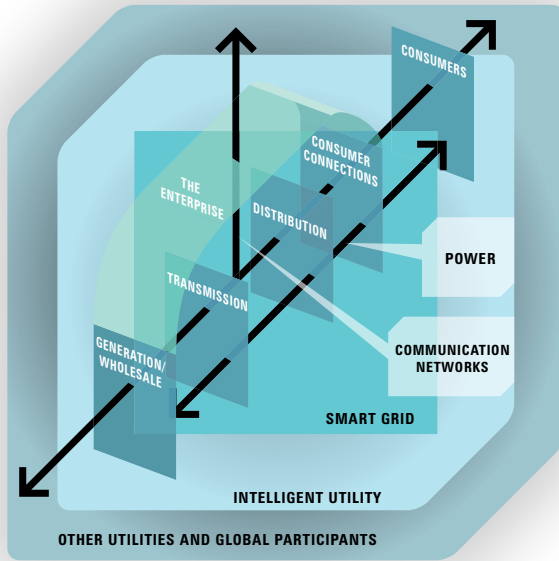
The credit crunch
Aging infrastructure
Growing demand for electricity
Environmental concerns
Connecting the customer
Operational efficiency
Transportation electrification
Improved reliability
Aging workforce

Some issues will require utilities to make investments in traditional infrastructure—for example, utilities will have to replace aging transformers and wires or build new transmission lines and generation plants to keep up with demand—but other issues will limit utilities’ ability make these investments—such as the backlash against coal generation and the credit crunch. To continue providing the type of energy that consumers demand, utilities will have to consider other solutions that go beyond traditional investments.

THE DIFFERENCE BETWEEN A SMART GRID AND AN INTELLIGENT UTILITY

Smart grid and intelligent utility can help utilities overcome these limitations by transforming business processes and technologies that support the grid’s operation. The specific business process

FIGURE 1: Smart grid/intelligent utility components



Source: Energy Central

and technology changes will vary for each utility, so let's focus on the high-level definitions. The smart grid is transforming business processes and technology to improve T&D network automation, control and monitoring and to better connect consumers and utility companies, so utilities can continue to provide reliable, affordable, efficient and sustainable energy. Therefore, smart grid typically focuses on business process and technology changes in these areas (Figure 1):

- \\ Transmission
- \\ Distribution
- \\ Communications
- \\ Consumer connections—including metering, end-user devices and distributed generation

Focusing on just smart grid, however, often leaves out many people, devices and systems outside of T&D—even outside of the utility—that impact the grid's operation. An intelligent utility takes smart grid a step further by enabling groups both across and outside the company to acquire the knowledge they need in order to provide reliable, affordable, efficient and sustainable energy:

- \\ The enterprise—including IT, finance, customer operations and executives
- \\ Generation/wholesale—including large-scale renewables
- \\ Consumers themselves
- \\ Other utilities and global participants

SOMETHING OLD, SOMETHING NEW

In terms of technology, a smarter grid and more intelligent

utility do not always require a massive outlay of smart meters to get started. It can begin by simply better leveraging information from existing systems or better integrating existing technologies. These systems and technologies could include:

- \\ Energy management system (EMS)
- \\ Distribution management system (DMS)
- \\ Supervisory control and data acquisition (SCADA) system
- \\ Outage management system (OMS)
- \\ Geographic information system (GIS)
- \\ Work management system
- \\ Asset management system
- \\ Network design application (e.g., CAD)
- \\ Demand response program
- \\ AMR
- \\ Customer information system (CIS)
- \\ Enterprise resource management (ERM)

In terms of business process change, utilities need to first consider how their personnel and systems can more effectively use data to make better decisions about the grid's operation. They also need to consider what groups—whether IT, customer operations or generation—should be involved with making changes to these business processes. It may be overwhelming at first, but take a deep breath (hopefully, you remember your pranayama breathing techniques), relax and learn how other utilities, like PPL Electric Utilities, are finding success in transforming their companies into intelligent utilities.



Winning the intelligent utility game

+ By Mike Smith

→ IT IS PRACTICALLY IMPOSSIBLE TO NOT FEEL overwhelmed by information emerging from all corners of the utility industry touting the coming age of intelligence across utilities. This age, in effect, will bring an entirely different game to the utility industry. The possibilities in this bold, new, intelligent utility game range from more ways to leverage existing intelligent systems to entirely different paradigms for how utilities operate.

As discussed in the previous article, “Don’t think Nashville.

Think Nirodha, too,” issues like aging infrastructure and financial compliance along with a rapidly changing financial landscape have created a “perfect storm” and set the stage for the emergence of the intelligent utility. Let’s take a look at the intelligent utility playing field, the players and take a guess at the final score.

A DIFFERENT PLAYING FIELD

At first glance, the playing field for building grid intelligence looks the same. Supervisory control and data acquisition (SCADA)? Check. Geographic information system (GIS)? Check. Outage management system (OMS)? Check. The list goes on, but a closer look reveals some major changes. In effect, we still have four bases and an outfield, but the foul poles have moved. The players are still trying to figure what is fair and what is foul, or essentially what is and what is not included in the intelligent utility.

Many of these core systems that support and in some cases drive operations, customer service, maintenance and reliability are key technologies for building an intelligent utility. However, the difference between an intelligent utility environment and a more traditional utility setting is that these systems are not an end unto themselves. For example, it is no longer enough for GIS to have just facilities data and a connectivity model. That data must now support multiple applications and job functions. Consider how a southwestern U.S. investor-owned utility experiencing high population growth uses GIS. As the utility builds substations to serve new subdivisions, the engineering and construction groups for these facilities will have their own set of data management requirements, many of which are best managed in a geospatial environment. The substation design files—which must be accessed by both the design staff in the office and by work crews in the field—will need to be geospatially referenced for the build-out of the distribution network for the new service territory. And with constant updating being done by both the office and field staffs, there will be a requirement for real-time, or near real-time, updates of these records. This example demonstrates the need for an integrated solution that encompasses work management, mobile workforce management, design and engineering analysis applications that all leverage geospatial data management capabilities.

Another example is on the customer side of the business. A customer information system (CIS) that stores customer data and generates bills is just the starting point. Sierra Energy Group research of CIS interfaces has shown as many as 200

● ● ● As we look forward, let’s look back. The whole notion of “smart grid” can be kind of insulting to us old utility folks. What has it been for the last 100 years, “dumb grid?” The National Academy of Engineering identified and ranked the most important engineering achievements of the 20th century. Neil Armstrong was among the notable participants who created a list of achievements, including automobiles, airplanes, space flight, computers, the interstate highway system, petroleum technology, telecommunications technology and water purification systems. At the very top of this remarkable list was electrification. I don’t think a dumb grid would have made the list.

Perhaps our vision for the 21st-century grid is to take electrification to the next level and make it the cleanest and most reliable energy source in the world, therefore enabling even greater achievements.
—Roger Gray, who wrote the article beginning on page 9

interfaces to other systems at a single utility. Interfaces that many utilities already have in place or are building include:

- ▼ **Mobile workforce management for fulfilling customer service orders in an accurate and timely manner**
- ▼ **Interactive voice response (IVR) and OMS for faster outage restoration**
- ▼ **Enterprise resource planning (ERP) systems for financial management**
- ▼ **GIS applications including service crew routing, customer location and customer service notifications**

Likewise, in distribution operations, traditional control systems from the transmission grid to distribution feeders must do more than open and close breakers or report on various status indicators in substations. These systems will have to make “self-healing” grids a reality. Once intelligent electronic devices (IED) and the distribution management system (DMS) are in place, the availability of real-time data and systems intelligence will create opportunities for these “self-healing” grids to impact utility operations. Essentially, the system will continually monitor the entire network’s status. This will in turn facilitate the recognition—or even the anticipation—of problems in the network due to faulty equipment and will make network

corrections beyond just notifications and alarming, which are common on most systems in place today. Several vendors already offer these types of feeder automation applications today.

Besides better leveraging existing systems and technologies, the intelligent utility will include capabilities that are only on today’s drawing boards or in the imaginations of some of the industry’s thought leaders. A few examples include:

- ▼ **Distributed generation:** Picture a city where every residence is its own solar generator and can function completely “off the grid.” What role will the traditional utility assume at that point?
- ▼ **Plug-in vehicles:** When these vehicles are not plugged into a customer’s residence or business, they may need to be charged somewhere else. Could utilities fill this need with charging stations that will take the place of today’s gas stations? How will utilities deal with billing customers as they drive and plug in their vehicles not only across a utility’s service territory, but outside the territory as well?
- ▼ **Microgrids:** One possibility of nuclear power is the

development of relatively small reactors in community power plants that could make complete generation-to-customer microgrids a distinct possibility. Would these all be part of a vertically oriented utility or would different microgrid specialists emerge?

This is what the future playing field might look like. The technologies utilities use today will help them move toward these possibilities, but only to a point. The intelligent utility will require new organizational practices, new submarkets, new financial scenarios and new ways to leverage technologies.

and foremost in their minds (*Figure 2*). Indeed, improving the core business and making the intelligent utility a reality are not mutually exclusive. They go hand-in-hand.

WHO WILL BE THE INTELLIGENT UTILITY WINNERS?

With a financial picture changing literally every day, financial models will not be as reliable as in the past. Clearly, the availability of financing to support the intelligent utility is a critical first hurdle in winning the intelligent utility game. As the chief financial officer (CFO) of a large investor-owned utility pointed out at Energy Central's Knowledge2008 Conference, money is still available, but it is not as cheap and not as plentiful as utilities have experienced in recent years. A utility's financial health, while always important, has become even more so in today's uncertain market and with the significant costs of building an intelligent utility. This reality could result in utilities focusing more on "the basics"—keeping the lights on and getting paid for providing this service. As a result, utilities may focus more on the intelligent utility applications that will provide tangible improvements in operating efficiency and in maintaining customer service.

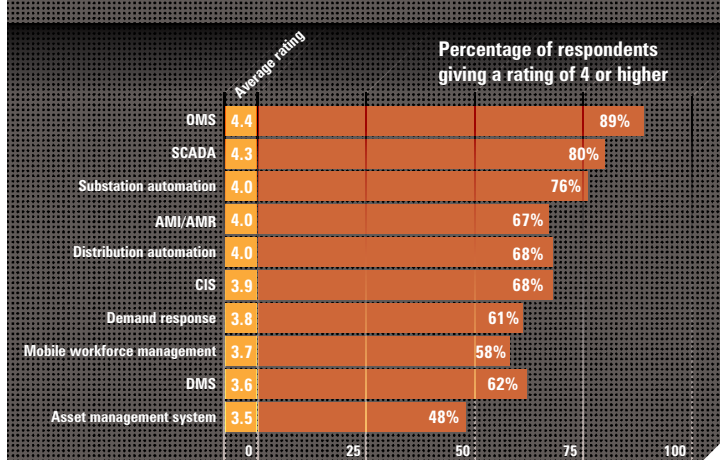
A second factor for winning in the intelligent utility game is a utility's intelligence posture in the "pre-intelligent utility" days. In other words, does a utility have current-enough systems to more easily leverage those systems into an integrated intelligent utility model? Other questions around issues, such as proprietary versus open communications protocols, communications infrastructure bandwidth, and the existing build-out of network devices, also take on an increased importance.

Another consideration is the recent investments in technology made by utilities. For instance, if a utility completed an automated meter reading (AMR) installation in 2007, building a business case for a new advanced metering infrastructure (AMI) initiative—with a budget in the hundreds of millions of dollars—will be extremely difficult, if not impossible. On the flip side, perhaps a utility strategically invested in distribution automation over the last three years will have the infrastructure and data available for more advanced distribution management applications.

With the evolving regulatory climate added to the above factors, predicting which utilities will "win" in the intelligent utility world is difficult. However, those utilities that make intelligent utility decisions by considering their current position in the intelligent utility playing field, aligning this position with their corporate strategies, and developing creative solutions in a challenging financial environment, stand to position themselves for the "win" column. ❧

Mike Smith is a senior vice president of Sierra Energy Group, a division of Energy Central.

FIGURE 2 IMPORTANCE OF APPLICATIONS/COMPONENTS FOR IMPLEMENTING SMART GRID/INTELLIGENT UTILITY
1 = minimal importance, 5 = most important



Source: Sierra Energy Group, a division of Energy Central

THE INTELLIGENT UTILITY PLAYERS

Arguments can be made as to where many of the innovations that we see today originated over the last 20 years. Is it from a vendor community that constantly looks for problems to solve and pushes new solutions to address them? Or is it the utility technical and executive leadership that clamor for new solutions to meet their complex business requirements and technical challenges?

One can still argue this point today, but it is clear that utility leadership sees the "new issues" and realizes that business as usual is not the answer. It is rare to see around 90 percent of any group agree on any given issue, especially utility managers and executives, but this is exactly what we see when it comes to intelligent utility and smart grid as the wave of the future in the U.S. utility industry. Sierra Energy Group's "2008 Intelligent Utility Enterprise Report" showed that 90 percent of respondents agreed that smart grid/intelligent utility is wave of the future. A similar percentage showed up in the 2007 edition of the report as well. It is clear that utility management is embracing the intelligent utility model, even as it continues to evolve.

Although these leaders are looking to the future, they are very clear on what their core business is. The applications that support the core business—keeping the lights on—are first