# THE MERGER OF TECHNOLOGY & TALENT

The utility industry is facing a workforce crisis. But the retirement of the Baby Boomers is allowing electric utilities to take full advantage of the Internet of Things and the wired and wireless world.

By Marc Goldsmith

By now, you've probably heard plenty of bad reports about the Millennial generation. Supposedly, they are pampered, unmotivated, always in need of praise or the dreaded "participation trophy."

I couldn't tell you if those stereotypes are at all accurate. But I do know that managers in the electric power, transmission, and distribution industry haven't had to worry about catering to Millennials. The bulk of the workforce in the electric utilities is made up of members of Generation X and the Baby Boom.

Now, the Baby Boom generation is starting to retire. In fact, according to a 2013 report by the Center for Energy Workforce Development, more than half of the current utility workforce will retire in the next ten years. As the Boomers retire and leave the business, it isn't just a question of hiring new people. Utilities need to find a way to hold onto critical knowledge and important institutional awareness of these longtime employees while letting go of the obsolete information that they also hold.

But perhaps the more important question isn't how to replace the Baby Boomers, but *whether* to replace them. Some of what these employees are doing already can be replicated by new technology. Advanced Meter Infrastructure—the so-called Smart Grid—and the suite of devices known as the Internet of Things will play a major role in the transition to a new workforce, and change the types of workers utilities employ. This new technology will require new skill sets to construct, operate, maintain, and decommission.

That means that the replacement of older workers cannot be a "one for one" process. New workers will be doing different tasks—most probably at a higher skill level—within the same business process.

## The New Utility

When the Baby Boom generation was first hired by utilities in the 1970s and 1980s, the industry was much different from what it has become today. Utilities were adding generating assets—mostly coal and nuclear plants—at a furious pace to meet rapid consumer load growth. The need for new workers was great, so recruiters brought in a surge of fresh faces at every level of power plant operations as well as transmission and distribution.

Deregulation, higher capacity factor operation, energy efficiency, and an economy slowly shifting away from manufacturing meant that utilities could make do with generating assets built decades ago rather than adding more. And that meant that, by and large, they could make do with their existing Boomer and Gen X employees. The great surge in the workforce 30 years ago has moved like the proverbial pig through a python. The average employee has been getting older every year while few new employees were being added.

These longtime employees have been a good deal for utilities and customers alike, since their experience has helped ensure the kind of reliable service customers expect. Indeed, reliability is more important than ever, since our homes and businesses have grown dependent on digital technology that does not happily tolerate interruptions in electrical supply.

While digital technology has upped the customer expectation for reliability, it has also opened up new possibilities for electric utilities. Digital technology, combined with and contained in such devices as cameras, strain gauges, accelerometers, microphones, and the like, can replace the senses of workers. Software coupled with computing power can improve the speed and accuracy of the engineering calculations or better analyze risk. Robots or unmanned vehicles can carry tools and sensors where it is dangerous or uneconomical to send workers.

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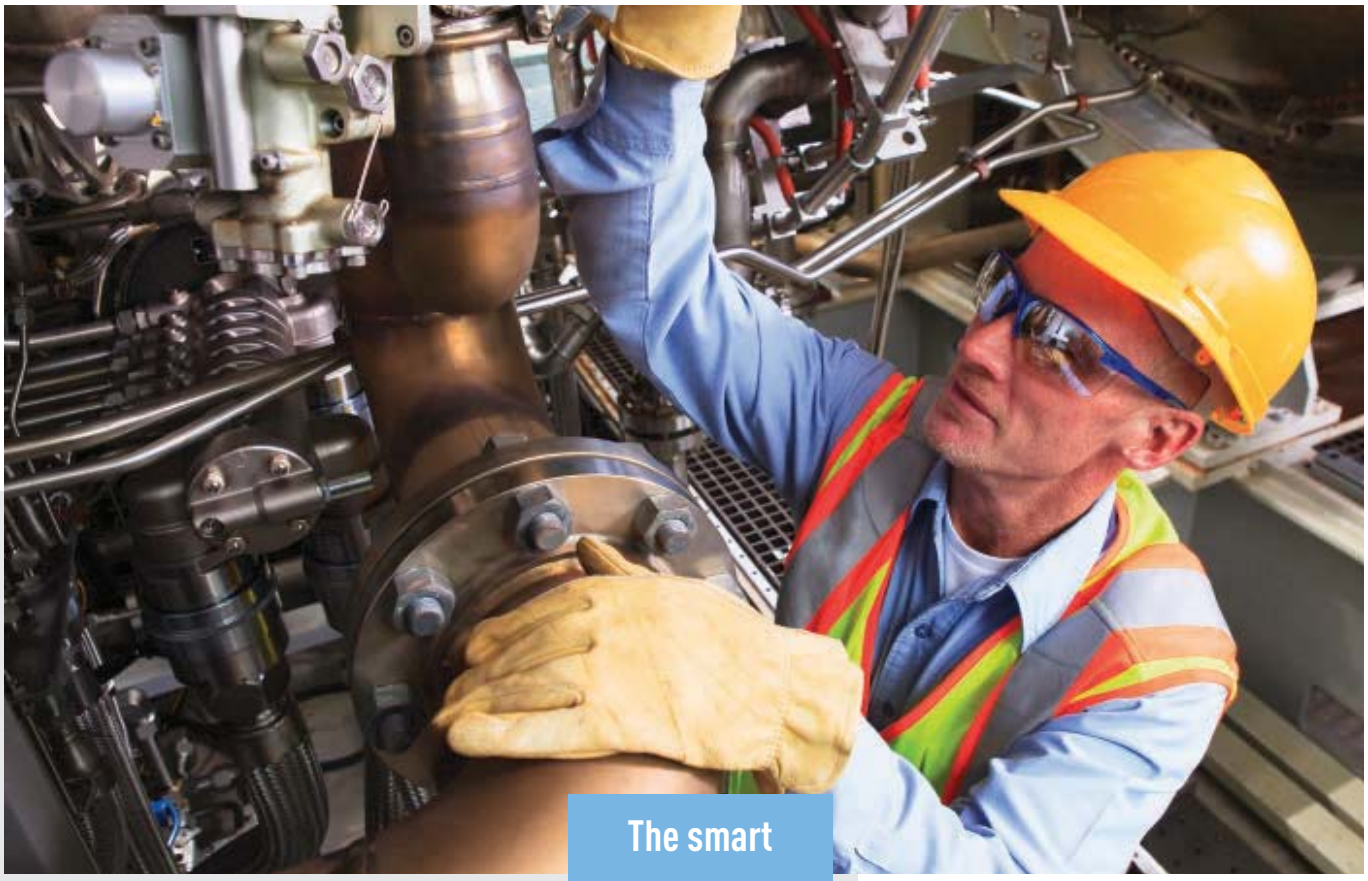
This suit of sensors and automation—including digital meters, advanced two-way communication, meter data management, customer billing software, and customer relationship management software—have enabled utilities to start building out the so-called smart grid. Utilities operating a smart grid are better able to monitor customer demand and in some instances collaborate with the customer proactively to turn off connected appliances and reduce load. The smart grid is also critical for moving utilities from their traditional baseload generation paradigm to distributed generation, which includes intermittent wind and rooftop solar power as well as feed-in from small-scale combined heat and power plants.

But as the complexity of technology control increases, these changes also shift the workforce.

One example of these changes starts at the customer meter and works all the way forward to the bill payment.

In the past, meter readers walked the street once per month and physically viewed each meter. They recorded the numerical readout on the meter and that monthly reading was carried back to the central office, where a billing specialist would calculate the usage based on the meter reading. A tariff approved by the local utilities commission (known as the rate) would be multiplied by the usage, adjustments made, and a paper bill sent out to the customer. The customer could pay by going to a billing office (in some communities the post office or general store) or mail the money to the utility.

As metering becomes smarter and more automated, meter readers, billing, accounts receivable, cashiers, and similar workers are being replaced not one-for-one, but by end-to-end software that starts at the meter and doesn't stop until the final bill



payment is received.

Now the meter reads itself every 15 minutes or less, and the results are radioed to a central meter data management system (computer plus software) and the usage calculated. That usage is sent to a customer relationship management system or billing system which prepares the bill and transmits it in whatever format the customer desires. The customer can set up automatic payment, or pay by cash or credit card.

Essentially no human intervention is necessary unless a customer calls for a problem.

The system replaces workers with IT and increases the need for programming staff and highly specialized customer service representatives to handle exceptional customer situations. It also increases the demand for engineers to continually add to and upgrade the hardware, software, and systems.

**The smart grid and other Internet of Things technologies will require workers to draw from a broader set of skills.**

There are other digital and information technologies that are transforming work and the worker at utilities. Supervisory control and data acquisition, or SCADA, systems are used to control the transmission and distribution system and address changes in load, supply, and impacts of weather, failures, and accidents. A control room SCADA system is faster than humans could ever hope to be. It can process a significantly larger amount of information and autonomously communicate and control with sensors, controllers, and displays to open and close breakers, switches, and other equipment. This speed, sophistication, and scope helps improve safety and

increase reliability and system quality.

What's more, SCADA systems are reducing the need for the manual switching of circuits in the field—and with it, the number of line jobs. Anyone hired for a line job today will, however, need to have more digital skills than ever before, as the sensors and controls are all being digitized.

## Digital and Analog

New technology is changing the role of engineers, as well. The smart grid and other Internet of Things technologies will require a broadening of the skills needed to service the equipment, the system growth, and the customer expectation.

For instance, the hand calculations that engineers have traditionally performed to estimate electrical loads, wire sizing, relay setting, reverse current, reactive voltage, and numerous other tasks can now be more easily and dependably done by specialized software applications. There are more than fifty software programs available to support electric utility system design. Some of the more common ones are ETAP, AutoCad Electric, MatLab, and EA-PSM.

Software is also assisting the mechanical engineer in sizing new towers, calculating physical loading, and performing a variety of thermal and design tasks.

On the other hand, SCADA systems that are being installed to improve utilities' reliability, costs, and response times also require more engineering to assure that the systems live up to the promised standards and are safe from cyber threats. And while technology is replicating many of the jobs engineers customarily performed, it is also amplifying the speed, productivity, and accuracy of what a single engineer can do.

On balance, then, what does the Internet of Things, digital revolution, and information boom mean for the engineering workforce in the electric utility industry? As the industry becomes increasingly digital, how should it respond to the Baby Boomer engineers who are now retiring and taking with them their analog skill set? Or has that analog knowledge become obsolete?

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Perhaps the most important question facing utilities and their human resource managers is: Do we need to replace that knowledge one for one?

I think not. But before that engineer goes into retirement we need to capture his or her institutional knowledge of the systems, operations, and maintenance that were never codified and therefore won't be available to the new user. In instances where training and institutional memory is lost, failures go up—and it is far from certain that the new smart grid technologies can make up the difference. Instead, if that knowledge is captured and stored in a systematic way, utilities would have a corporate institutional memory that is available on-demand to every employee.

A variety of new technologies, both used singularly and coupled together, will form the backbone of this knowledge capture. Examples of technology coupled together are helmet cams creating You-tube videos of work examples that train new engineers. Oil companies are using both Artificial Intelligence and virtual reality to both store knowledge and translate it into the engineering space.

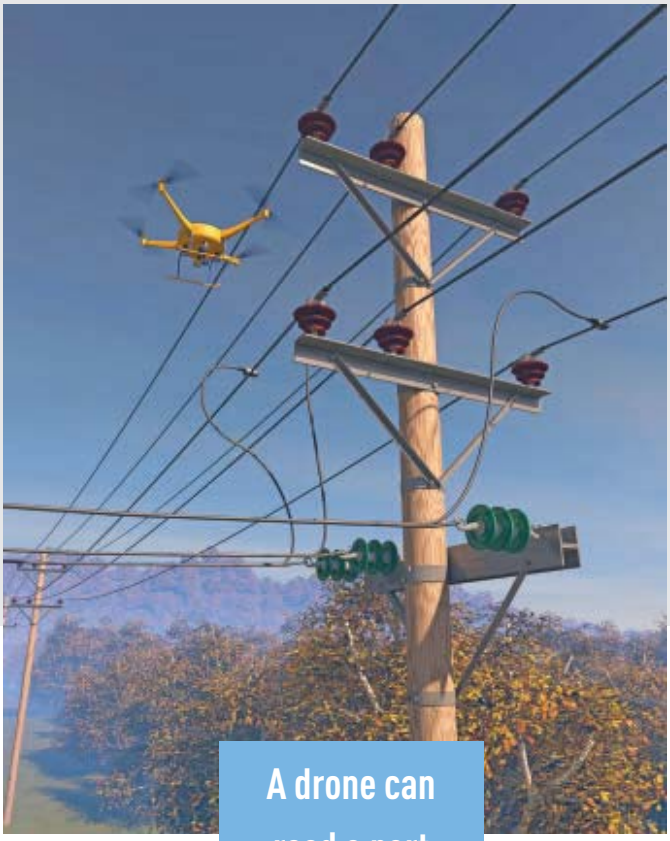
Online tools include the ability to pull drawings, procedures, and other information necessary to effect a field repair to an on-line mobile device.

## Navigating Change

For mechanical engineers who are currently in the middle of their careers at electric utilities, there are two distinct areas where new technology is both assisting and

competing with them.

On the one hand, new tools and technologies are making fieldwork safer and more efficient. For example, a drone can read a part number on a high voltage line where before it took three workers. The use of drones in this way is not only faster, safer, and less labor-intensive, but it can also provide more information, such as images of the area surrounding the damaged part that can be sent back to the office for analysis. In New York, Con Edison recently announced it is deploying an aerial drone that can inspect power plant boilers.



For the engineers doing design, operations, and maintenance from the office, the plethora of new software and other tools is amazing. Calculations that used to take days to do and more days to draw now take a fraction of the time—creating significant productivity improvement.

However, the time freed up by automated calculation is now going into analyzing the new big data sets as the information streams multiply and need to be analyzed and acted on. While CAD/CAM and other software reduce stress, static, and dynamic loading—as well as create better as-built drawings—new engineering tasks are created by the need for higher reliability, lower cost, greater cyber-security, and the maintenance of aging infrastructure.

In addition, engineers will need to work with a variety of other disciplines to define the knowledge, new skills, and technologies that will create ongoing value for the utility while maintaining the reliability and service that customers demand.

Ultimately, the most important impact of the smart grid and the Internet of Things on the engineering workforce is that utility companies will expect fewer engineers to deal with larger and more complex problems. The engineers who will have the greatest value to utilities are the ones who can best navigate the changing interface between knowledge, technology, and humans.

Given their reputation as savvy users of digital technology, I think engineers from the Millennial generation will be of great value to electric utilities. The Bureau of Labor Statistics expects only small growth in the number of engineers in the utility business in coming years. My take is the increasing reliability, complexity, knowledge needs, ownership of distributed generation, environmental control, and cyber-security (to just name a few of the engineering opportunities) will lead to a much greater need for new engineers in the electric power sector.

I'm still not sure whether engineers will be needed in as great numbers as they were during the great hiring spree of the 1970s and 1980s, but good engineers always can create new value for the electric power sector and are not going away from the utility business soon. ME

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