How the Digital Twin Delivers on the Promise of Digital Transformation
Platte River Power Authority serves customers in one of the most bucolic spots in America. Located in the shadows of Colorado’s Rocky Mountains, the communities of Estes Park, Fort Collins, Longmont and Loveland own the 46-year-old non-profit wholesale electricity generation and transmission utility, which operates a diverse mix of generation assets, including wind, solar, natural gas and coal units.

Platte River’s picturesque service territory does not bubble it off from the rapid changes taking place in both the state and national electricity sector. In fact, two of the primary changes Platte River is navigating are ones that are familiar to utilities across the nation: an aging workforce and a large influx of intermittent generation produced by wind and solar power plants. “Operating complexities have grown significantly in the past several years, with the growth of non-dispatchable resources, and the new growth of energy storage will complicate things further,” said Johel Comas, Senior Plant Electrical Engineer at Platte River.

It’s not a challenge faced by Platte River exclusively. Indeed, Bloomberg New Energy Finance (BNEF) projects that price reductions, technology improvements and increased demand for electric vehicles (EV) will lead the global market for energy storage to double six times by 2030. At Platte River, and around the nation, the increased complexity presented by significant increases in
renewable energy and energy storage will have to be handled by a relatively new and inexperienced workforce. The U.S. Department of Labor (DOL) recently estimated that around half of the current energy industry workforce will enter retirement within the next decade, and a report by the Department of Energy (DOE) said that 25 percent of electric and natural gas utilities will wrap up their careers within five years.

Platte River’s response to such all-encompassing change is to be proactive.

“We have a much shorter training timeframe for new operators and more confidence with our experienced operators to continue refreshing their skills.”

ROB BARDEN | OPERATIONS SUPERVISOR, PLATTE RIVER

“Constant training for our highly-skilled workforce keeps Platte River ahead of the curve, and the changes the utility industry is currently undergoing enable us to cultivate the skills and expertise needed for the future,” said Rob Barden, Platte River’s Operations Supervisor. Which is another way of saying that new technologies provide critical tools to prepare workers for a more complicated industry.

For example, Platte River is proactively planning for upcoming retirements among its operations workforce by acquiring a digital twin made by Emerson.
Automation Solutions, a Texas-based company that helps manufacturers and others automate and optimize their production processes.

Since acquiring it in late 2016, Platte River has used the digital twin to train both new and more experienced operators at its Rawhide Unit 1, a 280-megawatt coal power plant. The improvements have been noticeable. “We have a much shorter training timeframe for new operators and more confidence with our experienced operators to continue refreshing their skills,” said Barden.

The digital twin has been used to provide insights and guidance for operators about what to expect under the types of challenging conditions that are more prevalent as more wind and solar come online. Platte River has also used the digital twin to test new logic before it actually gets downloaded into the plant’s control system and to uncover any potential issues that may arise under low load operation.

Platte River can quantify the benefits it has reaped, including a 45 percent improvement in the efficiency of plant startups and shutdowns. “This equates to considerable savings in fuel oil,” said Comas.
THE PROMISE AND THE CHALLENGES OF DIGITAL TRANSFORMATION

By no means is Platte River alone in its efforts to tap the power of new digital tools to improve its operations and the skills of its workforce. A recent Deloitte global Industry 4.0 survey gathered insights from utility executives around the world about the forces that are having the most impact on their business – changes in fuel prices and availability topped the list, with the influx of solar not far behind.

The survey also gathered feedback about the top digital priorities executives have for their utilities over the next three to five years. Over half said that their priorities were admittedly ambitious: nothing less than implementing a holistic digital initiative spanning everything from generation to distributed energy management to drive improvements in overall productivity and profitability. Other top priorities included tapping data and analytics to run a more efficient business and to improve operations reliability with the help of machine learning and artificial intelligence (AI).

Those ambitions are widespread, though progress on actually achieving them has been slow. A recent Bain & Company report about utility digital transformations noted just how hard they are to accomplish, even as some companies have invested hundreds of millions of dollars and hired dozens of data scientists. In fact, Bain found that only 5% of utilities reported achieving or exceeding their expectations around digital transformation. By contrast, 75% said they had settled for “dilution of value
and mediocre performance.” A separate report by the McKinsey Global Institute found that U.S. utilities were lagging behind companies in other industries in achieving their digital ambitions.

This is a decidedly mixed narrative, full of promise and excitement as well as frustration. It is hardly surprising, then, that many utility executives have grown a bit weary of all the hype and grand promises that tend to accompany discussions of digital transformation.

It's only natural: panelists and vendors at industry trade shows and conferences continuously tout the many ways that AI, machine learning, industrial internet of things (IoT) and analytics will fundamentally reshape the industry. But few would disagree that progress is slow and difficult. “One of the main things that has happened is that there has been so much over promise and so much under delivery that the industry got burned. And not just the power industry, but many industries,” said Robert Yeager, President at Emerson Automation Solutions, Power & Water Solutions. “I think there’s a healthy skepticism that the proof has to be in the pudding. So, when you talk to utilities about digital transformation, you better back it up with a business case. That’s when you see success because otherwise, it’s just technology for technology’s sake.”

Real business cases for the use of digital technologies do exist. In fact, Emerson is engaged with over 70 digital transformations with utility customers around the world and has already
completed over 20. The business cases for each of these transformations is unique to the priorities, drivers and challenges faced by each utility. But as a rule, they each seek to achieve one or more of three benefits: cost reductions, cost avoidance and improved productivity.

"I think there's a healthy skepticism that the proof has to be in the pudding. So, when you talk to utilities about digital transformation, you better back it up with a business case."

ROBERT YEAGER | PRESIDENT, EMERSON AUTOMATION SOLUTIONS, POWER & WATER SOLUTIONS

The right digital twin can achieve all of these objectives today. But it’s essential to remember that not all digital twins are the same. As most power plant operators know well, digital twins have been around for a very long time. But the main problem with past iterations of digital twins is that they were highly accurate and effective — until they weren’t. “When you created a digital twin or some other kind of simulation of a process, it would work well for about six months,” said Yeager. “But then, after about six months, there are changes to the design, there are changes to the logic and it ultimately degrades into something unusable and actually better not to have at all because it provides disinformation.” In fact, Platte River sought out a new digital twin from Emerson because the one it had been using stopped providing the benefits the utility needed.

Emerson’s digital twin is an example of an ongoing breakthrough that erases the wall between a power plant’s control system, the automation system
and the digital twin. Today, they can be integrated, which is key to ensuring that a digital twin doesn’t become obsolete just months after it has been deployed. “With the most recent release of the digital twin, there’s no difference between the digital world and the automation system. There’s no difference,” said Yeager. “You can basically build the same thing in the digital world as in the plant’s world so that when the real plant changes, you can automatically export the logic into the digital twin.” This doesn’t just happen automatically, of course: it’s the result of six years of development and around five million lines of code. But the implications for utilities today – and even more so in the future – are profound.

“You can basically build the same thing in the digital world as in the plant’s world so that when the real plant changes, you can automatically export the logic into the digital twin.”

ROBERT YEAGER
PRESIDENT, EMERSON AUTOMATION SOLUTIONS, POWER & WATER SOLUTIONS
HOW A **DIGITAL TWIN BUILDS MOMENTUM FOR DIGITAL TRANSFORMATION**

The benefits of a digital twin able to mirror a plant’s control system do two vital things simultaneously: it delivers immediate and tangible results for plant operators and utilities, and those results help to build momentum for a more holistic digital transformation. Ultimately, the longstanding separation between plant systems and the digital twin will disappear completely. Yeager predicts that will be the reality in three to five years. “We’ll no longer be working on disparate systems. There won’t be a utility digital world and an Emerson digital world.

They’ll be the same,” he said. “They will be updating in real-time and diagnosing and troubleshooting in real-time in a way that allows operators to see pending problems in the plant and fix them before they break.”

While that’s not entirely the case today, what a sophisticated digital twin can deliver in terms of improved efficiency, cost containment and avoidance is more than enough to underscore the value of smartly implementing digital technologies in the utility industry. For example, the American Society of Civil Engineers (ASCE) issued a report card on the nation’s infrastructure and gave the energy sector a D+, noting that much of the electricity system was built in the 1950s and 1960s and expected to last 50 years. As more and more generation, transmission and distribution equipment nears the end of life (and also for newer equipment), the need to be hyper-vigilant about potential problems that can lead to outages becomes critical.
A digital twin can help avoid the potential maintenance costs that come from equipment failure by pinpointing it early and diagnosing a fix before it actually fails. This can amount to a cost-savings in the millions of dollars, and potentially much more when you consider the money that can be lost by not participating in a market for even a few days. “It’s not just the cost of replacing, say, a boiler feed pump on a coal plant,” said Yeager. “But when plants bid into markets and can’t supply the power, they can lose a million dollars a day.”

A digital twin can also help power plant operators maximize their revenues.

“They will be updating in real-time and diagnosing and troubleshooting in real-time in a way that allows operators to see pending problems in the plant and fix them before they break.”

ROBERT YEAGER | PRESIDENT, EMERSON AUTOMATION SOLUTIONS, POWER & WATER SOLUTIONS

Although each power market in the U.S. is different, many allow participation in emerging ancillary markets that reward frequency response or capacity to support intermittent renewable energy. For power plants that have long operated continuously to provide baseload power, participating in these markets requires the plant to function in a fundamentally different way. For example, more and more coal plants that have traditionally had a very high capacity factor are being asked to ramp faster in order to supply electricity when intermittent renewable generation is not producing enough to meet demand.
Taking advantage of new market opportunities can seem very risky if it’s not how a power plant has run in the past. A digital twin can lower that risk. “When you get into this digital twin common platform, you can see that you’re able to ramp the plant faster, which means improved productivity,” said Yeager. “You’re able to test these different scenarios and participate in these markets and sub-markets that have emerged.”

A digital twin can also help with the daunting challenge of a retiring workforce. No utility wants to provide on-the-job training that might risk a plant outage. At the same time, it’s more critical than ever to train the next generation of workers, which is something a digital twin can do. By leveraging the existing knowledge about everything from boiler feed pumps to combustion turbine
controls that experienced plant operators have, and allowing newer workers to train on a digital twin, it’s possible to prepare the employees all utilities will need in the future.

For example, the Korea South-East Power Company, Ltd., has embraced the use of Emerson’s digital twin virtual reality (VR) simulation training system in large part because of the state-owned utility’s need to train power plant operators quickly and effectively. “Retiring workers have a massive impact on the operation of our facilities,” said CheonHyung Lee, Associate director of KOEN Yeongheung power plant. “Training new workers is important to Korea South-East Power Company, Ltd. because new workers have to replace the retiring workers and operate the facilities based on accurate information and experience.”

The utility has implemented Emerson’s digital twin to augment training at its Yeongheung coal power plant, which delivers nearly 23% of the power consumed in the Seoul metropolitan area. The VR simulation training has replaced a more ad-hoc, text-heavy approach to knowledge transfer. The previous approach suffered from a lack of consistency in documenting best practices, was extremely time-intensive and represented a mode of learning younger workers did not embrace. “In the past, people got the information through the content based on the text,” said Lee. “Now, as Internet technology has improved, people learn and get new information through video content, like YouTube. We think VR technology is a higher-level technology that goes beyond video.”
Lee says that VR training has delivered more benefits than expected. Today, the utility uses VR training simulation before new operators attempt pilot operation of the plant. “New employees had been burdened with the fact that they had to learn and obtain their predecessor’s skills and knowledge in a short time. Now they have more time and less burden,” said Lee. “Thanks to the program, the operators’ skills and understanding of installation could be enhanced before putting them into the pilot operation.” Though it’s too early to quantify actual cost savings from using the VR training, Korea South-East Power Company, Ltd. expects it will reap long-term savings due to more efficient and effective training.

There’s an added benefit of using a digital twin for training: it’s a way to attract workers who expect a digital work environment and want to make an impact quickly. “What I’ve noticed about tech-savvy workers is that they want to come in and contribute fast,” said Yeager. “I’m good with that, and...”
I know they get frustrated when they don’t feel like they are making a difference. But if you put them in this digital twin world, not only do they learn quickly, they can’t hurt anything.”

There are simply too many upsides to utilities embracing digital tools to improve their operations and revenues for the understandable skepticism that exists today to stop progress. But that larger digital transformation that can help utilities, their customers and society as a whole starts with delivering measurable benefits today. “Emerson has a big digital transformation effort underway, and the digital twin is part of that,” said Yeager. “But to get to things like autonomous plants and some of the other benefits a digital transformation can deliver, we have to show real results. That’s our goal. That’s what we are doing.”
Emerson (NYSE: EMR), headquartered in St. Louis, Missouri (USA), is a global technology and engineering company providing innovative solutions for customers in industrial, commercial and residential markets. Our Emerson Automation Solutions business helps process, hybrid and discrete manufacturers maximize production, protect personnel and the environment while optimizing their energy and operating costs. Our Emerson Commercial and Residential Solutions business helps ensure human comfort and health, protect food quality and safety, advance energy efficiency and create sustainable infrastructure.
Industry Dive’s Brand Studio collaborates with clients to create impactful and insightful custom content. Our clients benefit from aligning with the highly-regarded editorial voice of our industry expert writers coupled with the credibility our editorial brands deliver. When we connect your brand to our sophisticated and engaged audience while associating them with the leading trends and respected editorial experts, we get results.