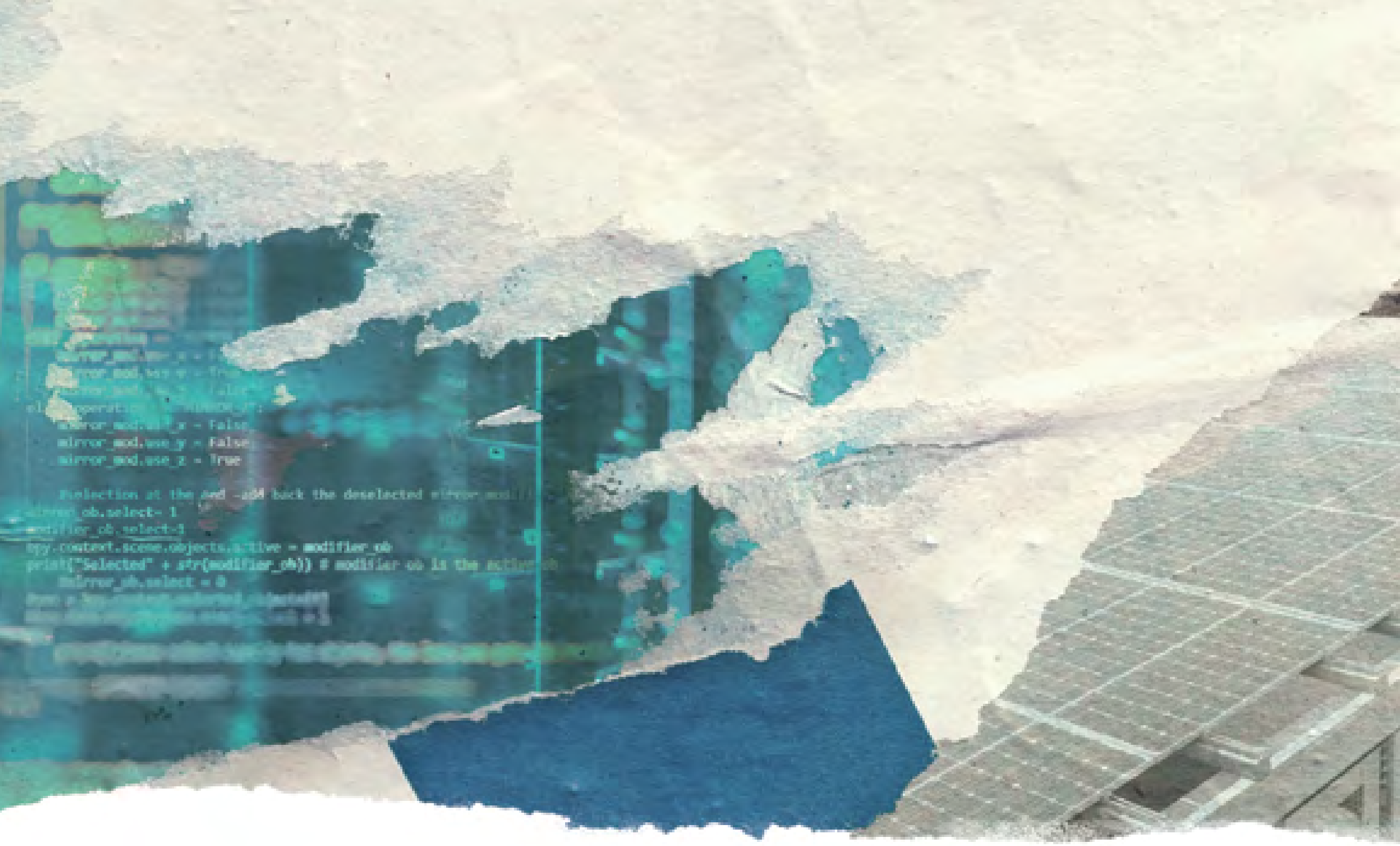
SOMETHING OLD SOMETHING NEW

SOMETHING BOLD BECOMING TRUE

Integrating new capabilities into legacy systems can involve untangling complex interactions, but the case for making the effort is growing ever stronger.



What's one of the most stressful situations in business? The IT department is taking a vital system offline, possibly for an extended period, to perform maintenance or install an upgrade.

Utilities have similar needs to maintain, service and upgrade their systems and equipment — and to do so without interrupting service to their customers.

"They don't get to say, 'Time out, we're going to stop delivering power for the next few weeks while we upgrade our back-end systems or replace a key piece of equipment, and we'll let you know when it's back online,'" says Lucas McIntosh, managing director of advisory consulting at 1898 & Co., a business, technology and security solutions consultancy, part of Burns & McDonnell.

Maintaining continuous service is but one of the challenges that accompany much-needed modernization and upgrade projects. Whether physical or digital — or a combination thereof — it can be cost-prohibitive and time-consuming to replace everything. Integrating old and new systems and equipment is a complex undertaking, but one that is essential to maximizing return on investment and keeping customers satisfied.

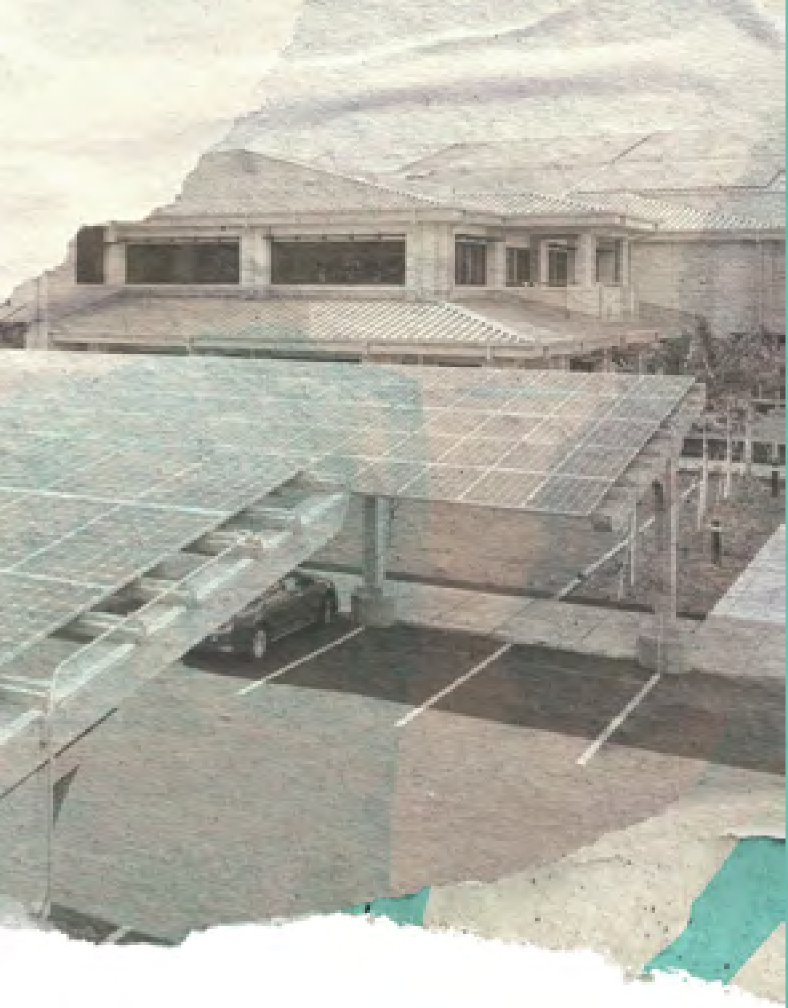
"How do we sequence the updates? How do we continue to operate while we modernize? How do we convert to new systems? What order do we conduct the integrations? These are all questions any operator needs to address," McIntosh says.

There are many reasons beyond outright cost that might cause one to explore incremental upgrades, which would then necessitate integrating systems.

Growing and changing expectations from end users can push utilities, for example, to embrace technologies and capabilities that might not have existed until recently.

"I don't care what industry you're in, customers are looking for answers, now versus in a monthly paper bill," says Robb Montgomery, director of enterprise systems and integration at 1898 & Co. "They want to be able to see their usage every day, how it compares year-over-year or month-over-month, to help them make better decisions. Industries and clients alike want to be able to pivot to answer questions quickly."

Technology has the potential to enable this and so much more. Advancements are being developed and released that can improve performance and efficiency, whether through more powerful hardware, greater real-time awareness and responsiveness to environmental variables, or other advances.



“The classic way to think about industrial controls is through centralized control,” says Mike Fenske, a vice president and general manager at Burns & McDonnell. However, with greater implementation of smart technologies, things are moving toward a more distributed model.

“Decentralized control works around the idea of reading environmental variables and adjusting decision-making based on what the environment is reporting,” Fenske says. “Buildings with these capabilities are becoming a smart element of the overall ecosystem by using the networked effects of distributed smart devices.” (***See page 33 for more about this technology.***)

With the ability to detect and adapt to energy usage patterns, thermal conditions and more, such buildings have great potential to perform better economically while improving the environment by reducing waste, he says.

Regulations can push operators toward the incremental update approach as well.

“Policy in the U.K. is fundamentally about optimizing the use of an asset over its life, not performing holistic asset replacements as sometimes occurs in the U.S.,” says Jeff Casey, who leads international project development for Burns & McDonnell in the United Kingdom. »

DRIVING ADAPTATION IN POWER SYSTEMS

The adoption of electric vehicles (EVs) is growing exponentially. One million EVs were on the road at the end of 2018, and the Edison Electric Institute estimates that number will grow to 18.7 million by 2030, including the next million hitting the road in less than three years. This rapid expansion is driving some utilities to revisit some assumptions about demand.

“The proliferation of EVs is fundamentally about integrating new with the old,” says Jeff Casey, who leads international project development for Burns & McDonnell in the United Kingdom. “The system is built for one-way power flow from a generator to a consumer, with measurable and consistent demand supplied by generation that can be planned well in advance.

“With intermittent renewables, and with flexibility and energy storage systems coming on faster than ever, and then adding electrification of heat and transport, that means the way we integrate these new technologies into an analog system needs to be reconsidered.”

Being smarter about the way electricity is managed, including EV charging management and flexible, responsive networks, is essential to maintaining systems that can respond to shifting demands.

“Many utilities are not prepared for all the EVs coming into the market,” says Preety Mathema, a senior consultant at 1898 & Co.

Systems could crash, she says, if charging is not managed and systems are not maintained and adapted to handle the shifting demand. “That means utilities are looking at integrating types of systems — like charging stations and charging management systems — that didn’t exist maybe 15 years ago but are becoming more prevalent.”

SYSTEM INTEGRATIONS:

HOW MIGHT THEY AFFECT DIFFERENT INDUSTRIES?

Aviation
Baggage handling systems could be tied into flight scheduling systems, traffic notifications and more.

Commercial
Customer information systems such as billing and payroll can be as complex to integrate as they are vital to daily operations.

Power
Incremental grid modernization steps enhance capabilities and support increasing customer demand for near-real-time data.

Transportation
Electric and autonomous vehicles will depend on — and feed into — highly responsive systems.

Water
Smart metering quickly identifies leaks or changes in water usage and can feed into long-term planning.

That means electric utilities need to be diligent about measuring, monitoring and accurately accounting for the lives of their assets, such that they're only replacing those needing attention.

Such regulatory policy, part of the U.K.'s RIIO (Revenue = Incentives + Innovation + Outputs) framework, requires utilities to deploy a condition-based maintenance and a totex (or whole-life cost) investment planning approach.

Consider a certain vintage and make/model of transformer, Casey says: "Maybe not all of them have experienced the same conditions — temperature, lightning, load, faults, runtime, etc. In the U.S., we might elect to replace them all across the system because they are 40 years old. In contrast, here in the U.K., we might look at them each based on the condition to make a weighted decision on which need replacement and when."

Once you shift to an incremental-replacement mentality, however, integration becomes critical to effective operations.

"If you're going to replace a transformer at an old substation with a new one that may have old control systems, you have to make the right investment and engineering decisions on how to integrate something that's new," Casey says.

LEARN MORE ABOUT HOW U.K. REGULATIONS ARE AFFECTING CAPITAL DECISIONS.
burnsmcd.com/RIIOrules

Additionally, it can become costly to support legacy systems as they become older and lose the support of vendors, who might only support a system for a given number of years or iterations. Keeping those systems working — and retaining the critical staff who know how to use and maintain them — can become an ever-growing concern.

"Some of a utility's most vital back-end systems might have been written back in the '70s," Montgomery says. The cost to support those legacy systems can be a powerful incentive to upgrade or modify an organization's technology stack.

Furthermore, he adds, there are fewer people around who know those technologies, forcing operators to either outsource that support or modernize the systems to keep them current. That's forcing some organizations to upgrade and either write the system from scratch or buy something off the shelf and customize it to meet their needs.

Mergers and acquisitions within an industry can also be a practical driver of change. For example, a power utility holding company with several operating companies in different states would have strong reasons to streamline vital systems from multiple vendors to unlock greater cross-enterprise efficiencies. Merging those systems into one can reduce support count and associated overhead, Montgomery says.

So the decision was made to upgrade some systems, and you need to manage their integration with your existing hardware or software. Now what?

“Disparate systems are more interconnected than ever,” says Preety Mathema, a senior consultant at 1898 & Co. “The distributed energy resources management system might talk to the distribution management system, which also might talk to the advanced metering infrastructure system or meter data management system.

“We have to make sure that different vendors’ systems will work with each other’s requirements and communicate that to our clients to make sure the systems are well integrated. IT and OT convergence means the requirements for safety, security and reliability are a thread throughout the transformation and moving forward.”
(***Read more about IT/OT convergence on page 8.***)

What’s true for digital systems is true for physical equipment too, McIntosh says: “Often we have to put out new devices on old infrastructure that have to be compatible with the communications systems already in place.”

Where systems are being integrated, data quality comes into play. If the data from the legacy and new systems is not mapping up, the systems are not properly and seamlessly integrated.

In one alternative to a standards-based approach to protocols and data architecture, some organizations are removing business processing from single applications and moving it into middleware systems, Montgomery says.

“Imagine the middleware as the center of the solar system, and all other applications — such as supply chain, customer systems, HR or finance — as planets orbiting the sun,” he says. “You could remove one of those planets and plug in a different system and it wouldn’t matter because having a piece of middleware in between systems that can convert the language — the data definitions — eliminates some communication problems.” »

READ HOW ELECTRICAL GRID DESIGN WILL CHANGE AS IT INTEGRATES DISRUPTIVE TECHNOLOGIES.
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Part of the rationale for this approach is that many of those applications can be used as the original equipment manufacturer intended, without customization. That makes upgrades easier; customization tends to increase the costs of ownership.

"We're always managing limitations of the system in general," McIntosh says. "That's why we promote standardization to minimize incompatibility issues. Standardization allows for more plug-and-play both in the physical and digital world."

Helping organizations select and set standards is part of that process. Analyzing the value of setting standards and enforcing them is another that can identify savings in operating and capital costs.

Using an engineering-led approach can make the integration process more efficient.

"We have a really strong understanding of how the components of the system, new and old, come together based on our experience with both the physical assets and the technologies they are controlling," Casey says. "We understand how they seamlessly knit together and interact in ways that solve the underlying challenges. That's one key to selecting the right technology to solve system problems."

Another is through vendor-agnostic and technology-agnostic solutions, says Jonathan Chapman, managing director for Burns & McDonnell in the U.K. He cites a recent confidential project in which Burns & McDonnell recommended a radically different solution than the client had proposed procuring.

"We went back to first principles and offered them something quite bold," he says. "We said, 'You've tried to solve the wrong problem,' and we explained why. The client could have been taken aback, but instead thanked us for helping them realize they'd been trying to solve the wrong problem for three years."

As more technology and different capabilities become available and need to be integrated into existing systems, partial solutions can arise in different places. Many operators perceive the challenge as overwhelming. Integrating those capabilities across the supply chain becomes the hurdle for a wide range of industries.

"We can act as that integrator for our clients," Chapman says. "Integrating all the different providers with different technologies to help solve a problem provides a tailored, bespoke solution."

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>
> JEFF CASEY

POWERFUL NETWORK EFFECTS THROUGH DISTRIBUTED DEVICES

Centralized control is typically a default assumption for computer systems. Information is gathered and brought to a central processing unit to evaluate and dictate action. But new technologies are enabling a strikingly different model.

As buildings are constructed or enhanced with many individual pieces of smart technology — think of a Wi-Fi enabled thermostat, smart light switches with built-in sensors, or internet-enabled smart speakers — they are both providing and receiving more environmental data than ever before, says Mike Fenske, vice president and general manager of the Global Facilities Group at Burns & McDonnell.

"That one sensor in the light switch can tell the entire system that the light is on," Fenske says. "It didn't need the whole house to know that, and it didn't need to rely on a central system to tell it that. The central system is the internet, and it's enabling technology to communicate in so many more layers than a set of wires."

When individuals agree to the terms of connected devices, those agreements enable communication paths that didn't exist before. With a growing body of agreements, there becomes new capability to leverage that ecosystem of knowledge to enable greater collaboration.

"Who controls that environmental knowledge, and who can use it?" Fenske says. "What new technologies will connect smart buildings to smart traffic signals, or autonomous cars to traffic data? Think of the day when you have a hot dog stand and it tells you to move down two blocks because the traffic pattern is different today."

While that level of awareness might intimidate some, its potential for improving comfort is vast. A smart building could draw on the environmental data from this swarm of sensors to do more than adjust lighting or heating. It might detect patterns in surges of power usage that could help recommend power purchases at better rates or drive more efficient usage.

Those capabilities come at a price. Making the right economic decisions on which technologies will enhance the value of the product is the ultimate question.

"In business, technology for technology's sake is often the enemy," Fenske says. "The key is using technology to improve the bottom line and make the product more valuable."