Benchmark Insights

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Digitizing electric utilities

Core Performers power up reliability and resiliency

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By Cristene Gonzalez-Wertz, Lisa-Giane Fisher, Ricardo Klatovsky, and Casey Werth

Key takeaways

The success of Core Performers demonstrates that the basics of energy management remain as important as ever. In fact, Core Performers are more than twice as profitable as their peers. Core Performers provide a model for building the sustainable utility of tomorrow through logical, extensible investments today.

Core Performers are deferring new capital investments in grid assets by optimizing existing equipment. A renovated grid needs to enable multidirectional flows and the scaling down of legacy sources while scaling up renewables—often at the individual location level. Core Performers investing in AI and advanced analytics for automated detection and response will more than double in the next three years.

But—Core Performers are grid-focused first. Their goal is to intelligently integrate, organize, and manage sources of renewable energy generation. This integration depends on a newfound ability to respond directly to real-time grid conditions. In the next three years, Core Performers are prioritizing IoT for remote alarms.

The future of electric power utilities will heavily rely on leaders and teams making radical, innovative choices. Consumers and businesses are demanding greener energy options —and electric utilities are preparing for a cleaner distributed energy future. In the next three years, nearly 60 percent of Core Performers expect to invest in transmission reliability, compared with 47 percent of other electric power utilities.

For most people, their utility grid isn't an afterthought—it's not a thought at all. For much of the grid's existence, consumers, businesses, and entire industries treated energy creation and consumption as a black box. Like the air we breathe, it's easy to take for granted.

This is changing, but exactly how is unclear. The future—even the near future—often holds surprises, be it a disruptive technology or a global pandemic.

We do know this: increasingly, consumers and businesses are demanding greener energy options and transformative initiatives. All over the world, people who aren't even employed by utilities are participating in energy transition efforts, funding, and advocacy. Simultaneously, electric utilities are considering numerous approaches to improving grid performance and preparing for a cleaner, distributed energy future.

But globally, power utility maturity is unequal at best. Availability of natural resources, such as sun and wind, and access to capital exacerbate inequities. And in a post-COVID world, an evolving—or nonexistent—"normal" may exert unique pressures on energy company operations (see "Insight: Integrating renewables—tempering realistic plans with new trends" on page 3).

To help guide short- and longer-term strategies, the IBM Institute for Business Value (IBV) identified a group of electric power generation, transmission, and distribution utilities that perform better than their peers in core reliability, resilience, and profitability metrics (see Figure 1). And, they're moving steadily toward a more sustainable energy future.

We call these leading organizations "Core Performers," and they demonstrate that the basics of energy management remain as important as ever, even in the face of constant disruption. Our analysis of Core Performers provides a roadmap for building the utility of tomorrow through logical, extensible investments today.

This report outlines four essential enablers that help Core Performers build a more resilient, reliable electric infrastructure. This framework enables growth while mitigating adverse impacts on people, local economies, and the environment.

Core Performers combine IoT-connected sensors with communications and analytic technologies to gain faster, more accurate insights that can help prolong asset life.

Build physical infrastructure efficiency, reliability, and resilience

This initiative improves the efficiency, reliability, and end-of-life replacement planning of physical infrastructures while reducing field crew visits, inspection-related shutdowns, and maintenance costs.

Almost one-third of Core Performers have implemented tools that can analyze data generated by sensors and actuators, along with real-time events and asset health indicators from SCADA/EMS, for *predictive maintenance and quality*.

On average, more than a third of Core Performers have *instrumented and connected equipment* in plants and grids. Equipment-mounted sensors collect operational data that, when analyzed, allows utilities to monitor performance, optimize maintenance schedules, and better understand performance shortfalls—in real time.

Geographic information systems and weather data, blended with data from smart meters, line sensors, and other types of IoT devices, are also analyzed to predict the possibility of equipment failure. This alerts operators to perform fixes *before* outages occur. Core Performers are in a better position to support fault and status detection using data from digitized assets (see Figure 3).

Increase the efficiency, reliability, and resilience of physical infrastructure

Counterintuitively, the percentage of Core Performers expecting to use IoT purely for predictive maintenance is expected to decline over the next three years, from 35 percent to 31 percent, with their use of advanced analytics for this purpose remaining flat at 31 percent (see Figure 3). Why? They plan on transitioning to more sophisticated applications to increase visibility and uptime benefits.

IoT for remote alarms allows a utility to monitor and detect anomalies in renewable energy IoT endpoint data—such as vibration, temperature, or humidity—and define conditional rules that trigger subsequent actions when thresholds are met. An example is the automatic shut-off of renewable energy equipment in case of harmful weather conditions. This mitigates the risk of damage.

IoT for facility management enables sensors to monitor the productivity of plant and grid equipment, alerting facility managers to real-time issues and automatically scheduling preventative maintenance. This application almost doubles in uptake by Core Performers, from 25 percent to 42 percent in the next three years (see Figure 3).

Over a third of all electric power utilities surveyed expect to use *digital twins*, precise data replicas of intelligent workflows, in the next three years (see Figure 3). Digital twins provide an asset management platform that combines large amounts of disparate data into a cyberphysical image that depicts comprehensive views of complex systems over time.

Digital twins also enable collaboration among experts from engineering, operations, and infrastructure planning, as well as suppliers, customers, and other electricity ecosystem participants. Keeping a digital twin fresh with current data and analytics is what drives its value. Well-documented rules, roles, and governance need to be established across the ecosystem.

Optimize efficiencies using automation and AI

The number of Core Performers applying IoT for machine/industrial automation in their plants and operations is expected to almost triple—from 14 percent today to 38 percent in three years. The use of automated detection and response and cognitive and prescriptive analytics should increase at a similar rate (see Figure 3).

IoT for facility management has a number of applications that are addressed in Pattern 2, including health and safety and physical security. Far more Core Performers collect health and safety data by using technologies such as Bluetooth beacons embedded in the clothes of field technicians, vendors, and visitors.

These technologies *monitor health key performance indicators (KPIs)* such as temperatures and heart rate, as well as identify symptoms of illness. The devices can also detect location information, helping to determine exposure to dangerous gases, chemicals, or other contaminants.

More than 40 percent of Core Performers plan to use these solutions in the next three years to track the number of injuries and illness rates, near misses, short- and long-term absences, vehicle incidents, and property damage or loss during daily operations (see Figure 4). Real-time reporting on health and safety KPIs enables faster intervention when needed, improving health, safety, and regulatory compliance.

As well, more than 40 percent of Core Performers report expecting to use IoT technologies to track, monitor, and manage multiple facility management operations simultaneously in the next three years—an increase of 17 percentage points from today (see Figure 4). This IoT dimension to facility management offers contingency planning and an improved workforce security visibility through connected cameras, implanted tags, beacons for workforce ID confirmation, and other tools. Beacons can also transmit messages that can be picked up by nearby devices and used to trigger actions or start scheduled workflows.

Update and digitize customer engagement, service, and support processes

The number of Core Performer utilities relying on narrow internal solutions for customer analytics is projected to decrease in the next three years. However, *what-if analysis and scenario planning* remain key analytical tools. In the next three years, some Core Performers expect to move toward enabling cognitive assistants (chatbots) or online self-service portals (see Figure 4). Many of these solutions could be supported on the cloud (see "Endesa: A cognitive contact center as a service").

Endesa: A cognitive contact center as a service[1]

Endesa, the largest energy power company in Spain, is using AI in its contact center operations for both chat and calls—meaning that clients can be assisted without speaking to an agent. After a 2017 pilot, Endesa expanded the program across their entire service organization.

This pilot is not just about costs—it's about best-of-breed technologies. Endesa's solution encompasses core AI capabilities, including IBM Watson AI, complemented by specialist services and a multicloud integration with customer, CRM, and telephony systems.

The solution's real innovation is an as-a-service, outcomes-based contract. Endesa pays a unit fee only when customer interactions are correctly resolved by the AI without human agent intervention. They are also classifying complaints more quickly using text analytics. Endesa is extending their use of AI into machine learning models to prevent instances of nonpayment, as well. And, they're exploring how Robotic Process Automation can facilitate faster actions across the organization.

Four in 10 respondents note they have developed actionable insights from advanced metering infrastructure (AMI) data. Together with smart meters, AMI lets utilities offer value-adding services to consumers, such as direct usage feedback, flexible tariffs, and smart-home applications.

AMI also adds value by detecting tampering, identifying and isolating outages, and monitoring voltage. This results in lower outage costs and fewer inconveniences for customers.

Automate workflows and implement AI-powered analytics

IoT, advanced analytics, and AI help utilities realize the immense value in their operational and customer data by enabling smarter, more automated business processes. In the next three years, Core Performers expect to use a combination of these tools to automate and optimize workflows and logistics (see Figure 4). This improves crew productivity, equipment demand forecasts, and emergency response.

Other applications and associated benefits abound. They include pushing the technical limits of grids to support distributed power and enhancing operational efficiencies in facilities and business functions. Companies can continually improve the health, safety, and productivity of their workforces. And customer interactions and experiences can evolve around convenience, customization, and control.

Pattern 3: Digitizing grid operations and integrating distributed energy resources (DERs)

A smarter, modern electric grid can lower consumer cost, contribute to a more efficient economy, facilitate rapid growth in renewable energy sources, and enhance overall energy reliability.[2]

Pattern 3 uses three activities to digitize grid operations and provide an effective path for integrating distributed resources (see Figure 5):

- Modernize and secure the grid
- Integrate distributed energy resources (DERs)
- Digitize grid operations.

Electric companies are evolving from managers of extensive, long-lasting physical infrastructure into managers of datapoint digitized infrastructures.[3] If transmission and distribution activities aren't reliable, integrating DERs can compound the challenge.

Core Performers are grid-focused first. Their goal is to intelligently integrate, organize, and manage sources of renewable energy generation, while improving consumer engagement and automating related business processes. This depends on a newfound ability to respond directly to real-time grid conditions, predicated upon improvements in data utilization.

Modernize and secure the grid

Core Performers' top three grid modernization initiatives revolve around building and augmenting an increasingly efficient, resilient, reliable, and secure grid infrastructure.

The motivation to *increase transmission reliability* is threefold: ease congestion, allow for increases in demand, and provide a greater degree of security. Transmission reliability is the number one priority for Core Performers both now and in the next three years, with 47 percent investing in improvements to monitoring, visualization, control, operations, and market structure. This is expected to increase to 59 percent of Core Performers over the next three years. The number of other utilities investing in transmission reliability is also projected to increase, yet their three-year projection only places them at the starting point for Core Performers—47 percent (see Figure 5).

Automation of power systems through digital technologies such as IoT introduces risks, many of them cybersecurity driven. Some are associated with vulnerabilities in devices, platforms, or gateways. Others relate to the increase in ecosystem partners that can access industrial control system (ICS) networks. Malicious actors attempting to exploit and gain access to these networks place critical infrastructures and digital assets at risk. A successful attack on a utility can have devastating consequences for society. Almost one in two Core Performers are *addressing security concerns* with digital as well as physical protection measures to help prevent unauthorized access. They're also reducing the impact of human and technical error, tampering, and infrastructure failures.

Unfortunately, 2019 saw a 2,000 percent increase in OT targeting incidents.[7] And early in 2020, COVID-19 provided new opportunities for malicious threat actors. The digitization of utilities, converged IT and OT, greater connectivity, and IoT device proliferation all introduce complexity. This presents a broad attack surface for malicious actors seeking to disrupt or damage critical infrastructure.

To address this, cybersecurity risks and business risks should be managed jointly at an enterprise level. Utilities need to create cross-functional security teams representing IT and OT security, engineering, operations, and control system and security vendors.

Cybersecurity incident response plans (CSIRPs)—indicating processes, people, and tools to be activated in the event of a breach—should be defined as part of the security management plan. Testing these CSIRPs using tabletop exercises and cybersecurity breach simulations can strengthen the ability to respond quickly and effectively.

This comprehensive approach yields better risk identification and mitigation plans. The result is cyber resilient organizations better positioned to maintain operational continuity and service delivery during a security breach or outage.

4. Workforce reskilling

A digitized electricity infrastructure uses new technology for expanded functionality. A mix of industry-specific (grid and infrastructure) and emerging technology skills are a prerequisite for successful implementation and long-term management. Tomorrow's grid requires myriad evolving roles, including engineers, data scientists, information architects, analysts, cybersecurity experts, and offering managers.

Core Performers are primarily focused on strong internal delivery capabilities by retaining and upskilling existing resources. Forty percent plan to train employees in emerging technologies, compared with 29 percent of other utilities. Other initiatives include hiring digital talent, provisioning mobile devices to increase employee efficiency, and using collaboration tools to foster innovation.

As well, protecting OT systems requires a blend of IT and OT skills. Many organizations find it easier to train IT people on OT sensitivities, versus training OT people on IT cybersecurity skills.[8] In crises, effective threat remediation comes down to the ability of individuals to work together on complex, often intractable, problems.[9]

Navigating the global energy transition

For all the wonders of the grid, the future of electric utilities will rely heavily on leaders and teams making radical, innovative choices in partnership with consumers, businesses, and governments. Core Performers are demonstrating how to build the foundation for this future.

Critical initiatives include a resilient, reliable, and extensible physical infrastructure comprised of digitized assets, equipment, and facilities. A safer, more efficient workforce and more engaged customers result from digitizing interactions. Digital interventions also apply to integrating renewable sources, decentralizing generation, and digitizing grid operations to deliver cleaner, more distributed energy systems. Last but not least, all of these digital interventions are energized by cloud-based platforms, new data, and AI.

Action guide

Digitizing electric utilities

For Core Performers, it's foundation first. While the post-pandemic world offers new opportunities to advance toward more sustainable energy models, utilities need to excel at the basics: reliability and resiliency. Here, we outline the Core Performers' roadmap that digitizes assets, interactions, and grid operations—building a solid foundation for a resilient, reliable, sustainable electricity infrastructure.

These three deployment patterns and four enablers can help you establish this foundation. What's more, their cost-effective strategies also mitigate impacts to the environment, economies, and individuals.

Start with the core: The Core Performers' roadmap

Deployment pattern 1: Digitize assets.

Use digital tools to monitor and upgrade physical infrastructure (assets, equipment, facilities). Create a stable, resilient core as a bedrock for future enhancements.

- *Build infrastructure efficiency, reliability, and resilience* using IoT and analytics solutions (sensor technologies, combined with communications and analytic technologies). These analytics provide faster, more accurate insights to help optimize and prolong asset life.
- *Increase the efficiency, reliability, and resilience of the physical infrastructure* by transitioning to more sophisticated digital applications that increase visibility and uptime benefits.
- *Optimize efficiencies* by increasing the level of automation and AI applied in facilities and business operations.

Deployment pattern 2: Digitize interactions.

Implement increasingly advanced digital tools and automation to take your workforce and customer interactions to the next level.

- *Apply a combination of IoT, automation, AI, and cloud-based applications* to monitor, manage, and optimize workforce productivity, health, safety, security, and compliance.
- *Use AI and analytical tools* to re-imagine, redesign, and automate customer engagement, service, and support processes.
- *Automate workflows and implement AI-powered analytics.* Push the technical limits of grids to support distributed generation and escalate operational efficiencies in facilities and business functions. Continually improve the productivity of workforces. Use near real-time analytics to evolve customer interactions and experiences.

Deployment pattern 3: Digitize grid operations.

Implement advanced grid technologies and accelerate the integration of distributed energy resources.

- *Modernize electricity transmission infrastructures and implement digital and physical security controls.* Protect power systems and their components from operational issues, natural disasters, and forced outages.
- *Accelerate integration of distributed energy resources*—and the systems required to serve customers—into an increasingly decentralized power system infrastructure.
- *Optimize distributed infrastructure.* Use tools that can aggregate energy and allow for the organization, planning, and intelligent management of sources of intermittent electricity generation across the entire grid.

Guardrails to keep you on course: Enabling the roadmap

Enabler 1: Accelerate cloud adoption.

Enable your digitized business to succeed.

- *Determine the right approach* to manage a hybrid environment. New workloads may have different cloud requirements.
- *Invest in multicloud solutions* that work easily across environments to create insights and enable automation without moving data between applications.
- *Migrate workloads to a cloud fit-for-business purpose:* public or private, bare metal, or SaaS.

Enabler 2: Integrate systems and data—and govern it well.

Data governance and usage is now a cross-enterprise responsibility. It has to be clear, visible, and easy to understand.

- *Publish business definitions* and keep them evergreen.
- *Facilitate integration* across IT and OT workstreams.
- *Enable digital twins* that reflect physical networks and cybernetworks using an appropriately designed network architecture.
- *Determine how your data policies and your cyberpolicies will intersect.*

Enabler 3: Build cyber resilience.

Take measures to better protect the electricity ecosystem from cyberattacks on critical infrastructure in integrated IT and OT environments.

- *Integrate cybersecurity risk with business risk* and manage it at an ecosystem level.
- *Build cross-functional security teams* with representation from IT and OT security, engineering, operations, and control system and security vendors.
- *Define and test incident response plans* to improve the ability to respond quickly and effectively in the event of a breach.

Enabler 4: Enable the workforce.

To successfully implement new technology roadmaps, cultivate a mix of skills:

- *Build strong internal delivery capabilities* by retaining and upskilling existing resources on emerging technologies.
- *Share interactions and expertise* among employees.

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Benchmark Insights feature insights for executives on important business and related technology topics. They are based on analysis of performance data and other benchmarking measures. For more information, contact the IBM Institute for Business Value at iibv@us.ibm.com.

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