



Benchmark Insights

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# Digitizing electric utilities

Core Performers  
power up reliability  
and resiliency

IBM Institute for  
Business Value



## How IBM can help

We help utilities boost efficiency with sustainable practices, which is good for the planet and the bottom line. The energy industry is shifting to a more ecosystem-centric model to combat climate change. Investing in sustainable energy sources helps engage businesses and people to participate in the transformation. Discover how dynamic solutions from IBM can help you work smarter, drive sustainable outcomes, and improve how you generate and distribute energy to customers. For more information, visit [ibm.com/energy](https://ibm.com/energy).

## 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.



# 2x+

Core Performers are **more than twice** as profitable as other electric power utilities.



# 60%

In the next three years, nearly **60% of Core Performers** expect to invest in **transmission reliability**, compared with **47%** of other electric power utilities.



# IoT

**Facility management and employee, vendor, and visitor monitoring** are the top **IoT applications** that core performers plan to invest in over the next three years.

## A strong core: The center of a resilient, reliable utility

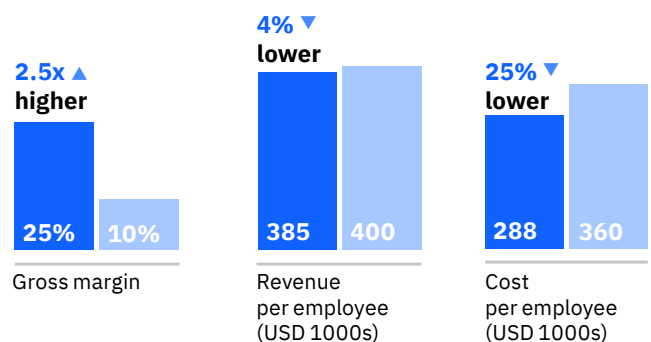
Electric power generation, transmission, and distribution executives from all over the world shared details on current performance, how they apply new technologies, and where digitization is moving them forward. Our group of Core Performers stands out as effectively navigating industry changes. In addition to being more resilient, reliable, and efficient than others in our research, they are more than twice as profitable (see Figure 1). Of the 240 electric power generation, transmission, and distribution utilities surveyed, 52 vertically integrated utilities fell within this group. They are defined as being, on average, in the top 30 percent of performers across three measures:

- Utility service minutes lost (downtime) per customer, or System Average Interruption Duration Index (SAIDI)
- Number of utility service interruptions per customer
- Estimated utility service restoration time accuracy.

For more details, see the “Research Methodology” section on page 16.

**Figure 1**

Core performers are leaner



**Core performers**   **All other electric utilities**

- Q. What is the total annual revenue for your organization in USD?
- Q. What is the total annual cost of continuing operations for your organization in USD?
- Q. What is the total number of your utility services customers?

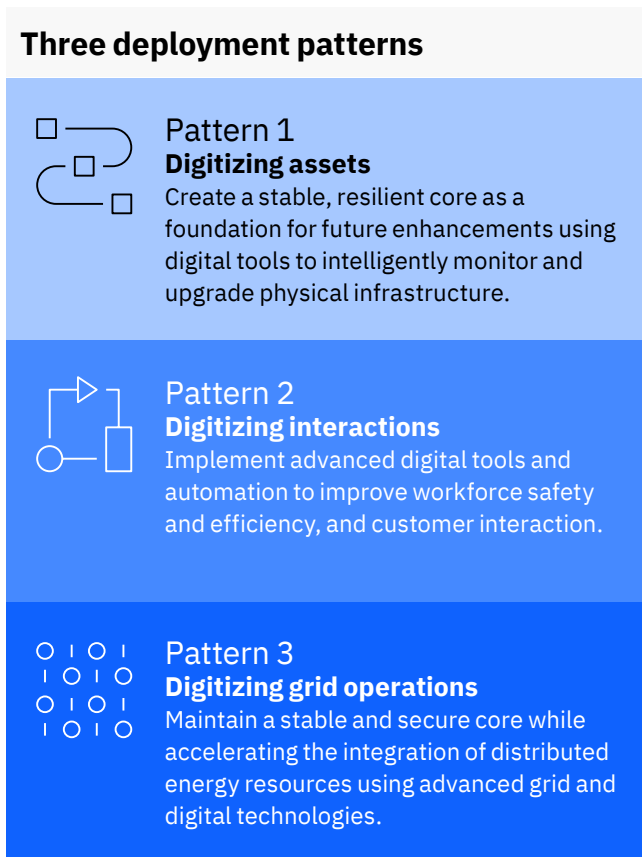
# Core Performers recognize that grid and infrastructure skills are critical to their future success.

What differentiates these companies, aside from superior performance, is the way they prioritize the integration of new technologies into their existing infrastructures and operations. Since reliability, resilience, and efficiency are their current priorities, they defer new capital investments in grid assets by optimizing existing equipment. Additionally, Core Performers recognize that grid and infrastructure skills are critical to their future success, so they're focusing on upskilling existing employees on emerging technologies.

The technology roadmaps of Core Performers display parallel deployment patterns with three themes (see Figure 2).

**Figure 2**

Core Performers' deployment patterns focus on the fundamentals while embracing digitization



Source: IBM Institute for Business Value analysis, 2020.

## Insight: Integrating renewables—tempering realistic plans with new trends

Core Performers epitomize this maxim: power utilities should focus on fundamentals to deliver in the here and now. Reliability and resilience are essential to successfully integrate renewable sources of electrical energy while continuing to meet demand. Plans to do so must include operational and technological approaches that both drive business success and improve environmental outcomes.

Realistic plans balance industry fundamentals with new trends:

- Most, if not all, industries require consistent and abundant power, with an increasing preference for clean power.
- Many countries are facing the need to upgrade or replace aging infrastructure while embedding and extending new energy sources and technology.
- More consumers are becoming prosumers, impacting rates, pricing, demand and supply, and energy flows.
- Planning and operational challenges exist in a regulatory environment with diverse approaches to incentives, pricing, and societal commitments.
- Current measures of success lack sustainable, environmental accounting across utility operations.

For any industry, coordinating impactful change is difficult. The challenges faced by electric utilities can be exponentially harder. They're required to develop business models that are stable but innovative. They must build and maintain an asset- and resource-intensive electricity infrastructure that is enduring but flexible, using limited capital. They must provide a consistent power supply to meet unpredictable demand using intermittent energy sources—all in a rapidly evolving regulatory environment.

## Pattern 1: Digitizing assets for intelligent monitoring and upgrades

The intricacies of asset management, especially for distribution entities, are often spread across several software applications and databases that span multiple enterprise and operational boundaries. Frequently, these boundaries are reinforced by a siloed approach to managing enabling technologies.

Meanwhile, IT and operational technology (OT), such as wires, substations, transformers, and other field equipment coordinated through supervisory control and data acquisition (SCADA) systems, are converging. Core Performers have digitized these assets. With OT systems and networks increasingly connected to IT networks, data

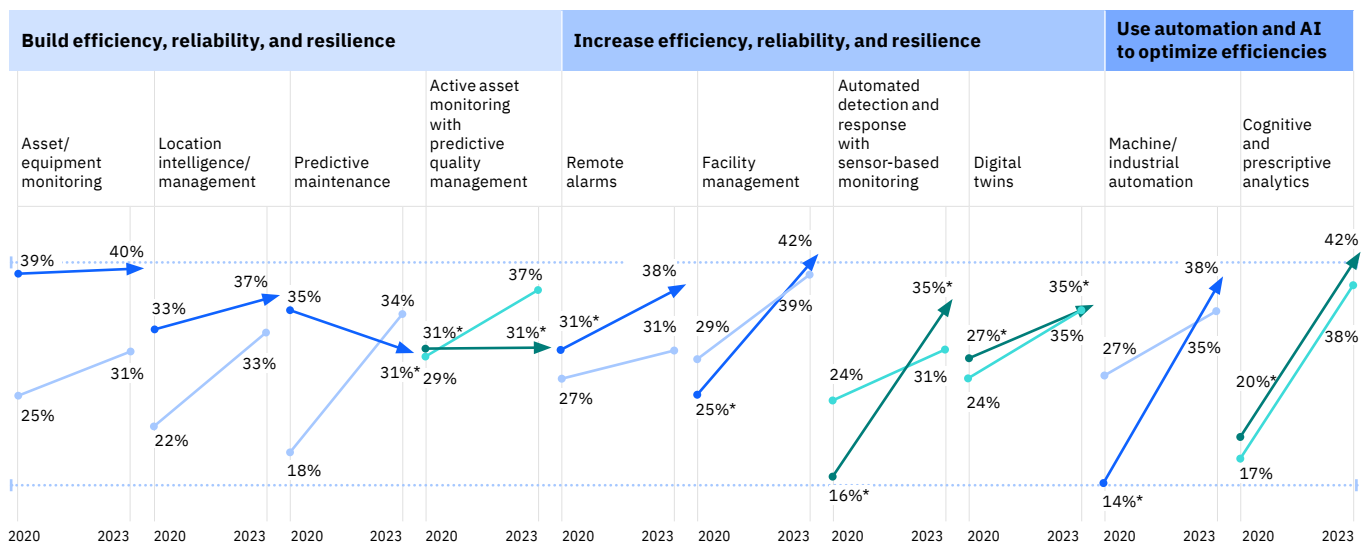
from Internet of Things (IoT) sensors can be transmitted and analyzed to deliver faster, more accurate insights—insights that can be used in developing strategies to prolong asset life. Whether the model for collecting, analyzing, and aggregating data is centralized in the cloud or managed locally using edge computing, it must allow for the outputs to be acted upon timeously.

Pattern 1 uses three activities to digitize assets and their management (see Figure 3):

- Build physical infrastructure efficiency, reliability, and resilience
- Increase the efficiency, reliability, and resilience of the physical infrastructure
- Optimize efficiencies using automation and artificial intelligence (AI).

**Figure 3**

Pattern 1: Digitizing assets for intelligent monitoring and upgrades now and in three years



IOT applications **Core performers** All other electric utilities

AI and advanced analytics applications **Core performers** All other electric utilities

\* Low n counts (n<20), which are statistically unreliable but can be considered directional when compared to remaining respondents.

Qs. How is/will IoT technology and AI be applied in your organization's operations? Select all that apply today and in the next three years.

## 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).

# Analytics based on real-time weather, traffic, and asset data can dramatically improve maintenance and service-scheduling practices

## Pattern 2: Digitizing interactions for all stakeholders

IoT, automation, AI, and cloud-based applications are potent technologies that serve multiple parts of the digitized interactions pattern. Core Performers say they will continue to lead other power utilities in managing their facilities, workforces, and customers digitally.

Pattern 2 uses three activities to digitize interactions (see Figure 4):

- Improve workforce safety, efficiency, and compliance
- Update and digitize customer engagement, service, and support processes
- Automate workflows and implement AI-powered analytics.

## Improve workforce safety, efficiency, and compliance

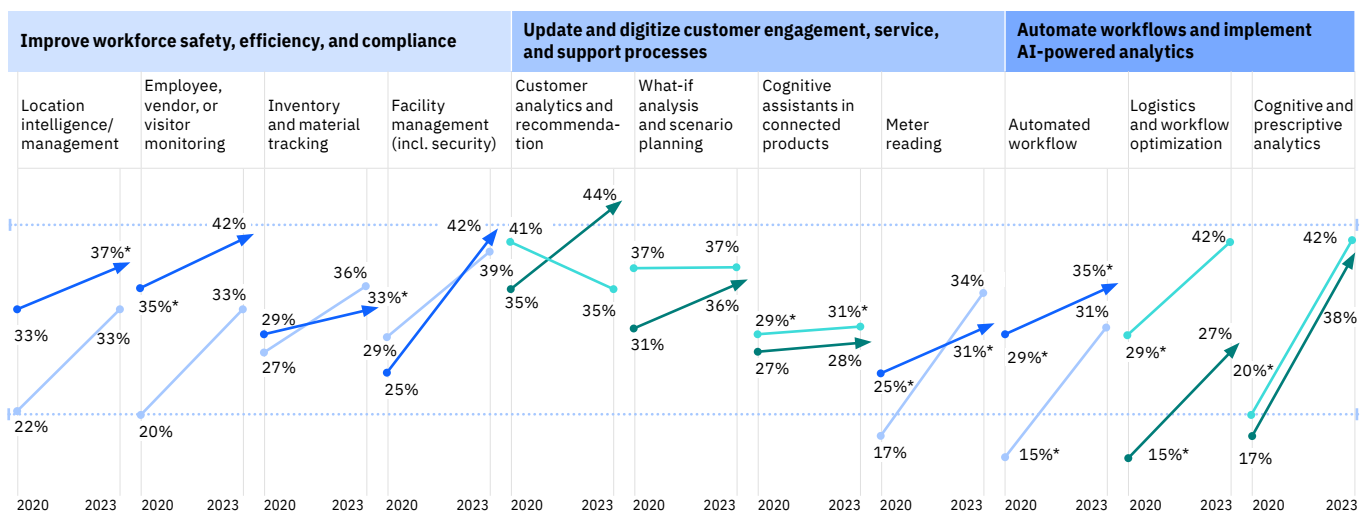
A third of Core Performers use location management solutions that, when coupled with advanced analytics and AI, help them *automate maintenance and support processes and improve visitor and workforce safety*.

Missing equipment, skills, and severe weather can slow down teams. That’s when analytics based on real-time weather, traffic, and asset data can dramatically improve maintenance and service-scheduling practices. Workforce mapping and asset visualization tools can be used to optimize travel routes of field technicians. Real-time monitoring enables scheduling and dispatching adjustments based on actual service call progress.

In the next three years, at least one in three utilities surveyed anticipates using IoT technologies to *manage the inventory* carried by service fleets (see Figure 4). A lack of inventory can significantly impact technician productivity, so this is an essential application.

**Figure 4**

Pattern 2: Digitizing interactions for all stakeholders now and in three years



IOT applications **Core performers** All other electric utilities  
 AI and advanced analytics applications **Core performers** All other electric utilities

\* Low n counts (n<20), which are statistically unreliable but can be considered directional when compared to remaining respondents.

Qs. How is/will IoT technology and AI be applied in your organization’s operations? Select all that apply today and in the next three years.



*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<sup>1</sup>**

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.<sup>2</sup>

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.<sup>3</sup> 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.

# Increasing transmission reliability eases congestion, allows for increases in demand, and provides a greater degree of security.

The third initiative is *investing in transformer resilience and advanced components*, where Core Performers prioritize protecting power systems and components. This includes protecting transformers and high-voltage products from operational issues, natural disasters, and forced outages.

Large power transformers represent a unique challenge. While critical, many are decades old and vulnerable. Continuous assessment, monitoring, and early intervention help prevent outages resulting from sustained use. In the next three years, Core Performers anticipate continuing to invest in advancing grid hardware to improve the performance and lifetime of this equipment (see Figure 5).

## Integrate DERs

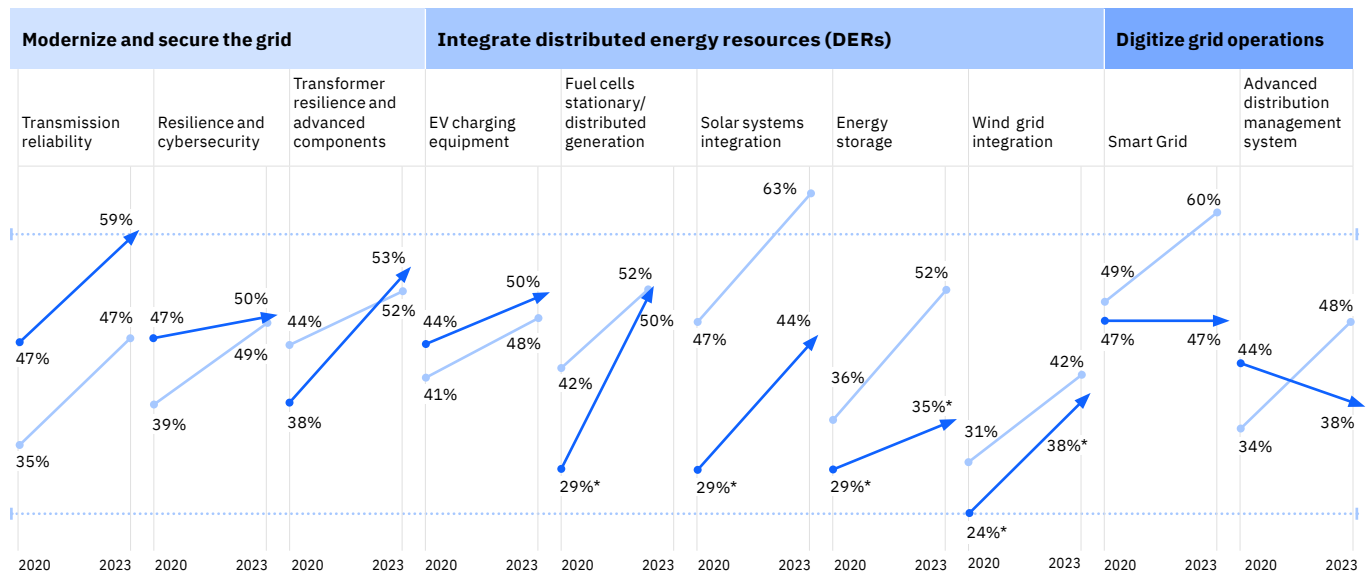
Over the next three years, Core Performers investing in decentralized generation and adding renewable sources will increase significantly (see Figure 5).

Fifty percent anticipate deploying *electric vehicle (EV) charging equipment* that increases flexibility in electricity demand. Vehicle-to-grid (V2G) technologies can allow electric vehicles to consume as well as charge back energy. Digital innovations and EVs may also contribute to improvements in energy efficiency by aligning charging systems to grid capacities, as well as limiting the needs for transformer stations and new lines. EV batteries can possibly regulate the grid or modulate peak demand when used as energy storage.<sup>4</sup>

Fifty percent of Core Performers anticipate investing in *distributed generation* in the next three years. The small modular technology of DERs places storage closer to the loads served. This includes *stationary fuel cells*. These can be grid-connected or installed as “offline” generators to provide supplemental power or emergency power systems for areas where reliable power is crucial. This flexible *energy storage* reacts quickly to improve power quality and frequency response.

**Figure 5**

Pattern 3: Digitizing grid operations and integrating distributed energy resources (DERs) now and in three years



IOT applications **Core performers** All other electric utilities

\*Low n counts (n<20), which are statistically unreliable but can be considered directional when compared to remaining respondents.  
 Q. In which of the following grid modernization initiatives is your organization investing/planning to invest? Select all that apply today and in the next three years.

## Digitize grid operations

Power utilities have implemented tools to store and analyze the billions of new datapoints available from instrumented plants, substations, transformers, and customer meters. These tools and data improve the safety, reliability, and efficiency of their plants and networks, as well as their workforces.

Outage management systems allow utilities to target failure locations and re-route around them, limiting the number of customers impacted. Distribution management systems facilitate real-time, network-wide insights into grid operations, including fault locations, load conditions, and voltages.<sup>5</sup>

Interestingly, the percentage of Core Performers investing in *smart grid technologies* is expected to remain flat in the next three years. The percentage investing in *advanced distribution management systems (ADMS)* is projected to decrease (see Figure 5).

The reason is eminently rational. Only when utilities have systems in place to intelligently manage individual feeders will grid-level capabilities become a necessity.

Until now, Core Performers have prioritized intelligently monitoring and upgrading existing infrastructure over the integration of clean, renewable distributed sources such as wind grids and solar arrays. Renewable sources are desirable, but also intermittent, with outputs that can quickly fluctuate.

As companies accelerate their integration, bringing more distributed generation sources online, the complexity of grid management will increase. ADMS can reduce this complexity, providing utilities with the ability to plan, manage, and realign distributed electricity generation across the entire grid.

## Beneath the patterns: The four essential enablers

Whether the forces driving change are external or internal, the ability to move with agility and decisiveness separates leaders from laggards. Future-ready utilities can form a strong foundation built on four essential enablers: workload-adaptive cloud, analytics-ready data integrations, cyber resilience, and workforce reskilling.

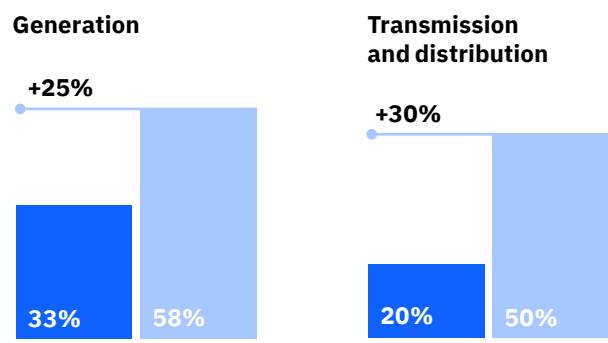
### 1. Workload-adaptive cloud

In the next three years, all surveyed companies expect at least 50 percent of their applications, including operational and administrative applications, to be running on remote servers rather than in their own data centers (see Figure 6).

Digitization relies on data and places additional demands on IT infrastructures and teams. These pressures can be alleviated by cloud-based solutions that are easily composable and integrated—in other words, a hybrid multicloud.

**Figure 6**

At least half of electric utility applications will be deployed on the cloud in the next three years



**Percentage of applications deployed on cloud**  
Percentage of applications that will be deployed on cloud in the next 3 years

Qs. What percentage of your applications are deployed on the cloud now? What percentage will be in the next three years?

# Tomorrow’s utility companies should be data-rich, agile, and integrated.

A hybrid multicloud architecture, calibrated to a utility’s unique requirements, can provide both rapid benefits and the ability to scale or contract to future needs. Adopting a hybrid multicloud approach requires:

- Determining the right approach to managing a hybrid environment. New workloads may have varying infrastructure requirements.
- Investing in multicloud solutions that easily work across environments. This creates insights and enables automation without moving data in and out of applications.
- Migrating workloads to a cloud fit-for-business purpose. Options include public or private, bare metal, or software-as-a-service (SaaS).

The goal is to efficiently connect data and functions from each cloud to other clouds as needed, allocating only the necessary capacity and power. For instance, some SaaS and IoT offerings, such as digital twins, encompass AI, advanced analytics, and edge applications. When the asset management system carries data and actions bidirectionally, speed is essential. Managing across systems requires tested multicloud management principles.

## 2. Analytics-ready data integration

Tomorrow’s utility companies should be data-rich, agile, and integrated. And they need information systems to match, including secure, well-architected data, storage, and management capabilities. The starting point: an ability to integrate large volumes of data from disparate operational, business, and customer systems.

Standardized data models, well-documented business definitions, and user-friendly interfaces allow IT and OT systems to share and comprehend data.

Keeping track of a continuously changing physical network requires an appropriately designed network architecture. The exchange of data among power ecosystem participants, including transmission system operators, DER operators, aggregators, and prosumers, necessitates consistent definitions, formats, standards for use, and transfer protocols (see Figure 7).

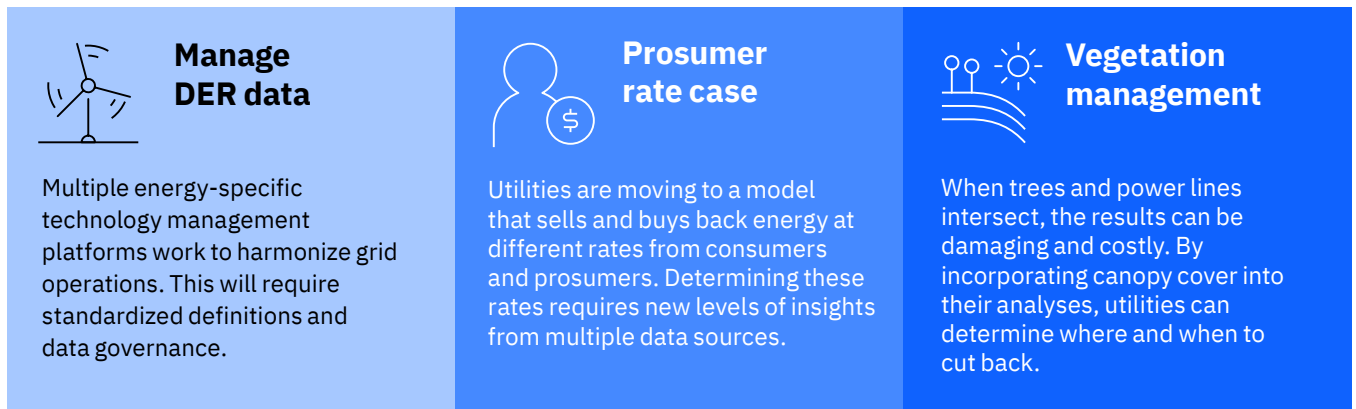
## 3. Cyber resilience

Cyber resilience refers to an enterprise’s capacity to maintain its core purpose and integrity in the face of cyberattacks. A cyber resilient organization can help prevent, detect, contain, and recover from a variety of serious threats against applications, data, and IT infrastructure.<sup>6</sup>

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**Figure 7**

The emerging multi-threaded world of utilities data



Source: IBM Institute for Business Value analysis, 2020.

Unfortunately, 2019 saw a 2,000 percent increase in OT targeting incidents.<sup>7</sup> 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.<sup>8</sup> In crises, effective threat remediation comes down to the ability of individuals to work together on complex, often intractable, problems.<sup>9</sup>

#### **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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## Methodology

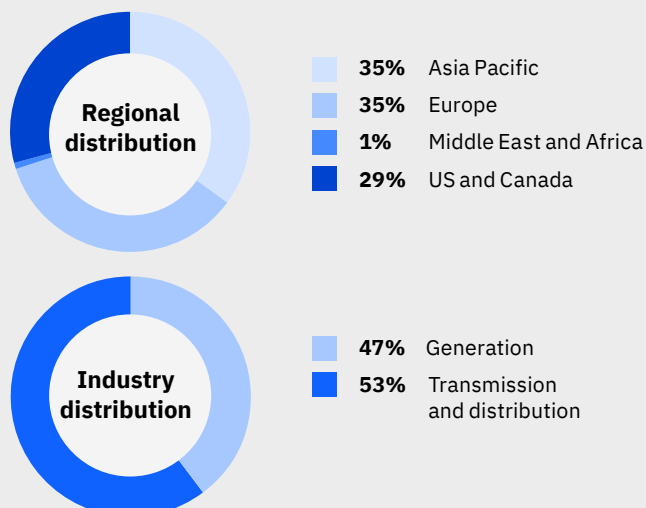
For insight into how electric power utilities are responding to the global energy transition, the IBV—in cooperation with the American Productivity & Quality Center (APQC)—surveyed respondents from 240 electric power generation, transmission, and distribution utilities from 17 countries in all major geographies.

Using an online survey, we asked how organizations are moving toward more sustainable energy models for the future; the status of their digital transformations; their adoption and application of new advanced grid/operational technologies, data, and insights; and the corresponding workforce implications.

We excluded “pure generators” from the data set, analyzed the responses, and calculated an average score for each vertically integrated utility across three key performance indicators (KPIs):

- Number of utility service minutes lost (downtime) per customer, or System Average Interruption Duration Index (SAIDI)
- Number of utility service interruptions per customer
- Estimated utility service restoration time accuracy.

This allowed us to identify those performing in the 70th percentile as our Core Performers group. All data, financial or otherwise, is self-reported.



## About Benchmark Insights

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