The intersection of digital transformation and the energy transition

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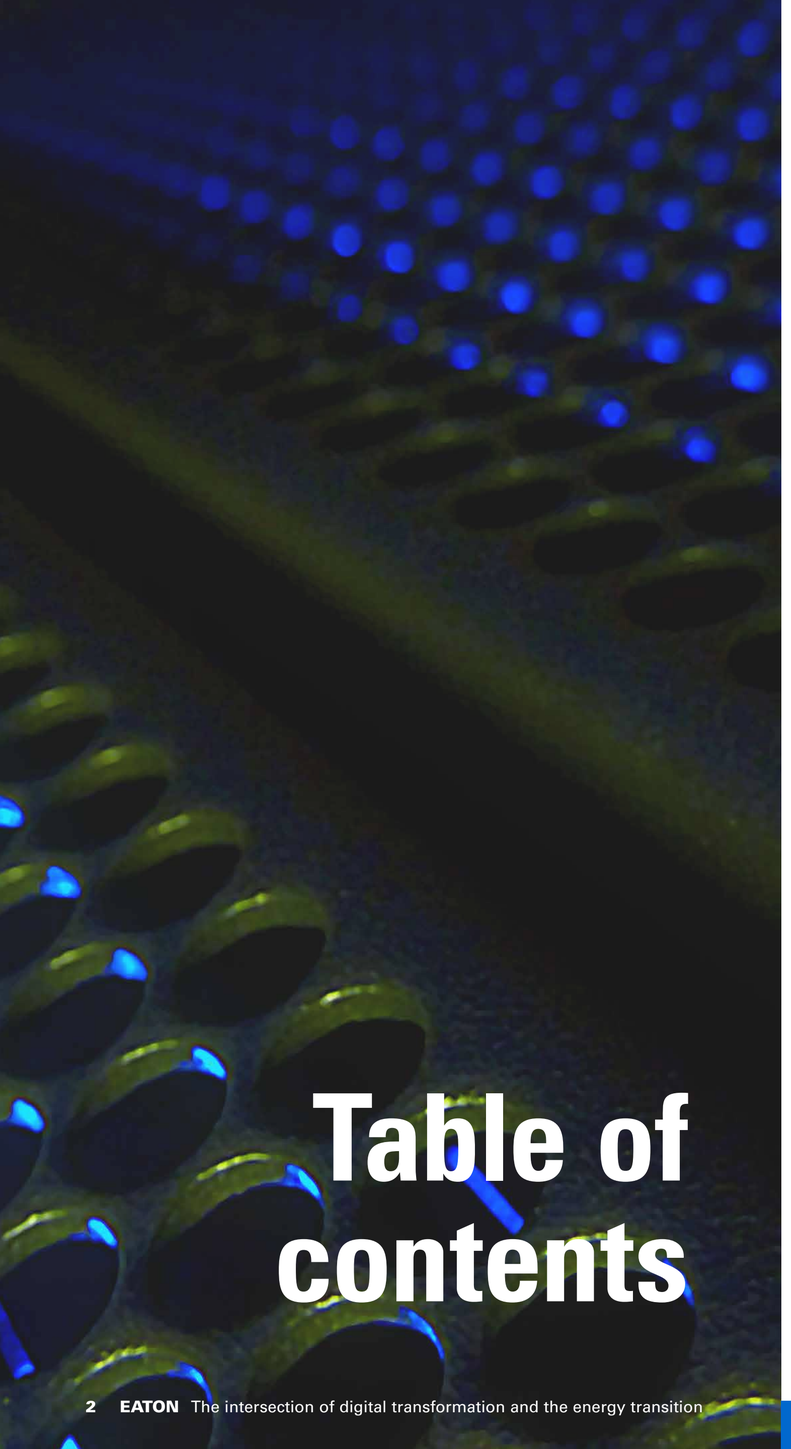

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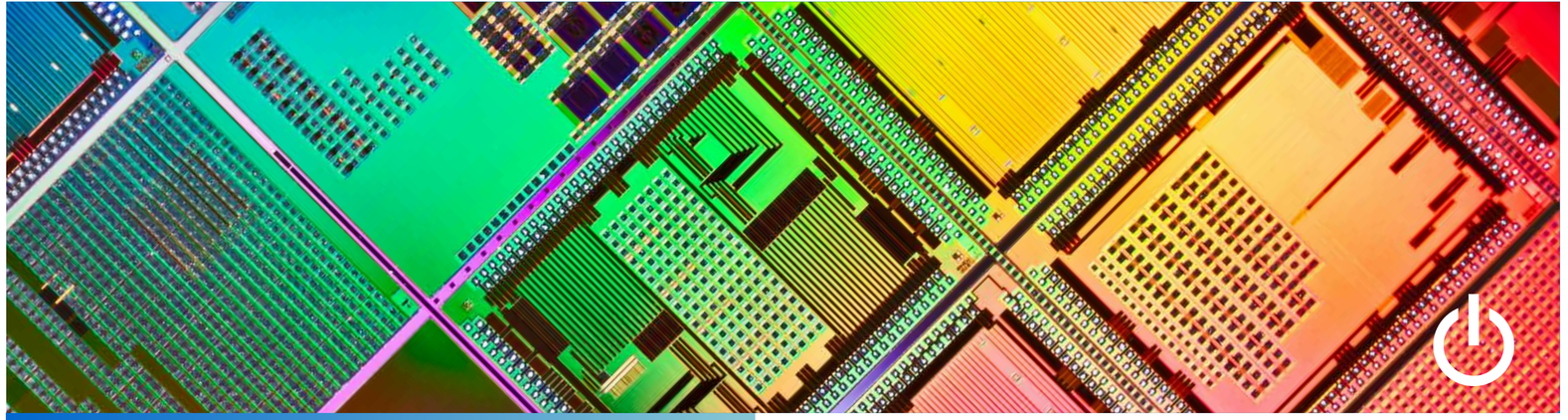
Introduction

As digital transformation advances, enterprises are increasingly augmenting their focus on operational transformation with new approaches to managing and optimizing energy consumption and power usage—driven by the same digital technologies and insights. That merging of operational optimization and energy transition efforts to inform digital transformation is a clear best practice to help enable asset-intensive and power-critical organizations to fully transform how they do business. Focusing only on process- or people-centric change without considering the major transitions occurring in energy and power is both risky and suboptimal, leaving significant cost savings and business transformation gains on the table. The energy transition is also a critical requirement in its own right, contributing to business and societal goals of sustainability and enhanced environmental, social and governance (ESG) reporting and investing.

"Focusing only on process- or people-centric change without considering the major transitions occurring in energy and power is both risky and suboptimal, leaving significant cost savings and business transformation gains on the table."

In this report, we examine the importance of factoring the energy transition into digital transformation planning and the impact that a more expansive view can have on four power-critical industries: industrial, utilities, buildings and data centers. To inform the analysis, Eaton and 451 Research commissioned an international web survey conducted in April and May 2022 of 1,001 respondents involved in their organization's digital transformation efforts in eight countries across North America, Europe, Middle East and Africa. See a complete description of the survey details in the Methodology section at the end of this report.



Top 10 takeaways

1. **Digital transformation in power-critical enterprises is real and growing, but it's still in the early stages.** Just 3% of enterprises have no digital strategy, while 47% are in consideration and 50% in execution.

2. **Advanced technologies and modern IT are central to digital transformation.** Top technology includes cloud infrastructure (deployed by 71% of digitally transforming enterprises) and Internet of Things (IoT) sensors/platforms (42%). That said, just 17% of firms have digitally enabled their legacy systems, a critical step for full digital transformation.

3. **Operational concerns drive digital efforts, but energy and power concerns are important to the story as well.** 44% percent of enterprises cited energy transition and greater power efficiency as a key digital transformation driver, while 43% touted ESG programs and reporting as critical.

4. **In addition to optimization goals, enterprises are facing a major energy transition, driven by governmental regulations, industry targets and societal change.** 77% percent of companies expect to transition away from their current power sources, and 29% are already underway. More than half (53%) of enterprises expect renewables to be their predominant energy source in the future.

5. **Most energy and power metrics tracked today are relatively simple, but they must become more sophisticated to contribute to digital transformation.** Top metrics that organizations are tracking today include relatively straightforward key performance indicators (KPIs) such as total energy consumption (measured by 51% of companies) and electrical safety (38%).

6. **Optimizing power and energy usage will require new metrics—enabled by new digital infrastructure, platforms and applications.** Less than a third of companies are tracking key sustainability and energy intelligence KPIs such as power usage effectiveness (PUE), carbon offset tracking and greenhouse emissions levels. Only 33% of enterprises have deployed intelligent energy/power management platforms capable of generating insights to track those numbers. That percentage must rise to fully address sustainability targets.

7. **Surprisingly, industrial firms are lagging in their awareness of the need for energy and power intelligence—creating significant competitive advantage for early adopters.** Just 24% of industrial respondents chose energy and power concerns as a top digital transformation driver. Those that prioritize it cited renewables adoption as their most critical energy goal.

8. **Utilities face significant challenges updating their infrastructure while meeting growing yet evolving service demands. The** energy transition has already come to the sector—respondents said that wind (chosen by 36% of respondents) and solar (28%) are significant energy sources even today. To continue that transition and meet demand will be a difficult task as 41% of utilities said they have concerns about outdated grid infrastructure.

9. **Power optimization and ESG reporting are critical issues for building owners and operators.** Being sustainable is the top goal for the sector, prioritized by 46% of respondents over resiliency and inhabitant comfort. 'Smart building' efforts targeting sustainability are already underway—76% of building respondents said they are deploying environmental monitoring digital use cases today, a first step toward broader energy management.

10. **Energy and power considerations are built into data center business and operational models.** That said, next-step goals for the sector include increasing use of renewables (cited by 50% of data center owners), improving energy storage (47%) and making money selling generated power back to the grid (34%). These steps further leverage the energy transition as a key sector change agent.

Energy, power and digital transformation

Digital transformation—enabled by the analytics-driven intersection of traditional operational technology (OT) and modern information technology (IT)—is critical for all industries and key to competitive, financial and operational excellence. While digital change has become a priority in corporate boardrooms, its evolution is still in its infancy, requiring C-level buy-in, upskilling
of digital capabilities and the adoption of enabling digital technologies:

- **C-suite commitment**
  Only 50% of enterprises consider themselves in the 'execution' phase of digital transformation today, compared to 47% in consideration and 3% with no digital strategy at all.
- **Digital skills**
  The majority of enterprises (74%) said they are in the process of building a digitally skilled staff but have room to improve. Just 22% described their in-house digital capabilities today as 'strong.'
- **Digital technology adoption**
  Similarly, 74% of companies said they have adopted 'some' digital technologies, while just 22% claimed 'broad' adoption (and 5% no adoption at all).

Digital transformation priorities

As more enterprises develop a digital mindset, the core drivers of digital change are also becoming clearer. Operational and business process goals tend to lead digital transformation efforts, but increasingly digital-savvy enterprises are also emphasizing energy transition and power optimization aspirations as well (see Figure 1).

Figure 1: Energy transition goals are a critical digital transformation driver

Q: Which of the following are drivers of your organization's current or future digital transformation initiatives?
Base: All respondents (n=1,001)
Source: 451 Research and Eaton custom survey

Indicates energy transition and power optimization-related priorities

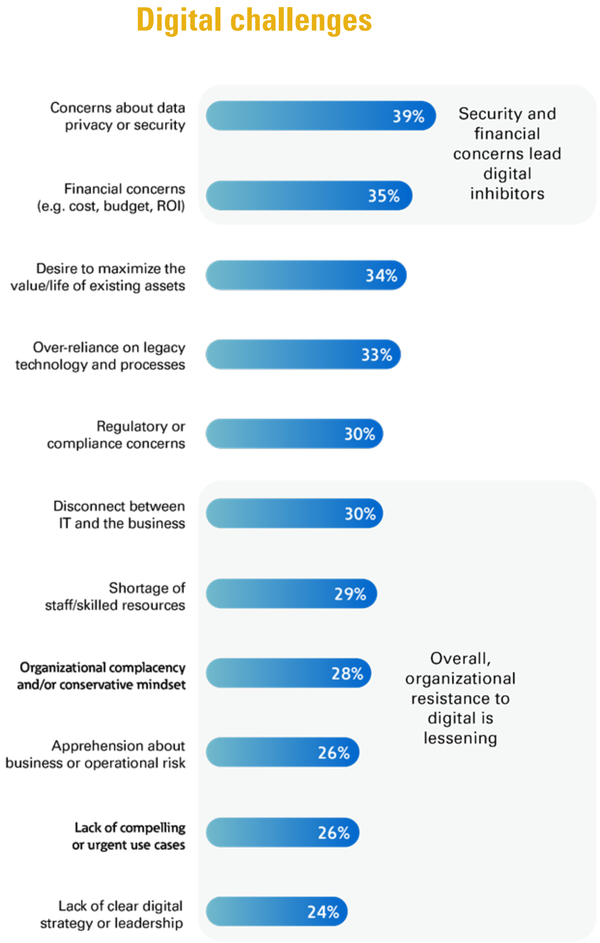
The importance of energy and power optimization cannot be overstated. In industry, energy is an input that enables work. Primary sources of energy include coal, natural gas, solar and wind. Electricity and gasoline are considered secondary energy sources, being generated from primary sources. Power, in turn, is the amount of energy transferred or converted over time, i.e., the rate at which work is done. Power is typically created by mechanical systems, such as a turbine or generator, which change energy inputs into power.

For a variety of reasons, enterprises must include intelligent energy and power management in order to fully achieve their digital transformation goals:

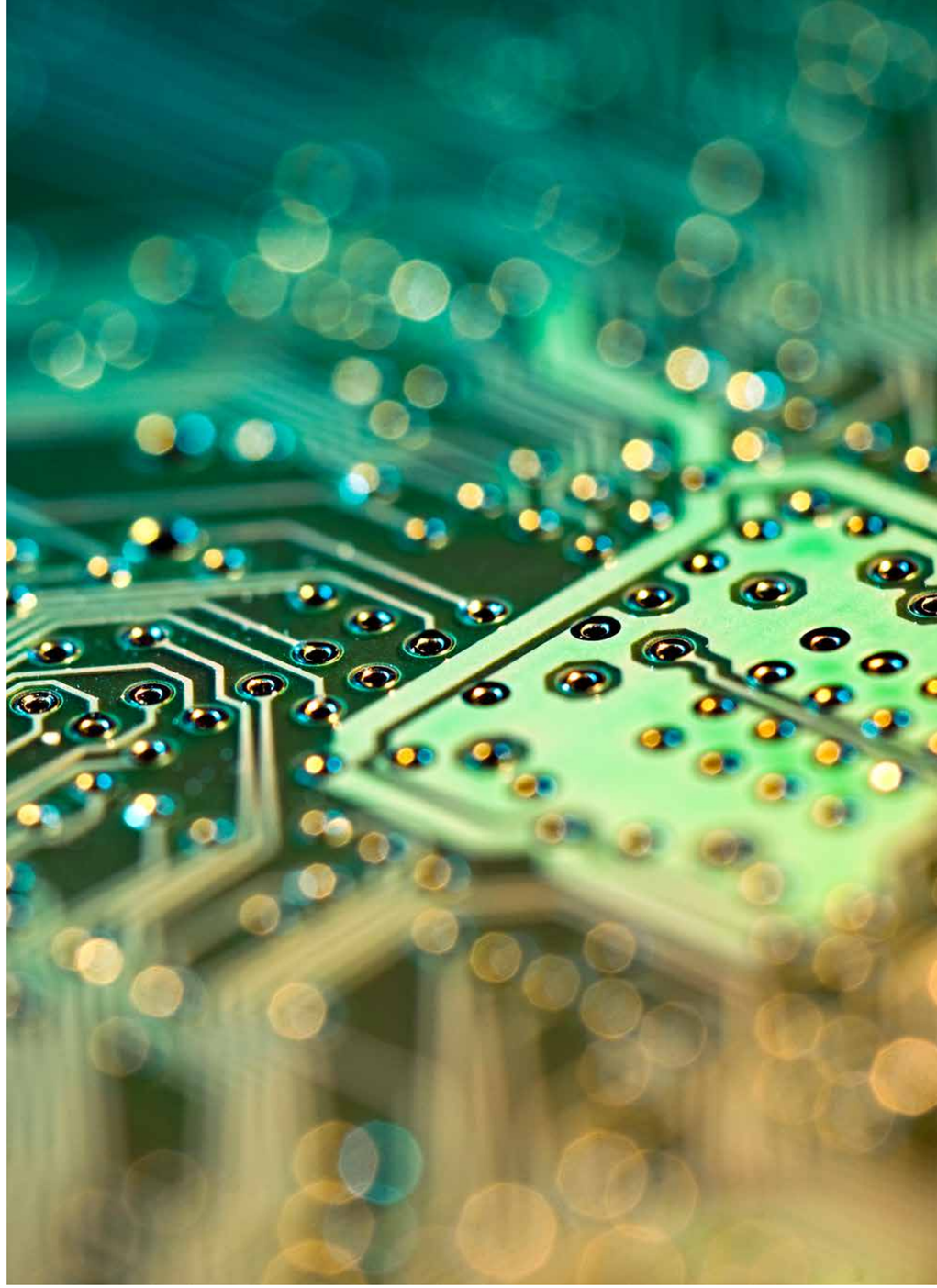
- **Critical input**
  Energy and power are key inputs to industry processes, as important as commodity product inputs or technology enablers.
- **Digital change**
  Energy and power today are too often managed using manual/analog processes, but they can be massively enhanced by real-time, data-driven insights.
- **Corporate goals**
  Along with the idea of intelligent power management as a key transformation enabler, better utilization and management of energy and power is a critical requirement in its own right, reflecting corporate and societal sustainability, energy transition and ESG goals.

Recognizing the need for digital change and energy transition is just step one. Enterprise digital transformation projects are a challenge in and of themselves: They have a wide-ranging business impact and are often sprawling in deployment, and they require new ways of thinking and new digital technologies to help enable true change. Top inhibitors to digital initiatives include concerns about security and data privacy and the ability to both fund and manage a return on digital investments. While such doubts can slow digital adoption, the good news is that corporate resistance—whether from a lack of leadership or strategy, concerns about operational risk or overall organizational complacency—appears to be waning as the imperative for digital transformation becomes increasingly mainstream (see Figure 2).

Figure 2: Functional areas, attitudes align to support digital initiatives



Q: Which of the following are challenges to the adoption of digital transformation within your organization?
Base: All respondents (n=1,001)
Source: 451 Research and Eaton custom survey



The energy transition is coming —if not here already

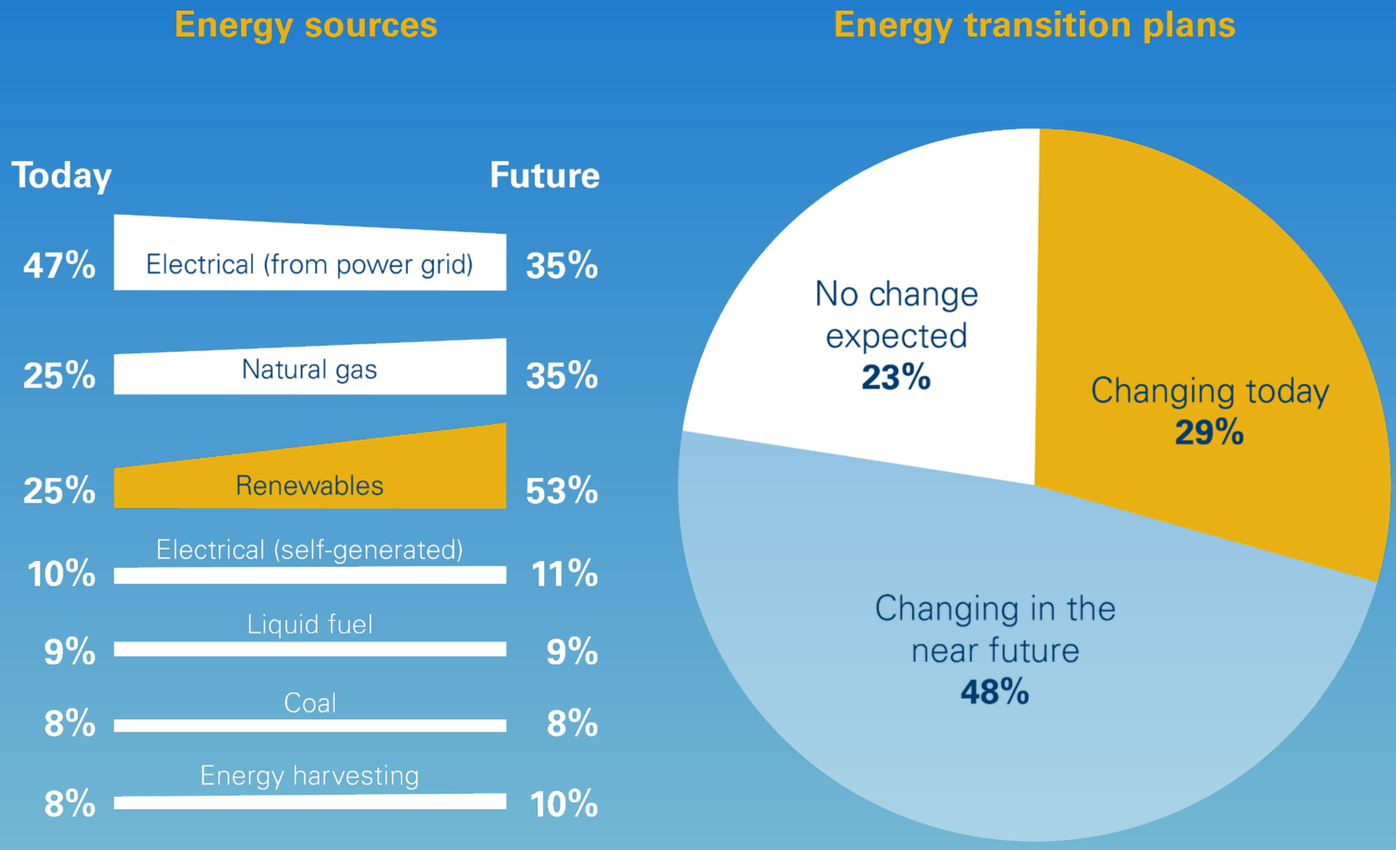
Is the time right to consider the energy transition as a critical element of digital transformation? Government and industry efforts in these areas speak to its importance, as does our earlier look at digital change drivers, which placed sustainability and ESG reporting as top concerns. Our survey shows yet another proof point: Enterprises are preparing to swap out old energy sources for new, and in many cases are doing so already.

For instance, 77% of enterprises expect to transition away from their current power sources, and 29% of those are underway with their plans. And while 25% of enterprises are already tapping renewable energy sources such as solar, wind and hydroelectric, that number is slated to grow to 53%. Enterprises must consider the urgency of that transition as they plot their digital strategies (see Figure 3).

Enabling that change requires enterprises to be mindful of—and more importantly, closely track—an entirely new set of power usage KPIs and overall energy metrics. What gets measured gets improved, as the saying goes, and the coming energy transition is no different. Today, enterprises are most likely to track relatively simple energy metrics, led by total energy consumption (measured by 51% of companies) and electrical safety (38%). Those metrics track costs and help guarantee worker safety. These are solid baseline goals, but they are not enough to optimize energy consumption and power usage.

To truly optimize energy/power usage, enterprises must track and report on more sophisticated KPIs, an activity just starting to hit the corporate radar. For example, only 34% of firms track PUE, a key metric that ties power usage to industrial output. Metrics critical to renewables transition are also less likely tracked today—e.g., carbon offsets (tracked by 33% of firms today), greenhouse gas emissions (24%) and ESG scoring (26%)—but organizations will need to attend to them in the future.

Figure 3: The energy transition is coming, with a renewables focus



Q: Which of the following are your organization's current primary power sources? Base: Respondents in industrial, building and data center sectors (n=750)
Q: Do you expect those primary power sources to change in the future? Base: Respondents in industrial, building and data center sectors (n=750)
Q: You indicated you expect your power sources to change over time. Which of the following do you anticipate being your enterprise's primary power sources in the future? Base: Respondents in industrial, building and data center sectors that expect to change their energy source in the future (n=576)
Source: 451 Research and Eaton custom survey

Digital change requires a new technology toolbox

If the energy transition is both a challenge and an opportunity, the next question becomes: What are the tools necessary to successfully navigate forward? And here we run into one of the required centerpiece initiatives of digital transformation—the need to digitalize legacy operational technologies while incorporating new, modern information technologies into the mix.

Every industry has legacy operational technologies it depends on as its life breath. For industrial firms, such technologies typically include decades-old manufacturing control systems and highly customized programmable logic controllers. For utilities, supervisory control and data acquisition (SCADA) systems manage a range of sensors, actuators, controllers and related hardware and software. OT systems in buildings include a range of mechanical systems from elevator lifts to heating, ventilation and cooling. In many cases, such systems are instrumented with analog alarms and serviced manually by experienced, mechanically proficient technicians. That also means they don't fit easily into emerging digital environments: They lack interfaces for digital communications and data exchange and are 'secure' only because they've never been connected to the outside world. Step one, then, in many digital transformation journeys is to modernize those systems, either by swapping them out for new or updating them with digital interfaces and sensors. That critical step can also be the most challenging: Just 17% of firms said they have digitally enabled their legacy systems (see Figure 4, next page).

Beyond digitalizing legacy systems, enterprises' digital technology 'stack' includes a range of technologies, some of which are essential and others simply nice to have. Adoption varies as well, based on several factors: What are the new technologies enabling? What are they replacing? How comfortable are enterprises placing them at the center of their business?

"Enterprises must become more comfortable with (and capable of) replacing analog and mechanical systems and processes with new digitally-enabled alternatives."

Top digital enabling technologies

Digital essential
Cybersecurity (deployed today by 73% of respondents) is an essential element of any digital transformation initiative, especially because—as noted earlier—many legacy systems have never been connected to the outside world and thus have been shielded from cyberattack. Building a connected digital infrastructure that encompasses legacy systems changes the security picture.

Must-have mainstream
One of the great enablers of technology change has been the emergence of cloud computing and as-a-service consumption models (deployed by 71% of respondents). The cloud speeds digital infrastructure and application deployment, making it more elastic—easier to wax and wane based on demand—and pay-as-you-go—easing some of the financial burden of digital deployment. Cloud's counterpart, edge computing, is less widely deployed but on the rise. Some digital use cases require the low latency, high performance and data privacy that edge does better than cloud (and edge infrastructure is now being delivered 'as a service' in many cases as well). Finally, IoT sensors and platforms, adopted by 42% of respondents, are in many ways the workhorses of digital transformation. They help pull data off of legacy systems, acquire data in new ways via camera/video analytics, provide a platform to manage and secure endpoints and analyze data for insights and real-time execution.

On the rise
Digital twins and digital threads (deployed by 33% of respondents) create working representations of physical processes, systems and facilities fed by live data. They are emerging as an important component of digital transformation, especially in industrial and other asset-intensive, power-critical sectors. They are a key part of the move from managing physical systems to virtual, digital ones. Along the same lines is AI/machine learning (ML) (deployed by 27%), which replaces technician intelligence with a continually learning digital approximation. For both digital twin and AI/ML, current deployment levels are relatively low for reasons we described earlier: adopters need to be comfortable with replace living systems with virtual ones, especially when they impact mission-critical operations. But both technologies hold such promise that it is fair to expect their adoption, and impact on digital transformation, to grow.

Niche today, wide tomorrow?
Finally, we have two technologies that sit at the center of the so-called 'metaverse'—virtual and augmented reality. Both enable digital representation and interaction to replace touch-and-feel analog contact. The comfort bar is even higher for AR/VR than it is for digital twin and AI/ML, but they hold an equally impactful place in some applications, such as delivering visualizations to technicians and ensuring worker safety.

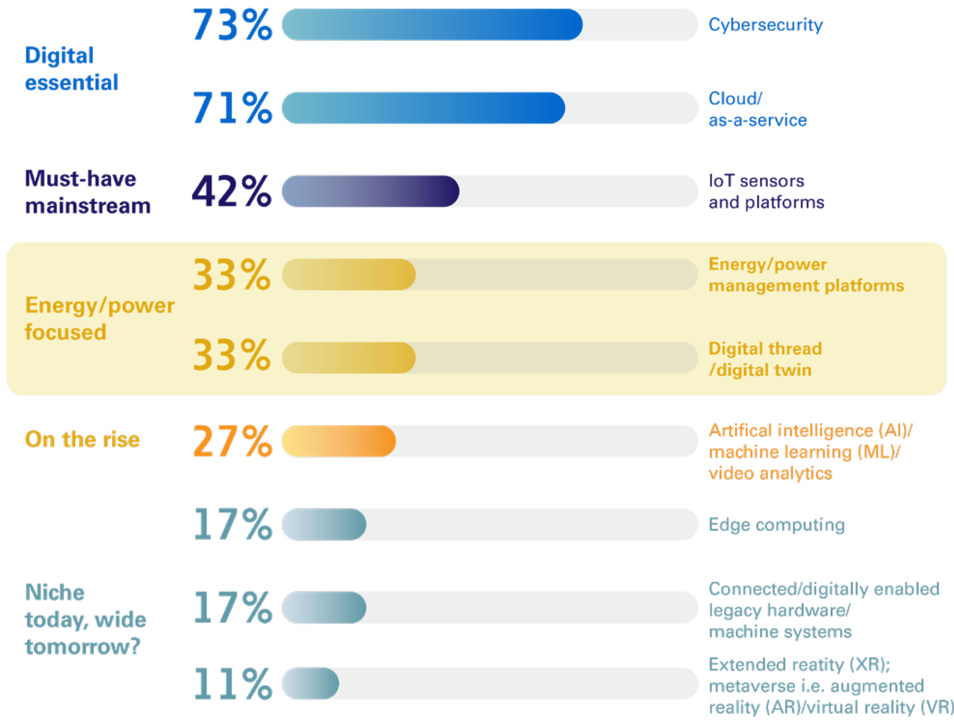
All of the elements in today's digital technology stack play a role in operationally focused transformation initiatives by helping manufacturers optimize assembly and quality processes, utility companies match power demand with supply more dynamically, and building owners better manage systems for resiliency and comfort. That said, they also all play a role in sustainability, decarbonization and ESG efforts. IoT sensors and platforms pull real-time data from heating and cooling systems while monitoring environmental factors. AI models can apply sophisticated algorithms to optimize power usage while learning and improving with each interaction. The cloud and edge provide the infrastructure for managing all of that data, while mechanisms such as digital twins and AR headsets provide new ways of visualizing a building or data center, for instance, as a living, breathing entity with ever-changing energy and power requirements.

All that said, one final piece of technology is critical for digitally enabled energy transition:

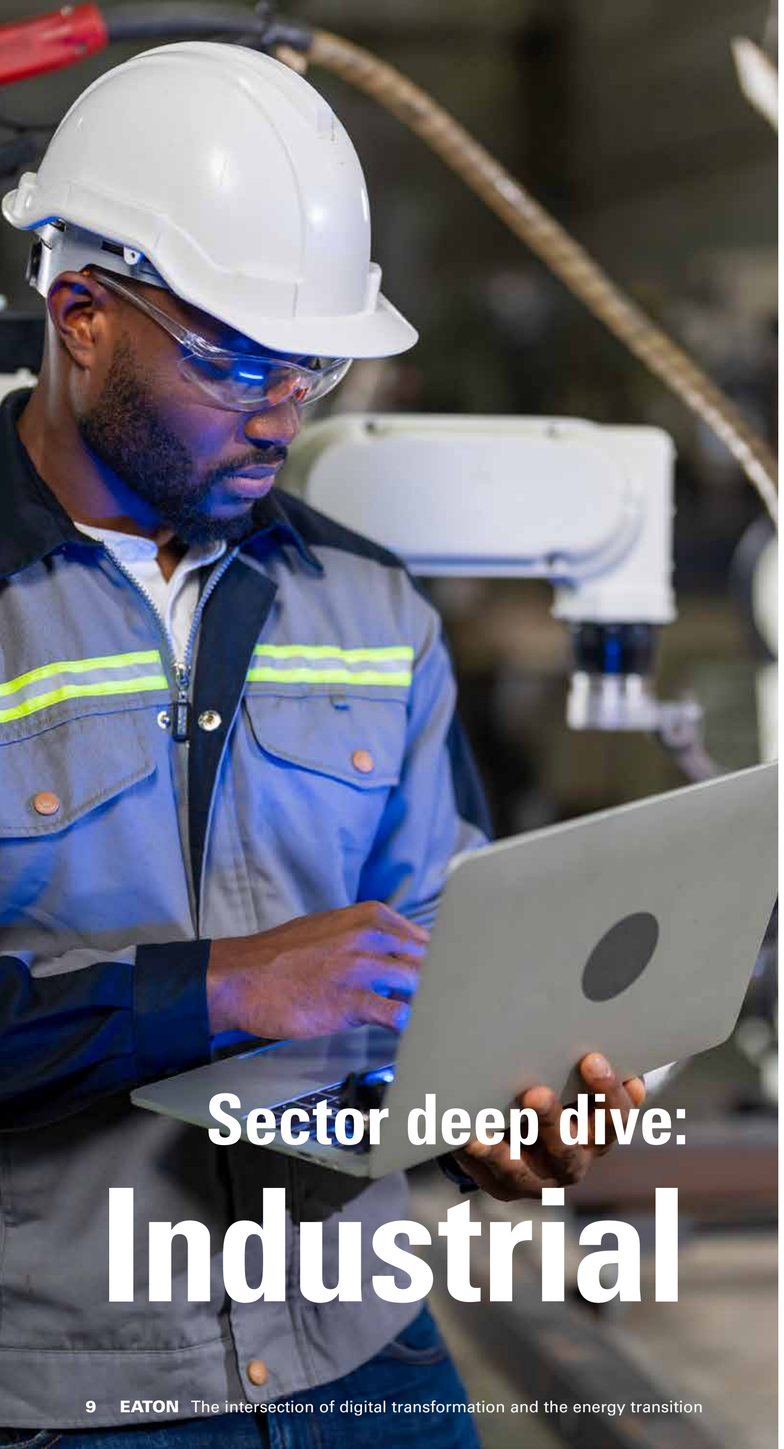
Energy/power-focused platforms
Depending on the sector, these solutions—specifically built to provide energy and power insights—typically go by different names with slightly different points of emphasis: building management systems for optimizing overall building operations; electrical power management systems specifically tuned to those requirements; and data center infrastructure management software for overseeing everything within a data center, energy and power included. Given the importance of the task, it's notable to see adoption of such systems fall just about in the middle of the pack: 33% of respondents have deployed such systems, signaling the importance of optimizing these critical industrial inputs while allowing for significant room for growth.

Deploying a capable technology stack is a critical part of any digital transformation effort. Enterprises must become more comfortable with (and capable of) replacing analog and mechanical systems and processes with new digital-enabled alternatives—from enabling infrastructure to applications that digitialize key processes: manufacture and assembly, maintenance and repair, energy and power management.

Figure 4: Digital tool adoption ranges from mainstream to niche



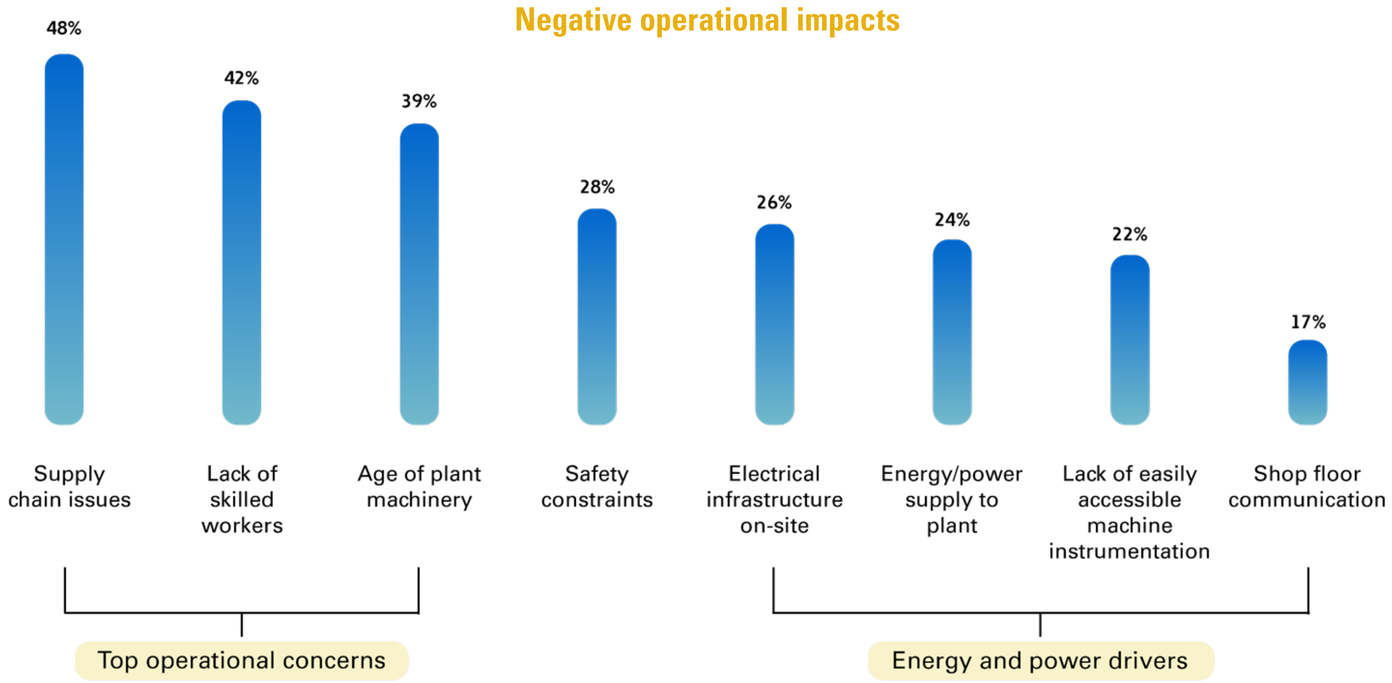
Q: Which of the following technologies, tools or applications have you deployed or plan to deploy in the next 12 months to support your organization's digital transformation?
Base: All respondents (n=1,001)
Source: 451 Research and Eaton custom survey



Sector deep dive: Industrial

Industrial firms—including those in manufacturing, food and beverage, chemicals, life sciences, oil and gas, and mining—largely began their digital transformation journeys by targeting their most immediate problems: supply chain issues (cited as a challenge by 48% of industrial respondents), lack of skilled workers (42%) and concerns about aging plant equipment (39%). Those issues sit at the very heart of the industrial sector (see Figure 5). Supply chain issues came to the fore during the pandemic. The 'great crew change'—retiring workers not yet backfilled by experienced replacements—helps explain the skills shortage. Aging plant infrastructure is a function of the expense and long payback time associated with industrial plant machinery. All three of these challenges slow the rate of digital change, but they can also be impacted by it: increased digital automation and IoT instrumentation has the potential to address supply chain complications, skills shortfalls and aging industrial plants in need of new life.

Figure 5: Pressing issues drive industrial transformation

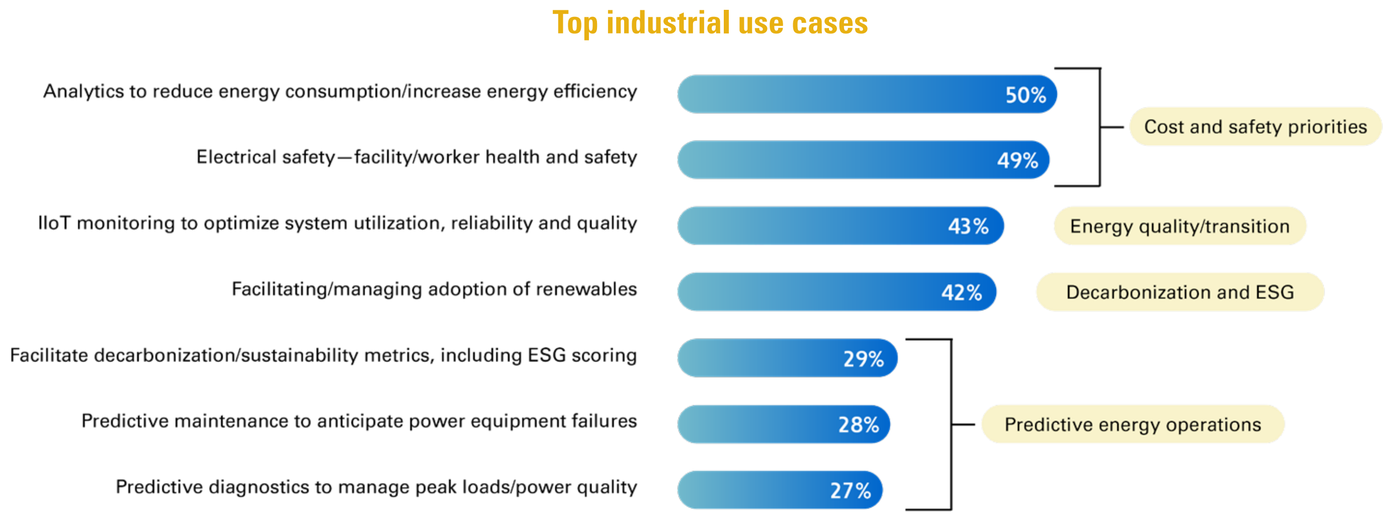


Q: Which of the following issues negatively impact the efficiency or capabilities of your operations today?
Base: Industrial respondents (n=250)
Source: 451 Research and Eaton custom survey

Key industrial digitalization takeaways

- **Accurate management and understanding of power usage** is a key driver of efficiency impacting competitive, operational, financial and ESG goals in the industrial sector.
- **Digital transformation and improved power management in the sector**—enabled by IIoT and AI/ML predictive analytics—will impact both industrial machines/systems and human capital, i.e., the industrial workforce.
- **Electrification and intelligent management of manufacturing and process systems** will be required to meet sustainability and climate goals in the industrial sector, which will be enforced through regulations.
- **Simulation and modeling**—from design and implementation to operations—for the entire plant will become the norm, enabled by increasingly detailed digital twins, including a representation of energy/power consumption.

Figure 6: Energy optimization today, decarbonization and ESG tomorrow



Q: Thinking specifically about your organization's energy and power systems, which of the following digitally enabled use cases have you deployed or plan to deploy in the next 12 months?
Base: Industrial respondents (n=250)
Source: 451 Research and Eaton custom survey

Only about a quarter (24%) of industrial respondents cited energy and power concerns as a key digital driver for industrial transformation. While that places the optimization of core industrial processes—such as manufacturing, assembly, quality assurance, etc.—above energy and power management concerns among digital priorities, it also creates an opportunity for early power intelligence adopters to gain significant competitive advantages.

Those industrial priorities are reflected in the digital-enabled use cases currently being deployed in the sector: supply chain optimization, IIoT machine and plant monitoring and digitally enabling legacy machinery—each is deployed by roughly half of respondents. This is followed by equipping workers with digital tooling (43%) and enabling more predictive maintenance capabilities (35%). Those use cases, almost exclusively targeted at operational improvements, are then followed by two energy and power applications: digital twins/digital threads (deployed by 34%) and electrical energy monitoring and management (27%). Digital twins, while also operationally important, will inevitably be used to represent power management and consumption, enabling capabilities such as what-if power engineering simulations of potential changes trialed on a copy of an operational digital twin.

To dig deeper, we asked those respondents interested in energy and power management in what ways they expected to apply digital technologies to the problem. Applying data analytics to reduce consumption and improve efficiency was the top response (chosen by 50% of respondents), followed by enhanced electrical safety (49%). Monitoring system utilization and facilitating renewables adoption also scored highly (see Figure 6).

Those top priorities, along with those that ranked lower but are likely to climb (especially decarbonization enablement and enterprise-wide ESG scoring), lay the groundwork for the digitalization of energy and power management in the industrial sector.

Sector deep dive: Utilities

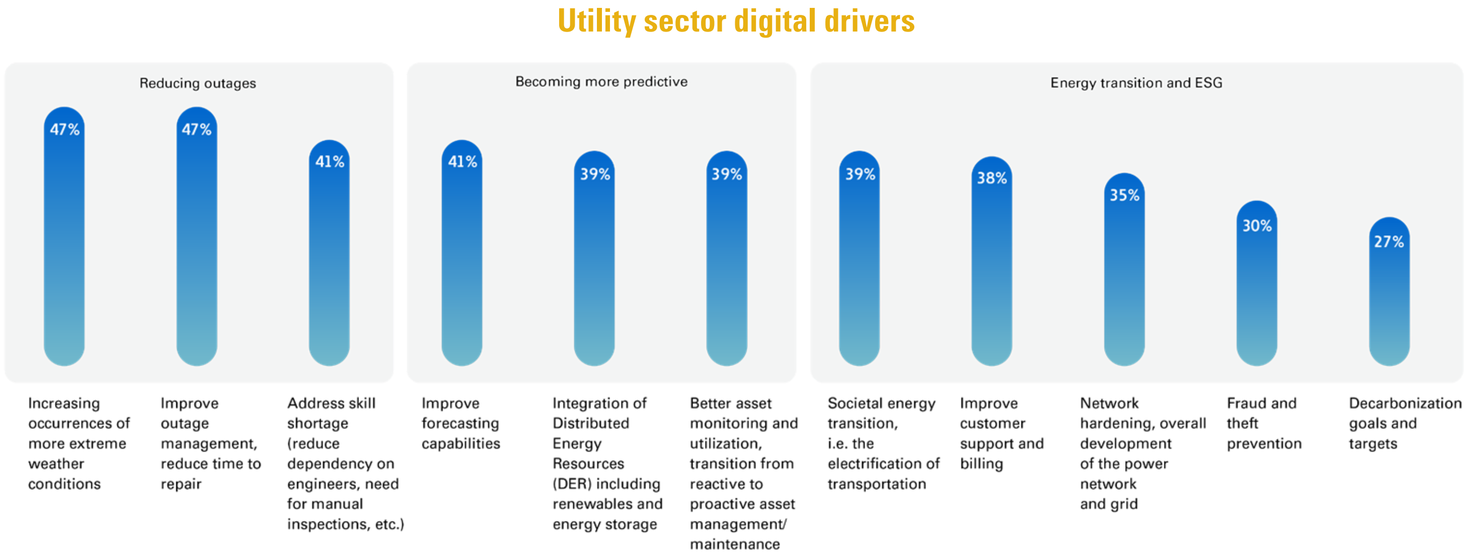
Digital transformation is a critical enabler for utilities, a sector facing a formidable task in managing a fast-moving energy transition while service demands are both growing and evolving. As part of this transition, many utilities are working to shut down existing coal plants (the prime energy source for 21% of utility survey respondents), while 37% rely on liquid natural gas, often seen as a bridge fuel in their journey to 'net zero.' Usage of renewables is also on the rise—though as a group, renewables lag slightly as a utility energy source—led by wind (chosen as an energy source by 36% of utilities) and solar (28%).

That shifting energy equation is driving a need for increased digital intelligence. These new energy sources do not provide a fixed amount of power per day. They are heavily dependent on weather conditions that change daily and even hourly, so they require constant monitoring, forecasting and optimization between demand and supply to maintain grid stability. Another complicating factor in this shift from centralized to more distributed power generation is the need to update power-providing infrastructure from a one-way delivery system to a bidirectional grid as consumers and industries become power 'prosumers' generating their own power and delivering back to the utilities.

This push and pull between being prepared for increased service demands and stabilizing the grid for resiliency and to reduce outages is the biggest challenge facing the sector today: 43% of survey respondents chose prioritizing investments to meet service demands as a top challenge, while 41% expressed concern about updating outdated infrastructure, the top two industry challenges cited by utility respondents. In both cases, legacy infrastructure upgrades can be abetted and complemented by digital technologies.

With those challenges as a backdrop, the utility sector is prioritizing an array of drivers for digitalization efforts. Perhaps more than any other industry, the utility sector is feeling a direct impact from climate change as extreme weather conditions such as heat waves, hurricanes and flooding increasingly play a part in causing blackouts. Respondents cited addressing weather impacts (including climate change effects) (47%) reducing outages (47%) and improving forecasting (41%) and asset monitoring (39%) as key digital drivers, all of which will play a role in modernizing infrastructure and providing better service (see Figure 7).

Figure 7: Aging utility plant modernization, service evolution drives digital change

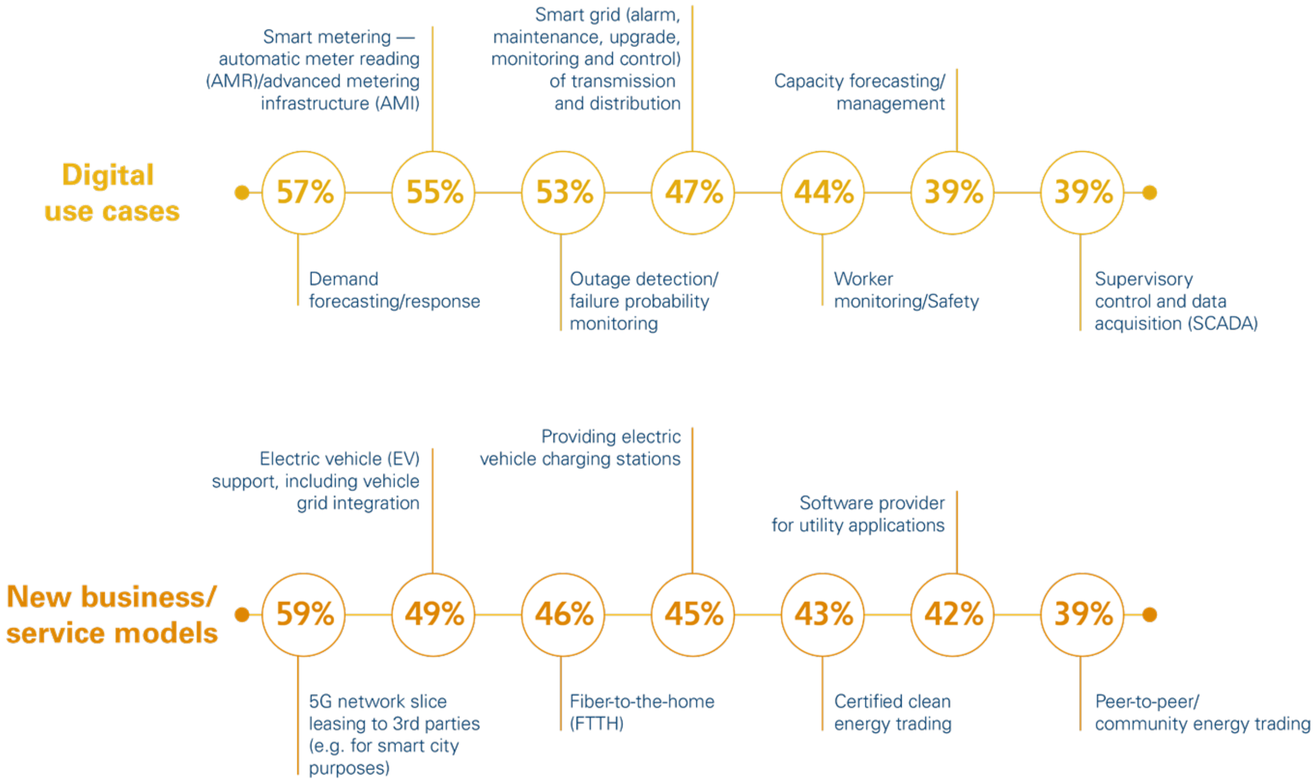


Q: Which of the following are drivers for the modernization and digitalization of your organization's operations?
Base: Utility respondents (n=251)
Source: 451 Research and Eaton custom survey

Key utility digitalization takeaways

- **The utility sector is at a critical transition point**—it is challenged to keep current grid and service levels in place among increasing demands and aging legacy infrastructure while facing the need to change service models and the opportunity to apply data insights to optimize operations.
- **Utilities can choose to view digital enablement and transformation through one of two lenses:** More pressing challenges will slow digital progress vs. digital progress is essential to meet those challenges and move the industry forward.
- **Digital maturity/readiness/willingness will likely be a major competitive differentiator in the sector looking forward:** Some traditional regulated energy providers will thrive; new competitors will emerge; and some utilities (and their customers) will get left behind.

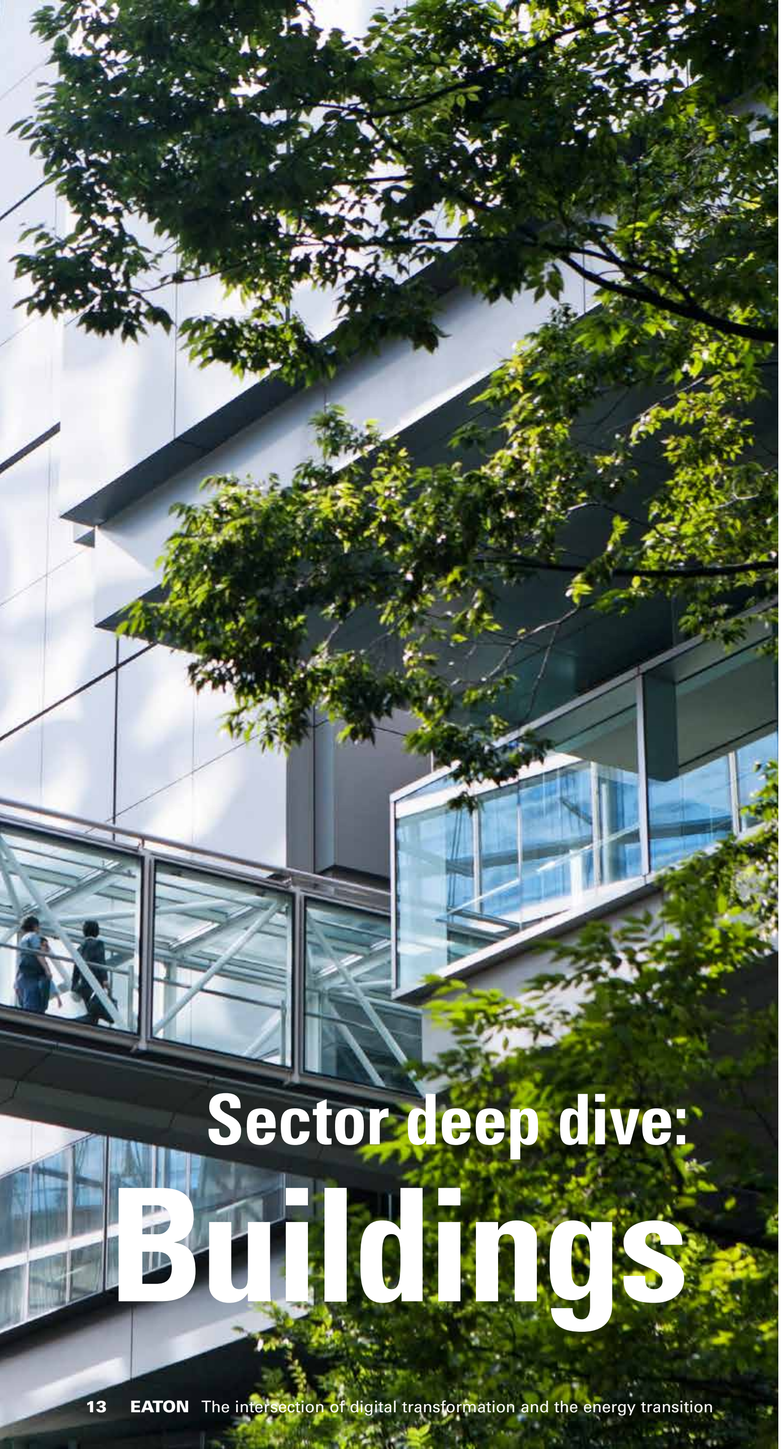
Figure 8: For utilities, digital drives operational improvements, new business models



Q: Within your organization, which of the following digitally enabled use cases have you deployed today or plan to deploy in the next 12 months?
Q: Where do you see additional revenue or business models developing in the next five years?
Base: Utility respondents (n=251)
Source: 451 Research and Eaton custom survey

Digital technologies and use cases are well-positioned to play a key role in helping to address those sector challenges and priorities. Top utility sector digital use cases include smart metering (deployed by 55% of utilities), outage detection/ probability monitoring (53%) and demand forecast/response (57%)—all of which use digital insights to optimize power generation, storage and delivery (see Figure 8).

On top of those operational improvements, utilities also see digital transformation as a path to new business models and revenue sources, including supporting customer EV charging needs (49%) or offering EV charging stations themselves (45%). Peer-to-peer energy trading (39%) and certified clean energy trading (43%) also offer utilities new digitally enabled ways of doing business.



Sector deep dive: Buildings

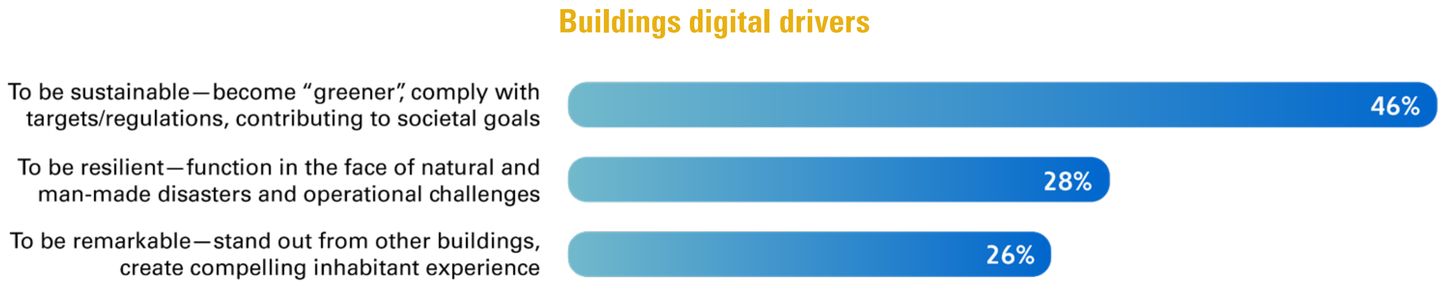
Power optimization and ESG reporting are critical issues for building owners and operators as they digitally transform—from meeting city/federal sustainability targets to lowering operational costs and providing a superior tenant experience. When asked to choose among three values—be sustainable, be resilient or be remarkable—survey respondents chose sustainability as their top digital priority, further evidence of the importance of ESG reporting and the business impact the energy transition in the sector (see Figure 9).

That said, building owners face significant challenges in reaching their sustainability goals. The top digital challenges include calculating a favorable cost/benefit analysis (cited by 52% building survey respondents) and a lack of pressing digital use cases (45%), both of which speak to a level of skepticism that so-called 'smart building' initiatives will pay off as fully as hoped. Respondents also cited the overall complexity of deploying new technologies (44%), compounding those doubts with concerns about the ability to integrate legacy building and new digital technologies—a challenge for a sector deep-rooted in mechanical systems. By comparison, all of those challenges were deemed more critical than the impact of COVID-19, chosen by just 36% of building operators.

Buildings, of course, come in all shapes and sizes—as do concerns. For instance, 'large' building operators were more likely to heavily weigh cost/benefit concerns than 'small' building operators (54% vs. 45%), reflecting the oversized investment one must make compared to the other. Meanwhile, 'medium' sized building operators (at 51%) were most likely to cite a lack of compelling use cases, pointing to a lack of silver bullet applications for facilities of that size.

Given the importance of sustainability to the sector, it's not surprising that energy- and power-centric digital use cases are among the most deployed today. For instance, 76% of building respondents said they have deployed environmental monitoring use cases, and another 58% cited energy-efficient management deployments—two of the top three digital use cases deployed (joining video surveillance/public safety, deployed by 70% of respondents).

Figure 9: What digital 'values' do building operators value most?

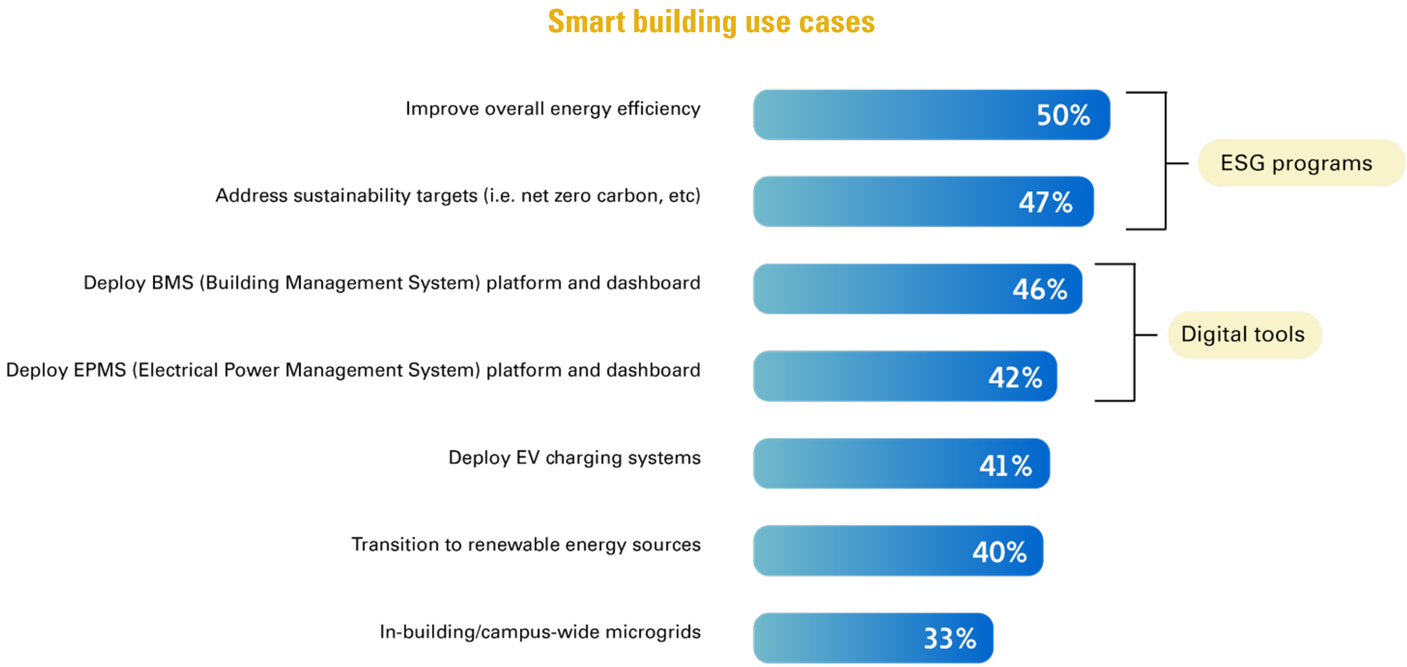


Q: When considering your organization's plans to upgrade building function/capabilities using digital technologies, which of the following drivers would you consider to be the primary motivation?
Base: Building respondents (n=250)
Source: 451 Research and Eaton custom survey

Key buildings digitalization takeaways

- **Smart building adoption will be strongly impacted by external forces**—regulatory requirements, economic environment, post-pandemic return-to-office and return-to-cities —that will both drive and impact timelines and priorities.
- **Two prime drivers are most impactful:**
  - Energy efficiency and sustainability benefits and targets.
  - The delivery of building features and comforts to spur and maintain building occupancy for both residential and commercial sites.
- **The building is very much a living environment,** 'enlivened' by a variety of connected systems and all driven by energy/power. The ability to reflect the function/repair of those systems via modern user interfaces (dashboards, alerts, digital twins, etc.) and manage them automatically and with efficiency delivers significant cost savings and more agile operations.

Figure 10: Building operators prioritize sustainability—and tools to measure it



Q: Which of the following energy- and power-specific smart building use cases have you deployed or plan to deploy in the next 12 months within your organization?
Base: Building respondents (n=250)
Source: 451 Research and Eaton custom survey

When asked specifically about energy-centric digital use cases planned, energy-efficiency initiatives came in on top, followed by programs to address sustainability targets, again reflecting the sector's sustainability and ESG reporting focus (see Figure 10).

Notably, respondents also prioritized the deployment of digital systems to help optimize and report on energy use, led by the implementation of building management systems (by 46% of respondents) and electrical power management systems, deployed by 42%.

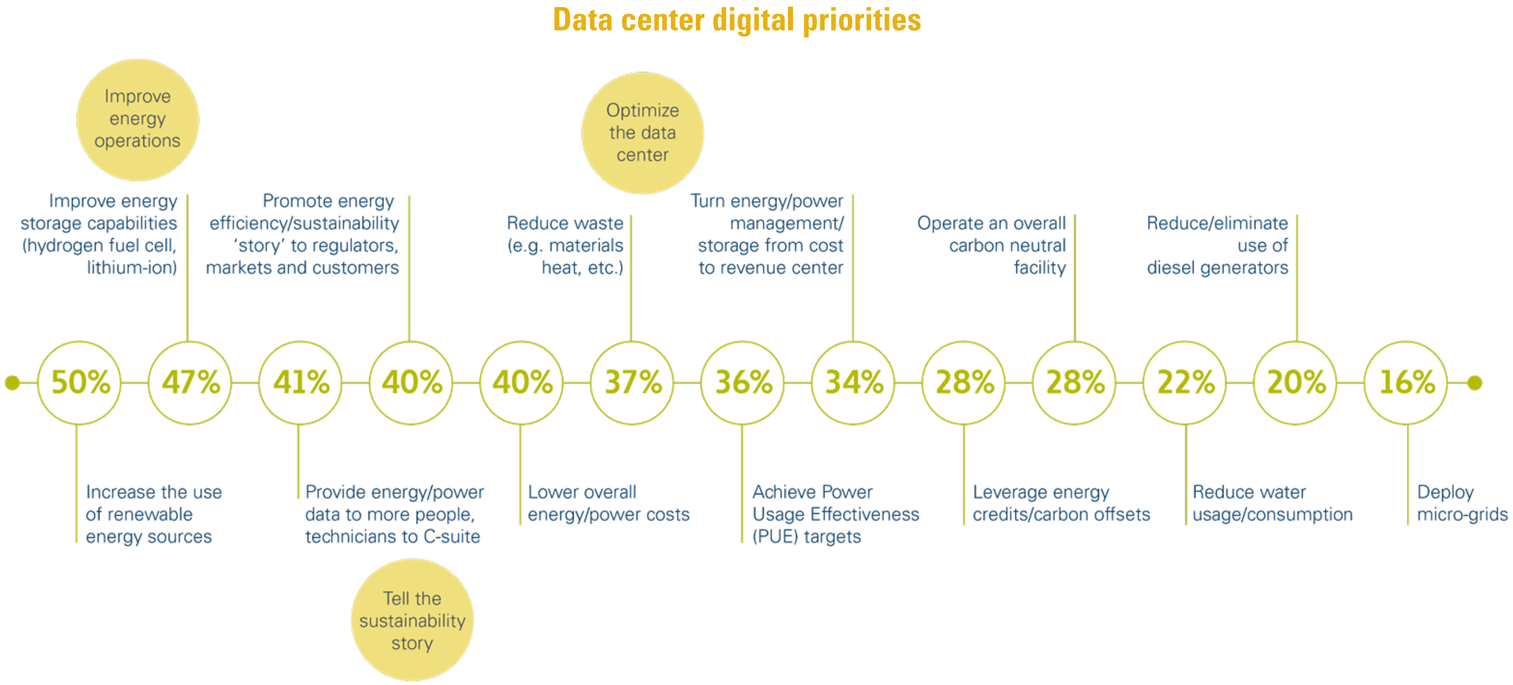
Sector deep dive: Data Centers

Energy considerations—power, cooling, heat utilization—are already a critical component of an optimized data center. Moving forward, those issues will become more important as data centers proliferate and scale, as data center services become more central to more businesses, and as energy issues impact data center siting, construction and operations. Digital technologies and platforms have the ability to address all of those challenges by providing additional power intelligence to optimize facilities and aid in the coming energy transition.

Like utilities, the data center sector is largely driven by two imperatives: to deliver new and better services on one hand and update and optimize infrastructure on the other. Those priorities are reflected in our survey: 47% of respondents cited delivering new services and capabilities as a top data center challenge, along with meeting rising performance requirements. But those service challenges are matched by operational challenges, including optimizing energy/power consumption (38%) and meeting sustainability goals and metrics (37%).

Among energy transition and sustainability goals, several stand out as most critical: 50% of data center respondents cited the need to increase renewables, followed by improving energy storage (47%), providing power intelligence insights to more people, from technicians to the c-suite (41%), and promoting that story to regulators, markets and customers (40%) (see Figure 11).

Figure 11: Sustainability, ESG storytelling goals drive data center digitalization

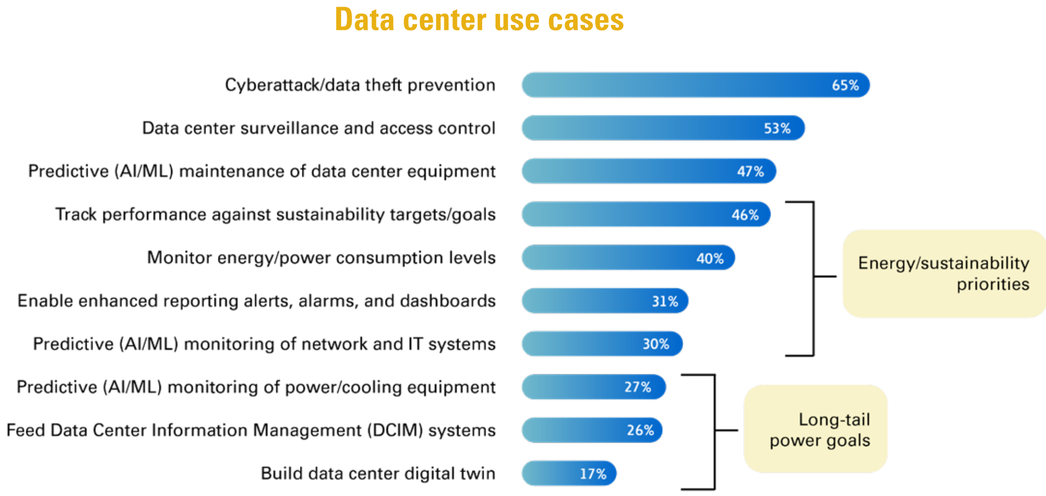


Q: Thinking specifically about the efficiency and sustainability of your data center, which considerations or goals guide your organization's efforts today?
Base: Data center respondents (n=250)
Source: 451 Research and Eaton custom survey

Key data center digitalization takeaways

- **Data centers are the lifeblood of the digital economy;** intelligent management of energy, power and cooling is as critical as the management of the infrastructure that sits inside them.
- **There are many types of data center owners and 'users.'** They have common energy and power management drivers and goals in many instances—efficiency, sustainability, cost savings, etc.—but they are also driven by unique concerns, from commercial hyperscale operations that require massive amounts of power to small installations enabled by a simple uninterruptible power supply (UPS), and everything in between.
- **New energy business models are key to the data center industry**—renewables, grid integration, data center-as-energy-provider, etc., which impact how data centers view and manage their power needs.
- **By their nature, data centers are technology-driven,** so operators are more comfortable than organizations in many sectors with advanced technologies such as IoT and AI/ML that can help them improve operations.

Figure 12: Energy-centric digital use cases vie for data center attention



Q: Which of the following digitally enabled data center management use cases has your organization deployed or plan to deploy in the next 12 months to improve how it operates its data centers?
Base: Data center operators (n=250)
Source: 451 Research and Eaton custom survey

Different types of data center providers have different priorities, in particular, commercial data center owners—i.e., cloud, multi-tenant data center and colocation providers—vs. enterprises that operate data centers on their own behalf. For instance:

- Commercial data centers are more likely to prioritize leveraging energy credits and carbon offsets (cited by 34% of commercial operators vs. just 19% of enterprise data center operators). They are also more likely to turn power storage from a cost to a revenue center (38% vs. 27%)
- By comparison, enterprises are more likely to prioritize operating a carbon-neutral data center (31% vs. 26%) or focus primarily on lowering overall energy/power costs (44% vs. 37%).

Despite the primacy of sustainability and energy transition goals, data center owners have other critical priorities as well, ones that are possible to address with digital tools and technologies.

So, when we look at the digital use case priorities for data center providers, energy and power considerations stand alongside security initiatives and efforts to update not just power, but IT infrastructure as well. That said, once security and IT system upkeep questions are out of the way, the deployment of digital tools to help better track energy goals is the next highest priority: 46% of data center respondents noted support for sustainability targets, while 40% cited improving the monitoring of energy and power levels (see Figure 12).

In the end, sustainability and energy transition in the data center sector doesn't just optimize how providers do business—reducing costs and increasing service revenue—it is part of a bigger picture central to the data center business, driving everything from regulatory compliance to funding and capitalization.

Summary

The evidence is clear that in power critical market segments, there is a definitive correlation between planning for and executing a successful digital transformation strategy and embracing the energy transition. Those organizations that can best plan, execute and measure their efforts will be well positioned for success as their respective markets continue to evolve.

Methodology

This report is based on a commissioned web survey conducted in April and May 2022. The respondents were qualified based on their expertise in their organization's adoption of digital transformation. Respondent companies were from diverse industries and had 100+ full-time employees. Surveyed countries include United States, United Kingdom, France, Germany, Spain, Italy, Nordic countries and UAE/Dubai. Total sample size for the study is 1,001.

Respondent roles fit into one of four eligible industry sectors: building services/facilities; data center owner/provider (including colocation and edge); manufacturing/industrial; and utilities. Survey invitations reached executives at the director level and above in IT, technology, facility operations, power management and environmental management job roles. Respondents were screened to be purchase decision-makers for embedded operations technology, having responsibility or connection in their role to operations technology for the site/facility. Their connection to operations technology could be either for IT or other mechanical operations. The survey was executed blindly—i.e., the survey sponsor name was not revealed to the participants at any stage of the project.

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