

2021 Black & Veatch
Strategic Directions



Trends
MEGA



About This Report

2020 has been a year unlike any other. The immense challenges of today's world have amplified the need for reliable and resilient infrastructure. COVID-19 has made power, water, natural gas and telecommunications more essential than ever. At the same time, catastrophic wildfire and hurricane seasons have underscored the growing impacts of climate change, reinforcing the importance of efforts to both mitigate and adapt to the change.

Most utilities have adjusted their operations to adhere to health and safety restrictions while maintaining uninterrupted service. At the same time, the global outbreak has highlighted the urgency of transitioning to new technologies and data-driven approaches that will enable more efficient management of critical systems and aging assets. Furthermore, the economic impact of COVID-19 is reducing some utilities' revenues that are critical to meeting both of these goals, adding critical to meeting both of these goals, adding tension and complexity to the prioritization of investments.

Besides addressing a global pandemic and a rise in extreme weather events, utilities also face pressure to help municipalities and commercial and industrial (C&I) customers meet their environmental, social and corporate governance (ESG) goals. As Fortune 500 companies commit to 100-percent renewable energy and decarbonization targets, utilities have had to ratchet up their own ambitions to keep pace — or risk losing business to unregulated competitors.

All these opportunities and challenges fit under the broad umbrella of sustainability, which for most utilities is centered on resilience. In the utility C-suite today, sustainability means rethinking the use of every resource with a laser focus on ESG



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goals while ensuring the overall health of the business. At the operational level, sustainability comes down to the long-held goals of reliability and resiliency, which are elevated even more with today's focus on an evolving power system and the need to decarbonize. Additionally, there is a critical role that digitalization and analytics will play in providing the insights necessary to reimagine the future and ensure secure, reliable long-term service.

Drawing upon data sourced from more than 1,000 professionals spanning critical infrastructure sectors — including the power, water, telecommunications and natural gas sectors, as well as deep insights from the C&I and manufacturing industries — Black & Veatch is proud to release the *2021 Strategic Directions: Megatrends Report*. By coupling primary research with our deep market insight and expertise, we look to inform the 2021 decision-making process that will drive capital spending and help utilities position for the future.

This year, we identified three megatrends that build on the [themes of recent years](#) — but throughout this epochal year, our professionals' market insights and client interactions have revealed notable shifts in their trajectories and focus, examined closely in these sections:

1. Customers Driving Sustainability in the C-Suite
2. Next-Level Reliability Through Resilience
3. Turning Data into Action

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Customers Driving Sustainability in the C-Suite

More efficient and sustainable operations have long been goals for utilities, but this has only become more challenging in the era of climate change. Utilities are being tasked with adapting faster than ever while also addressing more frequent extreme weather events, natural disasters, and regulatory structures that often do not keep pace with

changing market dynamics. While utilities have varying ESG goals, decarbonization has emerged as a primary effort for many. In just the past two years, major decarbonization announcements — many pledged outside of regulatory mandates — have become the norm among the world's largest utilities.

Figure 1

Does your organization have either carbon reduction, greenhouse gas emissions reduction, or renewables goals? (Select all that apply).

Source: Black & Veatch

53.3% Yes,
separate from any
regulatory mandate

40.5% Yes,
state regulatory mandate

15.2% Yes,
local regulatory mandate

15.2% No

Highlighting this point, more than half of respondents to our [2020 Strategic Directions: Electric Report](#) survey said they have decarbonization goals apart from regulatory directives, illustrating the importance of market drivers in this transition (Figure 1).

While Xcel Energy was an early mover in 2018 with its own net-zero carbon plans, zero-carbon plans have been announced by many of the biggest U.S. utilities, including Duke Energy, Dominion, Southern Company and Ameren. Companies of all sizes are embracing sustainability not only in the face of climate change but also as the workforce of the future demands to know what their employers are doing about these issues.

The key driver for utility decarbonization pledges is that sustainability has rapidly ascended as a priority for large corporate customers and other stakeholders, intensifying market drivers for decarbonization. Besides 100-percent renewable and net-zero commitments from Fortune 100 companies such as Amazon, Google, Maersk, Nestle Global and Dell — all part of the [RE100 initiative](#) — [net-zero goals](#) from telecom providers such as T-Mobile, Sprint and AT&T, along with the departure of major original equipment manufacturers (OEM) from the coal power sector, like General Electric, Siemens and Toshiba, reflect the impact of sustainability among corporate leaders. Black & Veatch recently released its [2020-2023 Sustainability Strategy](#), which outlines the company's path towards a more sustainable future.

On the municipal front, cities large and small around the globe have net-zero goals. 2020 also saw a marked uptick in action from shareholders as well as from financial giants such as Blackrock, which declared climate risk as a financial risk in an open letter from its CEO, Larry Fink. Additionally, an increasing number of financial regulators are exploring ways to address the systemic risk of climate change in financial markets. These trends are driving action from both forward-looking utilities and even the sector's most recalcitrant actors.

The newfound willingness by utilities to address deep decarbonization is attributable to the fast-expanding toolkit at their disposal, as well as collective understanding of market players that inaction also creates great risks to business as usual. It was only a few years ago that utilities saw "zero emissions" as an unrealistic or even impossible goal. But today, the continued cost declines of wind, solar and battery energy storage, along with flexible demand-side resources at scale, have made high penetrations of renewables a possibility without sacrificing grid reliability. Emerging technologies for dispatchable zero-carbon generation — including hydrogen, and carbon capture

sequestration and utilization technologies — also are drawing growing interest from utilities, as well as from oil and gas and other industrial sectors, seeking a broader low-carbon resource base.

Given the internal and external drivers, most utilities — no matter their size — are moving towards more sustainable operations. Survey results show that a combined 83 percent of large utilities (those serving at least 2 million customers) and 62 percent of smaller utilities (with fewer than 500,000 customers) “somewhat” or “strongly” agree that “we are pushing our capital towards clean energy” (Figure 2).

It is not just the electric sector that has embraced sustainability at the highest levels of the organization, with hydrogen particularly emerging as the hot energy topic in the past year. Both oil and gas interests and electric and natural gas utilities have focused on hydrogen as a unique opportunity to leverage their expertise and capital to fill gaps in the existing decarbonization solution set.

The gas industry notably is keenly interested in the ability of “blue hydrogen” produced from natural gas, with the carbon dioxide captured during the production process, to accelerate the deployment of hydrogen at scale. Eventually the industry hopes to move towards zero-emission “green hydrogen” produced from excess renewable energy. With its ability to mix with existing natural gas fuels (to a point), expect the debate over the net-carbon benefits of blue hydrogen to be weighed against its rapid deployment and its rapid impact on power sector emissions.

Additionally, development of lower-emission materials such as carbon-sequestering cement and engineered wood is attracting interest in the construction sector. Renewable natural gas also can offer an opportunity for both wastewater utilities and natural gas providers to substantially reduce their carbon footprints. While many water utilities have traditionally been technologically conservative, many are now embracing innovation to meet

Figure 2

To what extent do you agree or disagree with the following statement:
We are pushing our capital towards clean energy.

Source: Black & Veatch

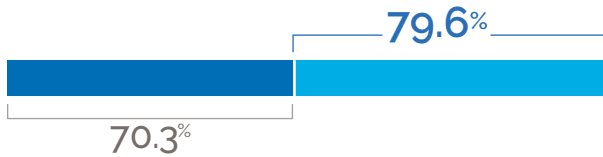
By population served	Strongly agree	Somewhat agree	Neither agree nor disagree	Disagree
Less than 500,000	29.2%	33.0%	28.3%	9.4%
500,000-1,999,999	37.0%	35.4%	22.0%	5.5%
2,000,000 or more	42.0%	37.6%	14.8%	2.4%

Figure 3

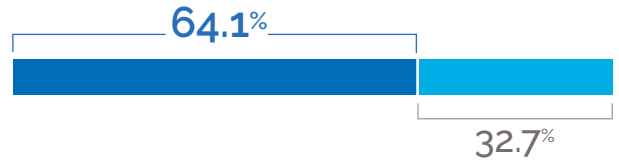
Please indicate how much you agree or disagree with the following statements as they relate to your organization and local economy. (Select one for each row).

Source: Black & Veatch

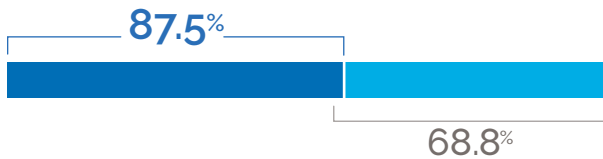
Top-level management in our organization demonstrates commitment to innovation and a culture of innovation is fostered at all levels



The use of resources within the water cycle is clearly mapped and documented to provide transparency in relation to the efficient use of water, nutrients, organics and energy



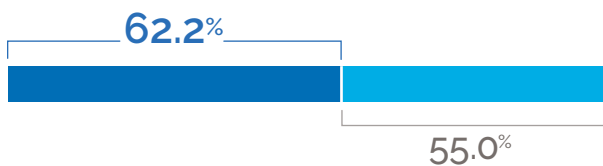
Our organization has a clear vision and goals established for more sustainable modes of operation in the future



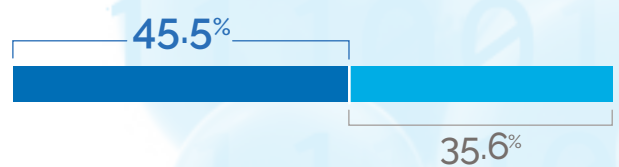
We maximize the value of nutrients and organics in the water cycle by promoting the production of products with a high value to society



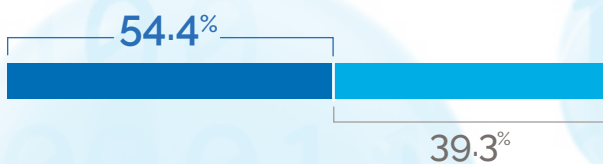
We collaborate with other organizations, including those outside of the water industry, to explore opportunities for improving the efficient management of resources



Water, nutrients, organics and energy are efficiently cycled within our local economy to maximize the inherent value of these components within the water cycle



We maximize the value of water in the water cycle by promoting re-use and cycling of water at it's highest value



Percent selecting strongly or somewhat agree

● Less than 500,000 ● 500,000 or more

environmental challenges, with nearly 70 percent of survey respondents claiming to be “leading innovation” or an “early adopter of innovative ideas” for environmental stewardship (Figure 3).

Given the increased focus on climate risk and sustainability in the private and public sectors, utilities are embracing their own sustainability goals, knowing that they no longer need to choose between decarbonization and financial

performance. Instead, savvy utilities are seeing that sustainability is opening doors to new types of service such as green tariffs and battery storage, which offer zero emissions and more reliable service to better serve tomorrow’s customers. ○

Next-Level Reliability Through Resilience

Reliable service always has been core to every utility's mandate, but achieving this is becoming more complex in the face of aging infrastructure and increasingly frequent and intense extreme weather events. As this report was being drafted, the second major hurricane of November (Category 3 or higher) made landfall in Central America as a Category 5 storm, with wind speeds accelerating from Category 1 to Category 4 in just 24 hours over abnormally warm seas. Similarly, wildfires continued to burn in parts of Colorado, months after the historic end to fire season.



Figure 4

What are the major challenges your team is facing with your current electric distribution system?
(Select up to three choices).

Source: Black & Veatch

72.5%
Improving reliability

49.5%
Asset management

48.6%
Improving resilience

37.2%
Integrating distributed energy resources (DERs)

34.4%
Physical security and cybersecurity

24.8%
Common distribution automation plan

It is with these varied factors in mind that in order to sustain reliability, utilities across the board recognize the need to be more resilient than ever. Starting nearly a decade ago, resiliency became the battle cry for utilities after the extensive damage of Superstorm Sandy, while Hurricane Harvey in 2017 was a wakeup call for the Gulf Coast.

Today, that battle has intensified. For example, despite maintaining reliability through the unprecedented conditions of the pandemic, electric utilities still struggled with extended outages in the wake of historic wildfires in California, storms in the Northeast and hurricanes in the Gulf of Mexico. Customers and regulators are not just asking but are demanding to know the return on investment of utility investments for ratepayers when extended outages remain a reality after weather events.

Unsurprisingly, when asked about the top challenges facing today's electric utility industry, the majority of respondents cited improving reliability, followed by asset management and, almost equally, improving resilience (Figure 4).



Figure 5

Which of the following elements are included in your water supply plan? (Select all that apply).

Source: Black & Veatch

85.1%

Water conservation and/or drought management

68.1%

Scenario planning

55.3%

Climate change/variability

31.9%

New surface water supplies

31.9%

New reservoir storage

8.5%

We do not have a water supply plan

According to our research, water utilities face the most aggressive resilience challenge from climate change, as more frequent droughts and unpredictable patterns of intense precipitation affect their ability to rely on reservoirs and other surface water resources while they also have to tackle aging infrastructure and the need to manage aging workforce. Whether it's less rain in increasingly populous regions or inundations from increasingly powerful storms, more than half of respondents to our [2020 water industry survey](#) are actively planning for climate change (Figure 5), employing strategies to bolster resilience that include seeking new groundwater sources — including investigating technologies for groundwater recharging — and adding reuse capabilities to help diversify supply (Figure 6).

One resilience strategy that is becoming increasingly important for both electric and water utilities is the pursuit of expanded and more integrated planning across their business silos. Water utilities are embracing programmatic solutions to mapping out resilience, including the popular One Water approach advocated by the U.S. Water Alliance, as well as the U.S. Environmental Protection Agency's (EPA) integrated planning process.

Figure 6

What steps are you taking to bolster water supply resiliency? (Select all that apply).

Source: Black & Veatch

42.9%

Seeking new groundwater sources

38.8%

Adding reuse capabilities

26.5%

Seeking new surface water sources

12.2%

Seeking new desalination/brackish sources

20.4%

We are not taking any steps

Figure 7

Is regulatory uncertainty at the federal or state level having an impact on your utility? (Select all that apply).

Source: Black & Veatch

Regulatory uncertainty impacts our ability to...

40.2%

Recover infrastructure investments to modernize the grid

39.2%

Recover operating costs and provide satisfactory earnings

26.8%

Accurately predict electricity prices

24.7%

Recover large one-time costs (e.g. storm restoration) in a timely fashion

16.5%

No, regulatory uncertainty does not have an impact



Electric utilities are broadening their planning lens to look at integrated resource blueprints that include supply and demand across central and distributed assets. They also are reconsidering physical grid-hardening strategies and exploring non-wires alternatives to boost resilience. As they recognize the growing threat — and cost — of prolonged outages, policymakers and regulators are showing more willingness to rate-base expensive hardening investments.

As with utilities across all sectors, the ability to embrace emerging opportunities to build resilience is largely determined by regulators. Because of this, utilities cite regulatory factors as the top risk they face. Amid rapid climate and technological change, electric utilities fear that regulators will not be able to keep pace with their need to invest in grid modernization approaches — and, in turn, cause them to lose customers to third-party competitors such as distributed solar providers, which offer the resilience and sustainability benefits they seek (Figure 7).

The growing mismatch between customers' expectations of the benefits of technology adoption, such as advanced meters, and regulatory incentives to adopt those technologies, can lead to negative publicity when outages occur, leaving customers to wonder, "What have you been doing with my money if you can't keep the lights on in a storm?" Utilities in our survey cited customer expectations as the second-greatest risk they face — behind regulatory risk but ahead of the interrelated risks of

climate change, technological change and environmental compliance (Figure 8). For example, some utilities still message their customers to contact the utility if the power goes out, despite the fact that they've deployed smart meters that automatically provide that information to the utility.

Some regulators are adapting, especially in hard-hit areas such as Florida, which is battered by more hurricanes annually than any other state. In 2019, the Florida Public Service Commission adopted new rules that would allow utilities to recover costs of system-hardening investments. Senate Bill 796, signed into law by Gov. Ron DeSantis in June 2019, enables the state's investor-owned utilities to levy a separate charge — outside of its base rates — to pay for undergrounding vulnerable power lines and other equipment to make them more resilient to hurricanes.

But reliability and sustainability do remain in conflict. In some regions, particularly in the Northeast, the mid-Atlantic and California, utilities increasingly are limited by growing opposition to natural gas, highlighting a potential tension between sustainability and resilience objectives in the near term. This conflict was on display this year in California, where Pacific Gas & Electric lacked sufficient gas resources and secondary power supply sources to meet the demands of heat waves and wildfires; and in the Northeast, where the Atlantic Coast Pipeline was cancelled despite aging existing pipeline infrastructure and repeated gas price spikes during winter months. But technology could render this sustainability-versus-resiliency issue moot in coming years, as demand-side resources and new technologies such as green hydrogen are brought into more comprehensive utility planning. ○

Figure 8

What are the risks that your organization must manage? (Select up to three choices).

Source: Black & Veatch

60.2%

Regulatory

37.1%

Customer expectations

34.0%

Environmental compliance

33.2%

Technological change

29.0%

Nature (storms, climate change, etc.)

23.9%

Political

21.2%

Market competition

20.8%

Labor

13.5%

Shareholder





Turning Data into Action

Leveraging smart infrastructure to enable data-driven utility operations has long been a work in progress, and advancement has been uneven. While many utilities have access to vast amounts of data thanks to deployment of advanced metering infrastructure and sensors across new and legacy assets, only a few early adopters have operationalized the data in a significant way.

Figure 9

What are the barriers your utility is facing to enable smart distribution infrastructure? (Select up to three choices).

Source: Black & Veatch

54.1%
Budget constraints

37.6%
Other competing priorities

36.6%
Regulatory hurdles

35.1%
Lack of resources or expertise

23.9%
Communication network capabilities

22.9%
Data quality or issues

19.5%
Gaining stakeholder support

18.0%
Ownership across departments

12.7%
Availability of technology

10.7%
Waiting for others to pave the way

5.4%
Unwillingness to look at opportunities in unregulated arena

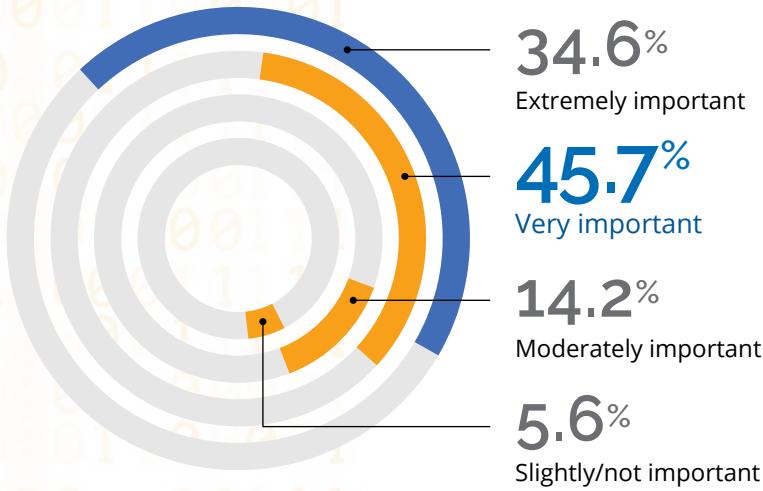
For example, the New York Power Authority (NYPA), the largest state public power utility in the U.S., is actively working to transform itself into a true “digital utility.” The utility is **“one of the key creators and implementers”** of Gov. Andrew Cuomo’s Reforming the Energy Vision (REV) initiative, which aims to transform how electricity is produced, bought and sold in New York state. Recognizing the need to gain comprehensive insight into the systems within their jurisdiction, the NYPA has invested in creating digital twins of all their assets, deploying technology capable of modeling how their systems might react to major storms, cyberattacks and other risks.

Similar to the NYPA, a growing number of large investor-owned utilities are making major commitments to using data to truly transform their operations. These utilities are enabled by the availability of software as a service and cloud-based solutions from third-party vendors, making it easier to close the digital divide. Even so, more than half of utilities said budget constraints, followed by competing priorities and regulatory hurdles, are impeding their ability to have smart distribution infrastructure that gathers data from sensors that can be used for a range of decision-making activities (Figure 9).

Figure 10

How is your organization viewing the importance of integrating its planning functions (e.g. transmission, distribution, and resource planning)? (Select one).

Source: Black & Veatch



Artificial Intelligence and Analytics

Given these constraints, the use of data for asset management has seen perhaps the greatest amount of interest, given that the ability to anticipate equipment failures and avoid costly outages presents a straightforward case for regulatory approval. This is particularly important for gas utilities, which are under greater scrutiny over risk-management practices after a series of high-profile safety incidents in recent years. The emergence of tools enabled by artificial intelligence (AI) to provide predictive analytics is especially important for all utility sectors, as the aging assets most likely to fail are less likely to be equipped with sensors. Better system intelligence and analytics also facilitate better and more reliable operation of utility systems and facilities.

Beyond enhancing reliability, early movers also seek to leverage data analytics and AI capabilities to build resilience. Many of these early movers have been collecting terabytes of data yet doing little with it so far. Data-driven modeling is a key for power utilities to anticipate and control the behavior of distributed



energy resources (DER), improve distribution grid resilience and enable more granular pricing. Sophisticated data analytics also are key to making the regulatory case for sustainable investments that take into consideration the benefits for the utility, the customer and the environment.

To this point, the data-driven integration of utility planning is emerging as a fast-growing use case, with 80 percent of respondents ranking planning integration as “very” or “extremely” important (*Figure 10*). For water utilities, digital tools are being used to dynamically plan and prioritize capital improvement plans based on scenarios of severe storms, financial events and more. Similarly, more than three-quarters of power utilities either “somewhat” or “strongly” agree that integrated IT/OT planning will deliver significant benefits. (*Figure 11*).

Figure 11

Statement agreement: there will be meaningful benefits if we integrate the planning of all our operational (OT) and information technology (IT) systems.

Source: Black & Veatch

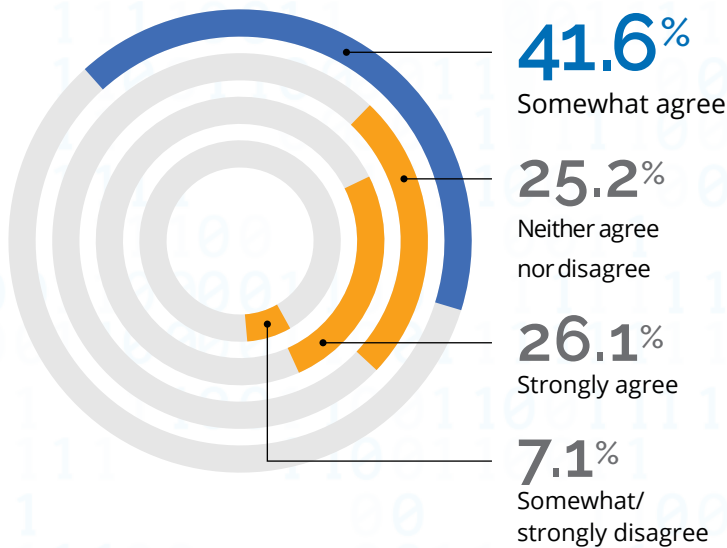
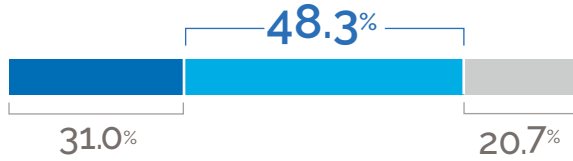


Figure 12

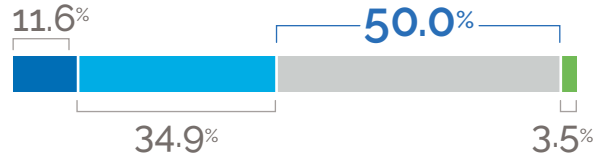
When thinking about the qualities your organization looks for in a new hire, how have those qualities changed from five years ago? (Select one for each row).

Source: Black & Veatch

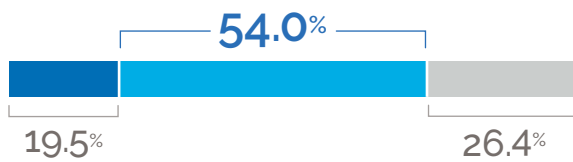
Digital savviness



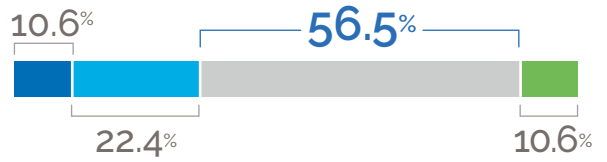
Experience in the industry



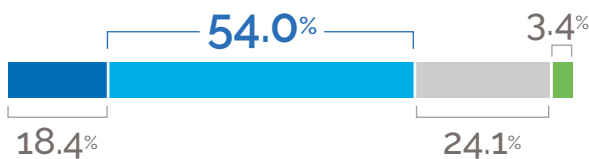
Communications skills



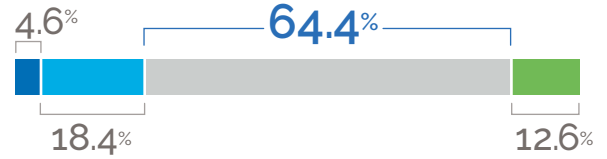
College degree



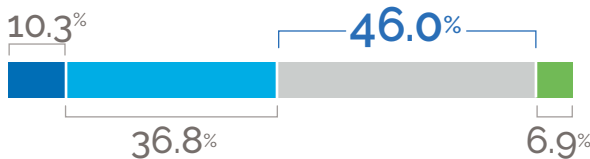
Analytical skills



Ability to work odd hours



Engineering background



- Much more important today
- Somewhat more important today
- Same importance today
- Somewhat/much less important today

Opportunities, Challenges of Digitization

The pandemic has proven data and IT solutions are valuable for operations planning, work prioritization and personnel management. Digitization has helped facilitate rapid changes to asset maintenance and incident response protocols, including a move to one-person crews, different work-staging processes and even quarantining on-site staff at critical facilities. As in other areas of the economy, it also has made it possible for large swaths of utility personnel to work remotely. While some of these changes may be temporary, the cost savings and efficiency improvements are likely to make them permanent in many cases.

Because data analytics is becoming core to utility operations, it has heightened the challenges they face in replacing an aging workforce. Eight out of 10 utilities see digital savviness as “somewhat more” or “much more” important for new hires today than it was five years ago (Figure 12). But that means utilities are competing with the likes of Amazon and Google, as well as the financial sector, for the latest crop of data scientists that may not see the utility sector as cutting edge.



Finally, any discussion of digitization must include the evolving cybersecurity environment. Attempted cyberattacks have risen in recent years, and this trend has accelerated since the pandemic's outset. But there has been growing utility collaboration and coordination with the federal government to share knowledge and protect against these threats, fueling hope they can continue to avoid major cybersecurity breaches — or, at the very least, avoid the liabilities by following established best practices. However, when best cybersecurity practices are followed, embracing data is an opportunity for utilities to truly transform their operations while also building a new paradigm to offer best-in-class customer experiences.

As uncertainty enveloped the globe due to COVID-19 this year, utilities have proven capable of taking a long-term view, especially when it comes to climate change and sustainability. With technology and data at their fingertips, utilities are poised to execute on increasingly aggressive decarbonization plans and respond to emergencies quicker and better. The details of these plans vary widely, but the ability of first movers to execute will bring confidence to historically cautious service providers who must transform their operations while providing even more reliable, resilient service to customers of all sizes. ●



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