BLACK & VEATCH

grid MOD

Grid Modernization 2022:

Resilience and Reliability

Grid Modernization

Grid modernization can restore pride in America's electric industry and pave the way for a more sustainable economy

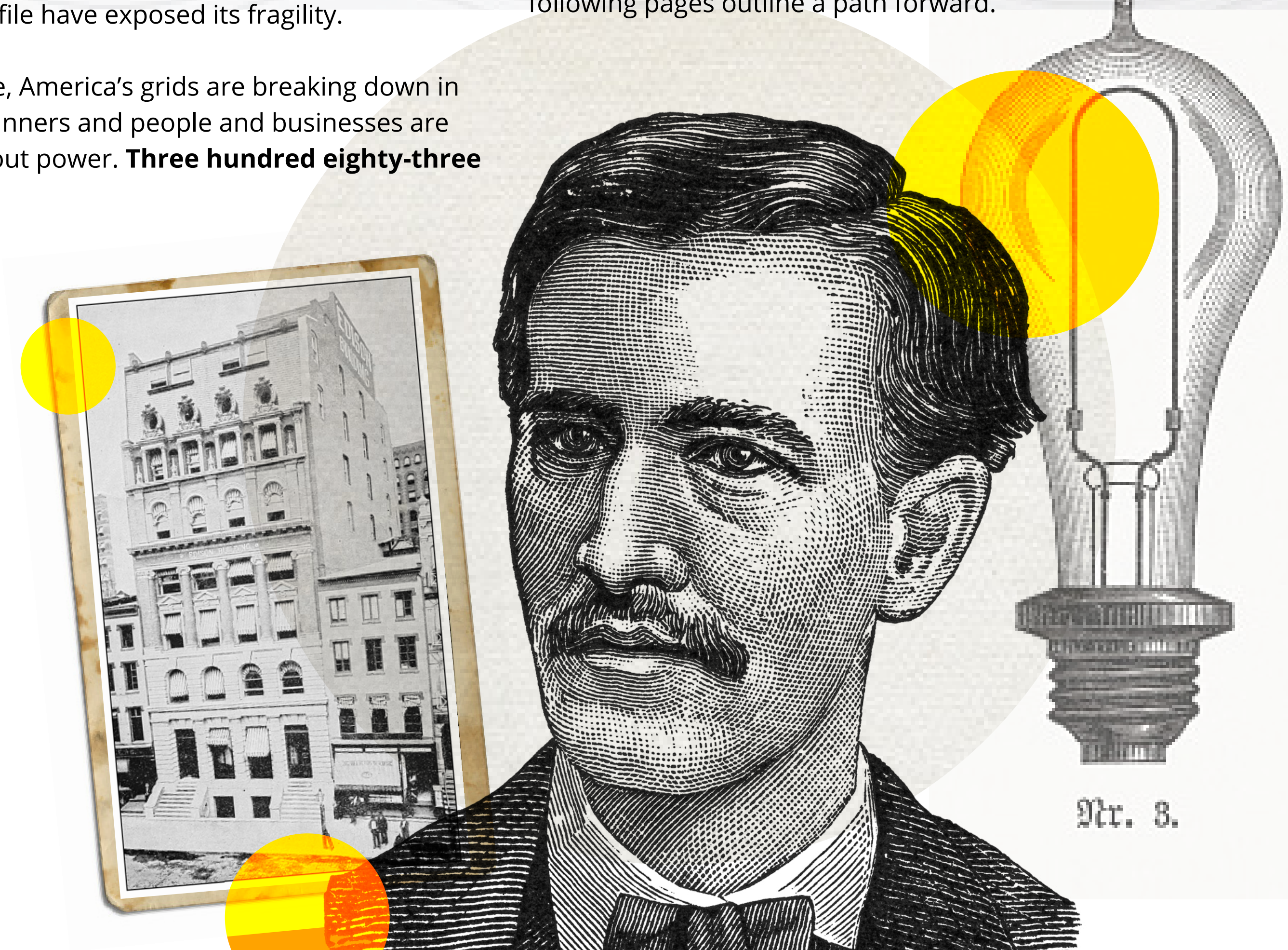
The U.S. electric grid is one of the world's most powerful machines. Its origins date back to Thomas Edison's Pearl Street Station, which served 59 customers when it started in 1882, but it has grown to almost 8,000 power plants connected by nearly 3 million miles of power lines, approximately 450,000 of which are high-voltage. Historically a wonderfully complex and well-oiled machine, the U.S. electric grid is an underappreciated engineering marvel that has been the backbone of the nation's economy and prosperity for generations. It is also a powerful tool for addressing our environmental challenges.

The grid is a marvel of ingenuity and a creation worthy of national pride, but the relentless impacts of climate change, aging infrastructure and a rapidly shifting generation profile have exposed its fragility.

More and more, America's grids are breaking down in high-profile manners and people and businesses are being left without power. **Three hundred eighty-three (383) electric disturbance events were recorded by the Department of Energy (DoE) in 2020, up from 150 in 2017.** The DoE estimates that power outages cost the economy $28 billion to $169 billion annually and the Texas blackouts in February of 2021 alone are estimated to have cost the state more than $110 billion in damages and losses — not counting human suffering.

Major outages triggered by extreme climate-related events — like arctic conditions in temperate latitudes, or wildfires in California — have captured headlines. Weather alone, however, is not the only reason. Aging infrastructure, increasingly distributed assets, variable generation and loads, and cybersecurity issues also threaten our grid's resilience.

How to build a more resilient and reliable grid, where to start and where to prioritize are top of mind. Utilities must think big and small, balancing long-range emissions goals with near-term financial metrics. The following pages outline a path forward.



6 Major Drivers of Grid Modernization

The world's electric systems are facing changes comparable to how fixed-line telephone systems transitioned to mobile. Distributed energy resources (DERs) are accelerating us past the days of a single-direction, centralized electric grid and towards a bi-directional, distributed grid faster than any of us ever imagined. Here are six factors behind this transformation.

1. **Aging Infrastructure.** The root cause of most grid challenges and failure is aging infrastructure. Year after year, aging infrastructure was identified as the single biggest challenge the electric industry is facing, according to Black & Veatch's Strategic Directions Reports. This changed in 2021 when it came in as the second biggest challenge, displaced by ...

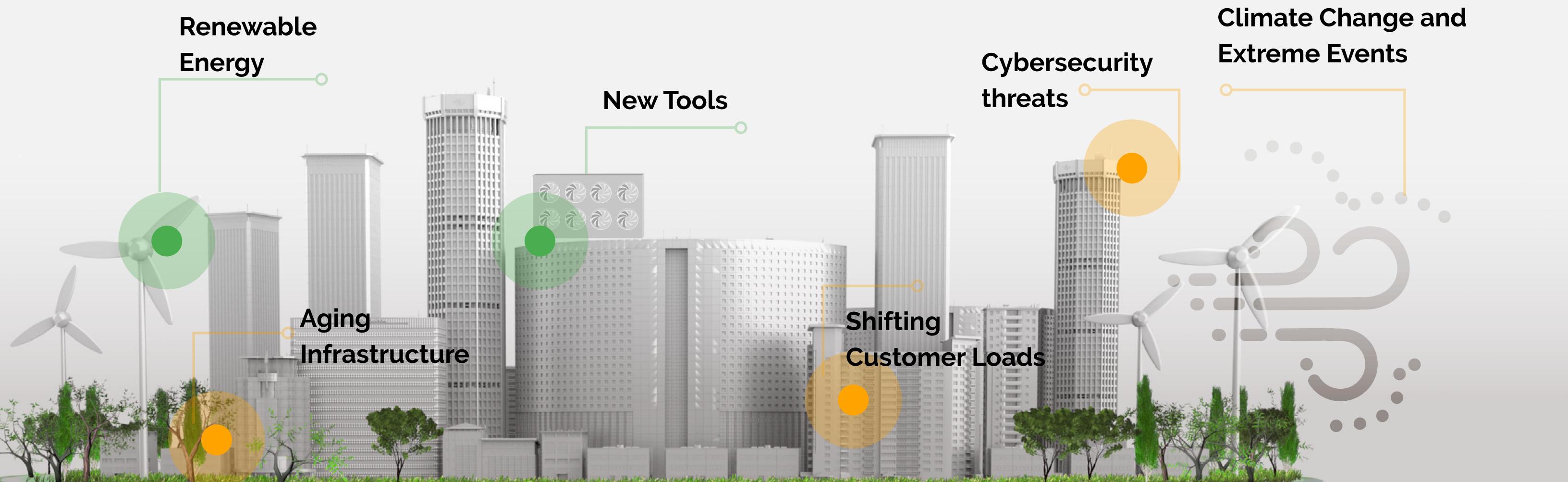
2. **Renewable Energy.** The drive for decarbonization and reduction in conventional generators, replaced by intermittent renewable energy sources like solar and wind, is a major grid management disruptor. Operating at both utility-scale and as distributed assets powering individual homes and businesses, variable renewables are changing the fundamentals of how grids are operated. For the first time in 2021, integrating renewable energy became the single biggest challenge facing the electric industry, pushing aging infrastructure to number two.

3. **Climate Change and Extreme Events.** Hundred-year storms are now common events; hurricanes make landfall with increasing intensity, wildfires, artic winter conditions, shifting floodplains and shorelines; and even solar flares can challenge outdated designs and unprepared grid operators.

4. **New Tools.** The addition of thousands of sensors and smart devices — tools intended to improve the performance of grids — adds a new dimension of complexity that grid operators must adjust to and work through before realizing productivity and performance gains.

5. **Shifting Customer Loads**. New and variable customer loads — more passenger and commercial electric vehicles or sudden changes in customer patterns in working from home in face of the COVID-19 pandemic — mean today's grid must carry, control and monitor the bi-directional flow of electric power safely, reliably and efficiently.

6. **Cybersecurity threats.** The growing reliance of the grid on a digital system increases the vulnerability to cyberattacks, which have risen in recent years, a trend accelerated since the pandemic's outset. The U.S. grid was hit by a cyberattack for the first time in 2019, though it did not cause any power disruption, and a ransomware assault on the Colonial Pipeline Company shut down the pipeline supplying almost half the oil to America's east coast for five days in May 2021.



What is Grid Modernization?

Grid Modernization

Grid modernization technologies play an important role in improving grid reliability and resiliency via a combination of detecting vulnerabilities better, reducing the area that is affected, and responding faster to adverse events. This includes both external and internal events, like the failure of aging infrastructure, and cyberattacks, and detection, isolation and accelerated response capabilities to failures. Grid modernization technologies enable the effective application of two-way communications, automation of grid response and system integration of greater quantities of intermittent clean energy and DER sources, while maintaining stability and accelerating the response time and localization of internal and external events.

Grid Modernization: What the Industry Thinks

When asked, as part of Black & Veatch's Strategic Directions Report series, to list the top drivers for electric distribution modernization, reliability comes out on top with 50 percent of respondents from utilities, ranking it ahead of increased monitoring, control and automation capabilities or the ongoing issue of aging infrastructure.

What's more, the integration of renewables is the single most challenging issue facing the electric industry today, followed next by the threat posed from cybersecurity breaches. Both of these top two issues can be addressed through strategic grid modernization investments.

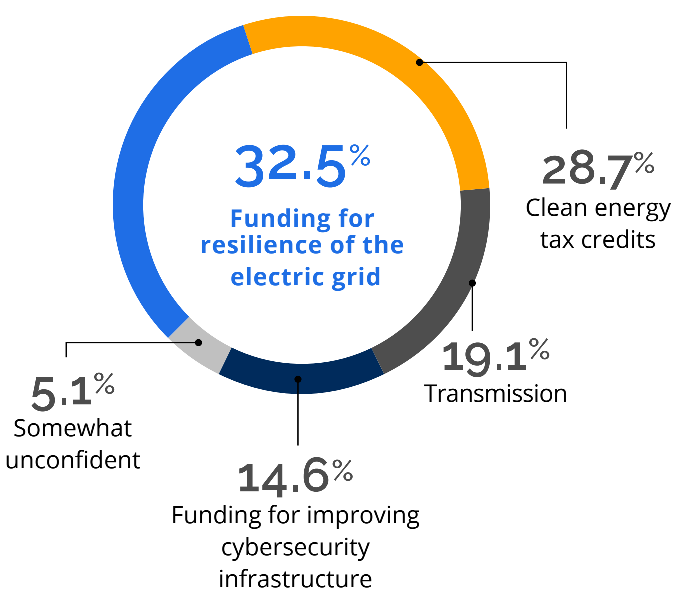
Significant funding gaps remain for improving the electric grid; the gap is projected at nearly $200 billion over the next decade, according to the American Society of Civil Engineers. Regulatory uncertainty is also hindering development. Amid such rapid climate and technological change, electric utilities fear that regulators will not be able to keep pace with their need to invest in grid modernization.

With historic levels of infrastructure investments being debated by the U.S. government as of this writing, we asked electric utilities where funding would be most beneficial to their utility? A clear message emerges: fund the resilience of the electric grid. For more information about leveraging federal funding opportunities, click here for the *Accessing Grid Resiliency Funding white paper*.

According to Surveyed Utilities:

As Congress negotiates historic investments in infrastructure, where would funding be most benficial to your utility? *(Select one)*

Source: Black & Veatch



Source: Black & Veatch

According to Surveyed Utilities:
Top Drivers for Distribution Modernization

50%
Reliability

38%
Increased monitoring, control, and automation capabilities

31%
Aging infrastructure

Source: Black & Veatch

According to Surveyed Utilities:
Top Issues Facing the Electric Industry Today

34.0%
Renewable integration

28.2%
Cybersecurity

25.9%
Aging infrastructure

A Resilient Path Forward: Holistic and Integrated

Dialogue around grid modernization often paints a bleak picture of catastrophic climate change, damaging cyberattacks and a deluge of unmanageable data. Electric grids can be engineered to handle a wide range of severe conditions and threats as long as grid operators can assess, plan for, and reliably predict the dangers.

From pragmatic hardening to capital-intensive investments, many solutions are available to improve the reliability and resiliency of a modern, clean and affordable electric system. Electric utilities are broadening their planning lens to look at integrated resource blueprints that include supply and demand across central and distributed assets. Utilities recognize the need to break down silos across generation, transmission and distribution, especially when it comes to planning. To this point, according to the *2020 Strategic Directions: Smart Utility report*, data-driven integration of utility planning is emerging as a fast-growing use case.

Successful utilities are approaching grid modernization holistically across all assets, integrating plans and departments while remaining agile and keeping pace with ever-changing technology and climate risks.

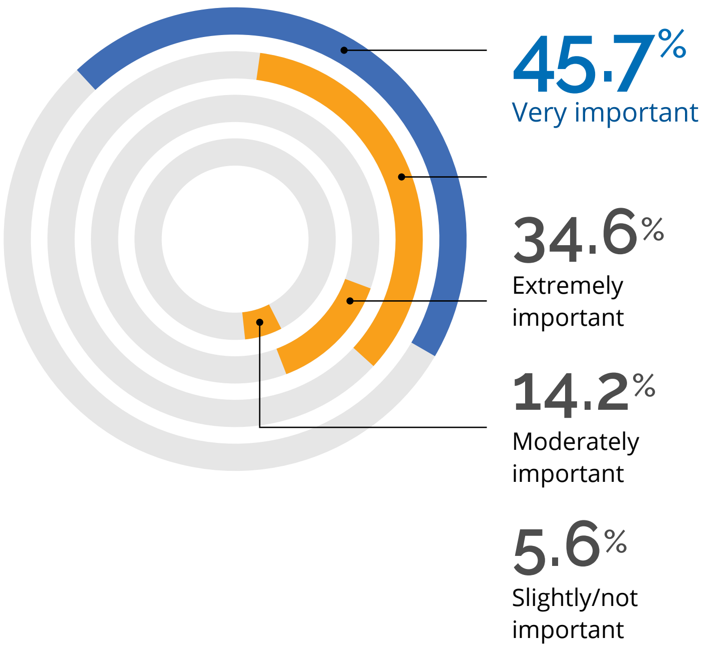
9 Areas to Achieve Effective and Efficient Grid Modernization:

Here are nine areas through which effective and efficient grid modernization can be achieved.

1. **Grid Modernization Strategy and Roadmap**
2. **Grid Modernization Investment Planning**
3. **Vulnerability Assessments**
4. **Grid Hardening**
5. **Distribution Asset and Device Management**
6. **Digitization, Modelling & Predictive Analytics**
7. **OT Cybersecurity**
8. **Generation and Transmission Investments**
9. **Telecommunication Investments: the 3rd Grid**

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

Source: Black & Veatch



1. Grid Modernization Strategy and Roadmap

A strategy and a roadmap are key first steps in the successful deployment of a grid modernization program. Roadmaps prove useful and agile tools that chart a sustainable pathway to improve the grid's reliability and resiliency and enable robust, prioritized action that allocates capital effectively and assigns resources where they are needed at the right time. For example, Black & Veatch Management Consulting's roadmap of Consumers Energy's proposed Grid Modernization Program[1], based on the Electric Power Research Institute's independent review, provides an excellent framework for defining grid modernization components and their ideal sequencing and prioritization across a 5-to-7 year investment horizon.

Developing a grid modernization strategy and roadmap starts with understanding the current operations of the utility. This covers areas such as distribution automation, substation automation, ADMS (Advanced Distribution Management Systems), DERMS (Distributed Energy Resources Management System) and asset management. It is also important to clearly understand the organization's objectives, whether to enable clean energy goals, improve reliability and resiliency or achieve cost efficiencies.

From here, through workshops and reference models, initiatives can be identified and structured in phases, overall durations, specific capabilities delivered and any constraints or dependencies, before being combined into multi-year implementation schedules. This should sit alongside a technical reference architecture that plots how technology will change over time as the grid modernization strategy is implemented. A cost-benefit analysis should also accompany this exercise, to identify the value delivered through the program so that the benefit to the utility, its customers and the community can be demonstrated.

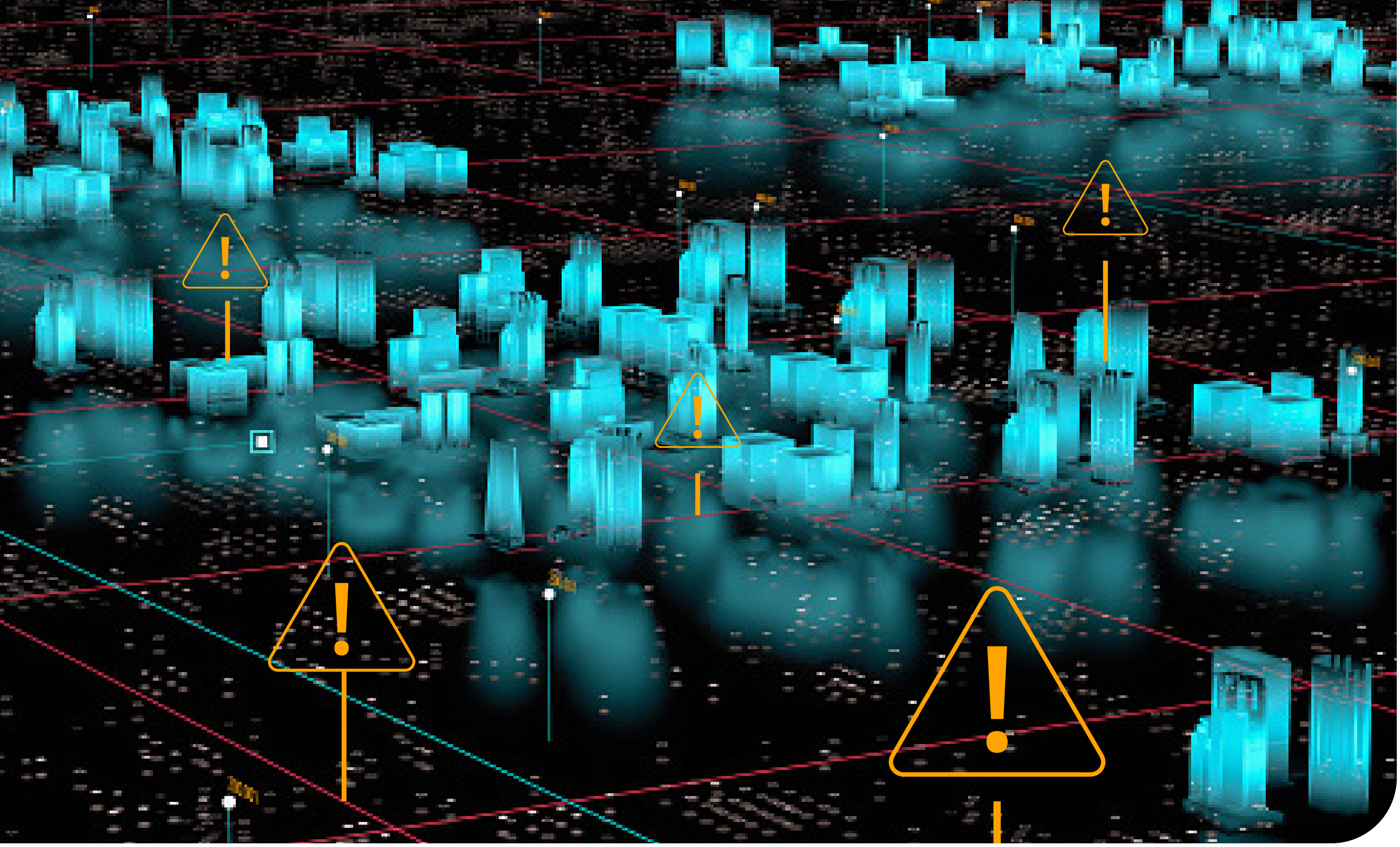
2. Grid Modernization Investment Planning

Grid modernization is an increasing focus of utility investment across the United States, as documented in numerous utility investment program filings, investment incentives and policy initiatives[2]. Grid modernization programs address most, if not all, of the six drivers cited above.

Modernization improves the resilience and reliability of the grid, allows increased penetration of renewable energy and DER, and the application of grid automation technology. Examples of the latter include self-optimizing grid technologies, like Automated Distribution Management Systems, Volt VaR Control, and the use of automated line devices to limit and isolate line outages. Dual directional power flow and distribution automation technologies also improve reliability and resiliency in response to system disturbances and operational imbalances, driven by intermittent energy, load swings, equipment failures or external disruptions.

While concerns about the cost of grid modernization are legitimate, they must be assessed in context of the value of grid modernization to customers, the utility and society. A well-structured grid modernization analysis can assess cost-benefit economics at the circuit level, and the program can be designed to roll out investment by location and timing to produce the highest value. The combined impact of effective investment planning, backed by optimization tools and operations value capture, will improve both projected and realized economics of well-planned grid modernization over time.

[1]Consumer's Energy Grid Modernization Roadmap Assessment is downloadable here.
[2]See, for example, "50 States of Grid Modernization" Q1, 2021 Quarterly Report, North Carolina Clean Energy Technology Center, April 2021.



3. Vulnerability Assessments

Grids combine the old and the new. They are complex and extensive systems, undergoing a fundamental shift in how they operate, as they integrate renewable energy and DERs, new data-rich sensors and systems, and greater levels of electrification of transport and industry. To modernize successfully, grid owners and operators must first understand and systematically address a multitude of risks and vulnerabilities, some of which are escalating threats.

Grid operators today are embracing regular and objective assessments of risks, often uncovering problematic vulnerabilities — through methods such as hiring external parties to test a system's physical, information technology (IT) and operations technology (OT) defenses. Best practice assessments incorporate a broad view across the portfolio of generation facilities, transmission and distribution infrastructure and grid operations, telecommunications infrastructure, and interconnected infrastructure as well as assesments of the supply of fuels. Assessments must also consider third-party DERs and associated control devices.

The increased deployment of microprocessor-based technology across infrastructure is pushing incumbent systems to evolve at the speed of light. Utilities always must be mindful that the greater the technological dependency, the more operators must know both how to detect, circumvent and rapidly respond to threats to reliability and resiliency. This can be achieved via grid technology, communications and advance investment to mitigate the probability of occurrence and its associated costs, both from internal and external conditions.

Whether adopting technological advancements, mitigating against climate change, assessing cyber threats, or addressing specific weather-related impacts such as winterization, tropical storms, or wildfire risks, asset owners and operators must calibrate vulnerabilities and risks. To do this, they must perform a quantitative analysis that identifies, pinpoints and documents the critical and innovative grid system modifications and upgrades required to cost-effectively reduce the primary threats to system reliability and resiliency.

Storm in El Paso

The Texas power crisis in mid-February 2021 knocked out power and heat to millions of homes and businesses for days. But in the state's far-western city of 680,000-resident El Paso, the outcome was far different. Of more than 443,000 retail and wholesale customers of regional utility El Paso Electric, fewer than 3,000 customers in El Paso lost power, and those outages proved short.

El Paso Electric's more favorable showing wasn't merely because it was on a different grid than most of the rest of Texas. Civic leaders and the utility credit their actions taken after a similar 2011 storm knocked out power and water in the city. They invested in a rigorous, top-to-bottom assessment and winterization program of generation, transmission and distribution assets, even if such winter storms were uncommon there.

From investments in the latest winterization technologies and special scrutiny of freeze protection systems that were approaching the end of their lifecycles, Black & Veatch also created maintenance checklists and offered intensive training on work processes and upkeep workflow for the utility. Sometimes, "it takes just minor modifications to literally get you through the storm," said Black & Veatch's Dustin Rogge, a microgrid solutions manager who, as an engineering manager in 2011, helped guide El Paso Electric through its freeze protection review and mitigation. Read the full story here.

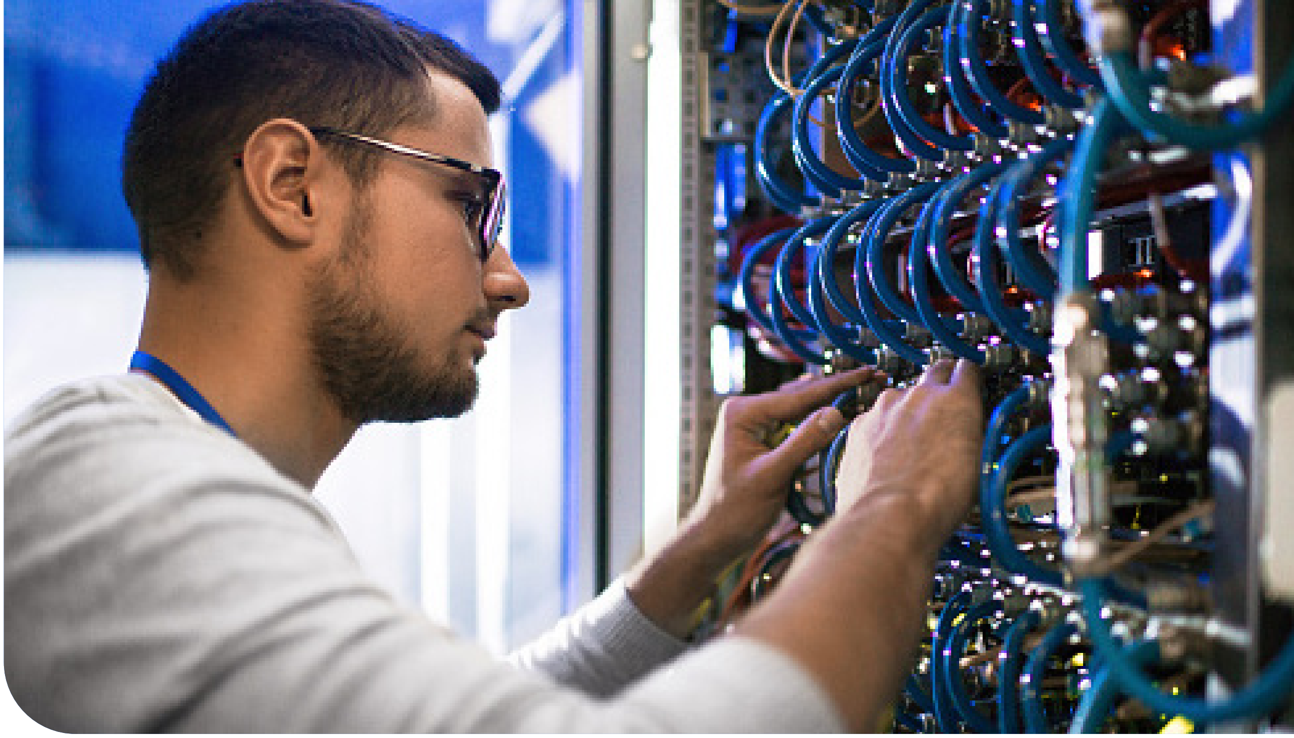
4. Grid Hardening

Unless grid operators start planning for increasingly wild and unpredictable climate conditions and events, grid failures will happen again and again. From physical infrastructure to communications systems, grid hardening recognizes that in the face of increased stressors, additional direct actions must be taken to protect grid infrastructure better than it is today. Grid hardening improves the system's preparedness and recovery from weather events.

With trees falling on distribution lines a common and frequent cause of outages, grid hardening efforts could seem endless in the absence of a prioritized plan across the operators' entire asset portfolio. Burying wires underground could harden grids in places prone to high winds and fire but is a significant investment; some estimates put converting overhead lines to underground lines at $3 million per mile in urban settings, and $1 million in less densely populated areas.

Paying off these investments would likely take decades, versus the savings from avoided outages, and may not suit all owners. In some cases, informed by long-term modernization roadmaps and utility-grade risk-based investment valuation and optimization tools, other solutions like ensuring above-ground poles are fire-resistant or swapping wooden poles with concrete poles. More creatively, an integrated planning approach may tap into the potential of distribution poles as revenue generators for utilities; hardening activities could be part-financed by utilities charging fees to others, to use the poles for illuminated signs, telecommunications equipment and other devices.

Hardening, of course, goes beyond modifying electric poles and is applied at all levels of the grid across powerlines, substations and power generation facilities.



5. Distribution Asset and Device Management

A common pitfall to grid modernization program success — observed in several evaluations of utility programs — is the failure to consider distribution assets and device management. This narrowing of scope results in these frequently observed issues:

1. Installed devices begin to malfunction

Once automated devices have been installed as part of a grid modernization program, they need to be managed just like any other asset, to ensure continued operation. Establishing operational ownership of the devices is critical. An asset and device management initiative would define device ownership and establish a device lifecycle including periodic inspection and maintenance required to keep the device in good health. With automated devices that might be re-started or cycled remotely to update, for example, broadening the grid management program with an asset and device management initiative would establish processes for documenting how and when devices need to be updated.

2. Field technicians need new work processes

Any asset, or device that is installed in the field is going to need servicing over its lifetime, to maintain it in operable condition. Automated devices are unlike other assets that technicians have experience maintaining. For example, these devices might have IP addresses, installed software or firmware requiring version control, upgrades and cybersecurity protocols. Many field technicians will need training to get the expertise to repair or maintain them, leading to devices being maintained by specialized crews, or worse, ignored. The asset and device management initiative would define how and when a device requires maintenance or repair, provide procedures and policies for field technicians, document required skills and experience, and identify the data needed to manage the assets.

3. Devices include emerging technologies that lead to a shorter asset lifecycle

The expected life of automated devices may be much shorter than the decades typical of older equipment. Five to ten years might see a quantum leap in technological capability. As these technologies improve, the quantity and quality of data being gathered, communicated and analyzed by these devices are increasing exponentially. The grid management functionality that the organization expects or is required by regulators and customers is also increasing.

Asset and device management initiatives include strategic asset management plans that cover frequent assessments of improvements in automation device capabilities, with decisions on when the advanced capabilities of a newer device warrant declaring the old ones obsolete, and replacing them. A good management plan enables accurate tracking of devices to identify circuits where older devices are located and build capital investment plans to replace all devices that are no longer useful.

6. Digitization, Modelling & Predictive Analytics

One of the foremost aspects of grid modernization is its digitization. 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 the deployment of advanced metering infrastructure (AMI) and sensors across new and legacy assets, only a few early adopters have put the data to work.

Data-driven modeling is a key grid management capability; it can anticipate and control the behavior of DERs, improve distribution grid resilience and enable more granular pricing. Sophisticated data analytics and their application to investment decisions also are key to making the regulatory case for sustainable investments that benefit the utility, the customer and the environment.

Most utilities admit that forecasting, monitoring and managing their own or third-party DERs is one of the most challenging issues today, however. Integrated IT/OT planning will be critical to this effort.

Quickly, utilities have gone from operating a relatively static grid to biting off a massive amount of complexity, such as investing in next-generation AMI (Advanced Metering Infrastructure), and replacing SCADA (Supervisory Control and Data Acquisition) and implementing ADMS. Advanced communications infrastructure will enable more effective asset management, allowing utilities to operate their systems at a more localized level and meet regulator and customer demands. Utilities have a long road ahead as they work to handle distribution in a more localized fashion, but integrated systems planning will remain key to their success as they work to overcome silos and incorporate more DERs and non-wires alternatives.

Finally, systems and tools are emerging, using artificial intelligence and systems learning protocols, that can detect failures on a timely and localized basis and predict issues before they undermine system integrity. Aging assets are more likely to fail and less likely to be equipped with new sensors, and retrofitting older technology with better system intelligence is often a top priority in grid modernization roadmaps.

Digitized Utilities and COVID-19

Entering the pandemic, digitization helped utilities make 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.

7. OT Cybersecurity

OT Cybersecurity (CS) has emerged as a significant grid risk requiring investment, given the proliferation of OT systems and devices utilized to manage and protect grid operations, as well as the increased sophistication and frequency of external and internal threats. According to the *Strategic Directions 2021: Electric Report*, cybersecurity is the top challenges facing electric utilities' current distribution system automation and communication capabilities.

The increased dependence on layered networks to support OT operations and increased IP Connectivity, including SCADA communications, energy and operations management systems and RTUs (Remote Terminal Units) are at the root of the increased system complexity and exposure. In addition, the reliance on field devices, including metering, monitoring, control systems (e.g., relays, reclosers, voltage regulators), cellular connection and numerous IoT applications creates an expanded and complex network of exposures to be managed by utilities via governance and technology investments.

Standards for OT CS protection are emerging, as for example provided by the Transportation Security Administration's (TSA) recent Security Directives (SD1 and SD2) as well as existing but evolving standards from such organizations as the North American Electric Reliability Corporation, the National Institute of Standards and Technology for power infrastructure, and the Department of Homeland Security and the Amercian Petroleum Institute for gas infrastructure. In fact, utilities surveyed by Black & Veatch maintain that compliance is the number one cybersecurity and physical security need they will face over the next five to ten years.

Proactive and dynamic OT CS risk detection, protection and response procedures and supporting technologies are vital now for any grid company to effectively assess exposure, and detect and protect itself from emerging threats, as evidenced by the recent (long-undetected) Solar Winds sleeper virus sabotage.

Source: Black & Veatch

According to Surveyed Utilities:

Top Three Challenges Current Distribution System Automation And Communication Capabilities

46.3%
Cybersecurity

35.5%
Old and obsolete equipment

34.7%
Integrating distributed energy resources (DER)

Source: Black & Veatch

According to Surveyed Utilities:

Top Cyber and Physical Security Needs of Utilities in Five to Ten Years

44%
Maintaining Compliance

43%
Endpoint management and vulnerabilities

39%
Retaining cybersecurity talent

35%
Security education and training

Traditional control strategies, such as configuration management, patch management, physical and access monitoring, security information management, and authentication and situational awareness (real-time) monitoring must be augmented by emerging dynamic engineering design and response solutions, including Consequence-driven Cyber-informed Engineering (CCE).

Grid modernization creates multiple internal exposure points. Combined expertise in OT system design and cybersecurity risk threats and mitigation measures is vital in creating a traditional compliance capability, and to take the next step to proactive engineering-based measures to isolate and defend against emerging external threats. Realizing the value proposition of emerging technologies requires advanced protection, including isolation design measures, detection and response.

Cybersecurity Collaboration

In April 2021, the DOE began a one-hundred-day initiative to enhance grid cybersecurity. A coordinated effort among the DOE, the electricity industry, and the Cybersecurity and Infrastructure Security Agency (CISA), the initiative explored technologies and systems that will improve cyber visibility, detection, and response capabilities for industrial control systems of electric utilities. This is part of growing utility collaboration and coordination efforts with the federal government, to share knowledge and protect against these threats, fueling hope that the utilities can continue to avoid major cybersecurity breaches — or, at the very least, avoid the liabilities by following established best practices.

8. Generation and Transmission Investments

Developing the modern grid will inevitably require the development and integration of a diverse range of new and advanced infrastructure, upgrades and non-wires alternative solutions, using grid investment analytics platforms that are utility grade and reflect emerging best practices.

CCE, like grid segmentation strategies, emphasizes the role of engineering design to limit attack access and to cordon off key grid or related infrastructure operations and controls from both external and internal attacks, so that critical operations and associated technologies are effectively isolated and protected.

The top two factors driving new transmission investment, according to Black & Veatch's *2020 Strategic Directions: Electric Report*, are not surprisingly renewable energy followed by resiliency and reliability. High-voltage transmission lines — also identified as key investment areas in the American Jobs Plan — will be required to connect new renewable energy investment to large demand centers.

Attention will also be needed to modernize transmission infrastructure to ensure resiliency and reliability across the entire network. Upgrading substations and transmission lines will have a digital dimension, migrating them to microprocessor-based technology and fiber optic communication. These efforts will improve asset condition monitoring, and enable more sophisticated failure analyses and targeted predictive maintenance investment.

As the cost of lithium-ion batteries continues to fall, its application for short-duration grid storage will only grow, given how battery energy storage systems improve grid stability as well as the overall economic performance of intermittent renewable energy facilities and traditional gas-fired facilities. Long-duration or seasonal energy storage – through solid-state and other emerging battery technologies, and green hydrogen, for example – may also emerge over the mid-term, assuming costs can be driven down to compete for support of clean firm generation.

Local solutions, such as distributed generation and resilient microgrids, may offer lower-cost alternatives to major system investments, particularly in areas at elevated risk and significant customer exposures to severe weather or other natural disasters. These, together with other non-wires alternative solutions, will become more commonplace as supported by cost-benefit analytics.

A Technology to Watch: Grid Forming

Following an outage or large disturbance on the grid, conventional inverters connecting energy sources like solar panels, wind turbines and battery storage systems will shut down; once the disturbance has resolved and the grid has stabilized, the inverters will restart and reconnect the energy sources back to the grid. This is *grid following*. It means that grid operators typically rely on fast-start natural gas plants to restart grids after a black out.

Emerging *grid-forming* inverter technology changes this dynamic. With the ever-increasing share of renewable energy on our grid, grid-forming inverters would enable inverter-based energy sources to restart the grid themselves. Being piloted at a limited scale across microgrids today, solar, wind and battery storage systems with grid-forming inverters will improve operators' grid management capabilities over the next five to ten years.

9. Telecommunication Investments: the ‘3rd Grid’

As our power grids continue to evolve and increase in complexity, investment in and the creation of a digital grid will be central to the sustainable and reliable operations of every utility. Through this we are seeing the emergence of a 3rd grid: advanced private telecommunications grids that are essential to modernizing existing transmission and distribution grids.

Communications systems will be at the heart of future grid intelligence. Migrating from legacy to advanced technologies for their private network such as Long Term Evolution (LTE) and 5th Generation (5G) networks will provide utilities with a dedicated spectrum to support reliable, high speed, low latency and secure communications with thousands of connection points that continue to increase in complexity and function. Planning for this densification of IP devices across the grid — consisting of high-performance computing, automation, data storage and high speed networks — will create a new backbone for utilities to manage bi-directional power flows across the electric grids. Responsiveness will become instantaneous, decreasing from what is seconds today to milliseconds in the near future helping to manage the increasingly variable sources of renewable power, predict maintenance issues and help avoid unforeseen externalities that could disrupt power supply.

Master system planning is a critical first step. Utilities will need to balance current regulatory and management needs while keeping on course to enable their vision and plan for the future grid, in a fast-moving technology environment. What’s more establishing this 3rd grid promises an early-mover advantage for utilities to capitalize on the potential value of an open DER market.

Conclusion

Embracing grid modernization and building resilience comes at a cost. That cost must be balanced and prioritized against the backdrop of relevant regulations and standards, and regulatory cost recovery standards, recognizing that grid modernization is a journey requiring an integrated planning, deployment and operation approach.

Talk to Black & Veatch no matter how advanced you are in the modernization of your grid. We'll meet you where you are and assemble a full bench of expertise across power, telecommunications, cybersecurity, regulation, environmental impacts and much more, to create a resilient and reliable grid of the future.

Accelerate

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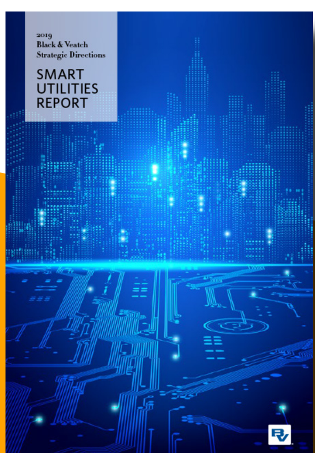

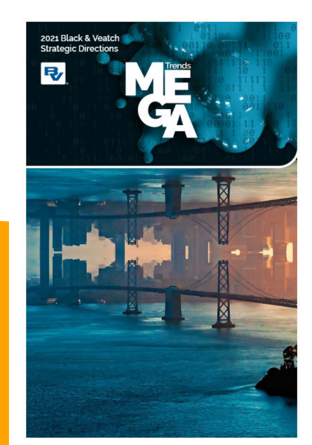

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