REPORT

2021 ENERGY & UTILITIES OUTLOOK: A DECARBONIZED FUTURE

westMONROE

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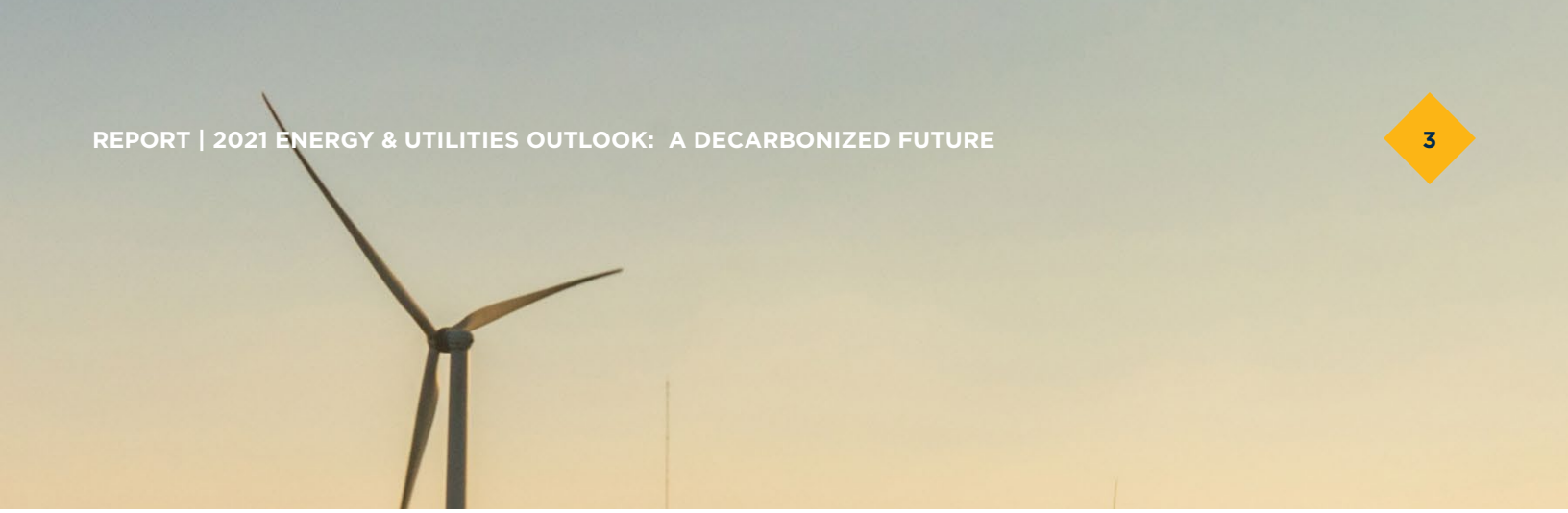

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This report covers six areas of opportunity for utilities as they work toward decarbonizing, many of which are well underway at utilities across the country:

Improving resiliency

New and innovative approaches to support resiliency while adding more distributed energy resources and new loads to the electric grid are being considered to avoid potential issues associated with the shift from a centralized power generation grid to a more decentralized grid.

Integrating distributed energy resources (DERs)

Transmission and distribution utilities design and influence mutually beneficial DER adoption and energy use behaviors, viewing DERs more as an opportunity than a threat.

Electrifying transportation

As more customers look to transition to electric vehicles, utilities will have to manage large, additional electric loads and support the investment in the charging infrastructure required.

Delivering on the customer promise

Decarbonization requires participation and support from customers partnering with utilities and energy service providers, necessitating a more seamless and multichannel end-to-end customer experience.

Discovering value through data

Complex business decisions and energy use behavioral changes require insights from data and analytics and involve a more deliberate effort to collect, store, converge, and analyze data to support decision-making.

Securing IT/OT systems and data

As information and operations technology (IT/OT) networks grow, so do their interdependencies and vulnerabilities, making the need for security, both physical and cyber, of paramount importance to utilities.

INTRODUCTION

Clean energy efforts by states and the federal government are gaining momentum. With some states enacting laws to decarbonize all sectors of the economy, and the Biden administration signaling intentions to form public-private partnerships to address climate change, the electric utility industry and clean energy providers are positioned to see significant growth in sales.

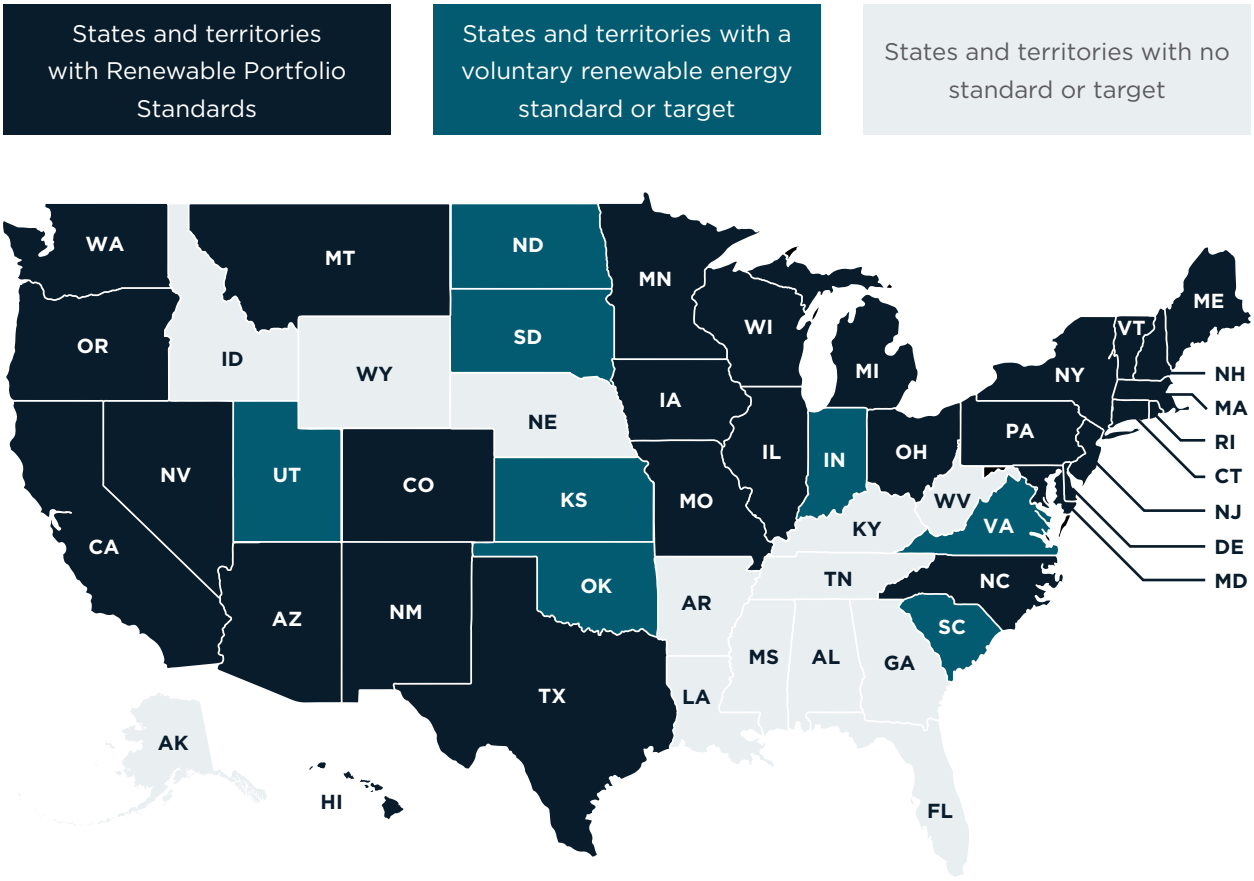


Figure 1, NCSL[1]

The most significant progress to date in reducing carbon emissions has been in the electric sector. Cleaner generation resources—including renewable energy—and demand response programs represent the fastest growing market for reducing fossil fuel use in generation. All but 12 states have enacted renewable portfolio standards (RPS), which requires that a specified percentage of the electricity that utilities sell comes from renewable resources (Figure 1, NCSL[1]). Combined with continued advancements in energy efficiency and demand management, carbon emissions are projected to continue declining.

As goals and timelines vary by state and region, so do the approaches taken to achieve clean energy and decarbonization targets. A utility's primary responsibility is to meet electricity service needs safely and reliably at fair and reasonable costs while meeting statewide and regulatory clean energy, policy, and decarbonization goals. Achieving these objectives requires innovative initiatives like adopting new technologies, creating new and updated customer programs, rethinking the utility and energy services business models, and implementing more digital solutions supporting utility operations. However, without customer support and engagement—such as enrolling in energy efficiency programs, adopting alternative fuel vehicles including electric and hydrogen, electrifying buildings, and shifting habits of energy use—such efforts will face significant challenges.

CHAPTER 1

Improving resiliency

CHALLENGE

Approaches to improving utility resiliency are evolving in response to today's challenges. Utilities have observed an uptick in recent years of the quantity and severity of large weather events, including hurricanes, wildfires, ice storms, derechos, and other events that further challenge an aging physical grid infrastructure.

In 2020, there were 22 weather and climate disaster events[2] with losses exceeding $1 billion and total damage of roughly $95 billion. These events included one drought, 13 severe storms, seven tropical cyclones, and one wildfire (Figure 2, NOAA NCEI[2]).

U.S. 2020 billion-dollar weather and climate disasters

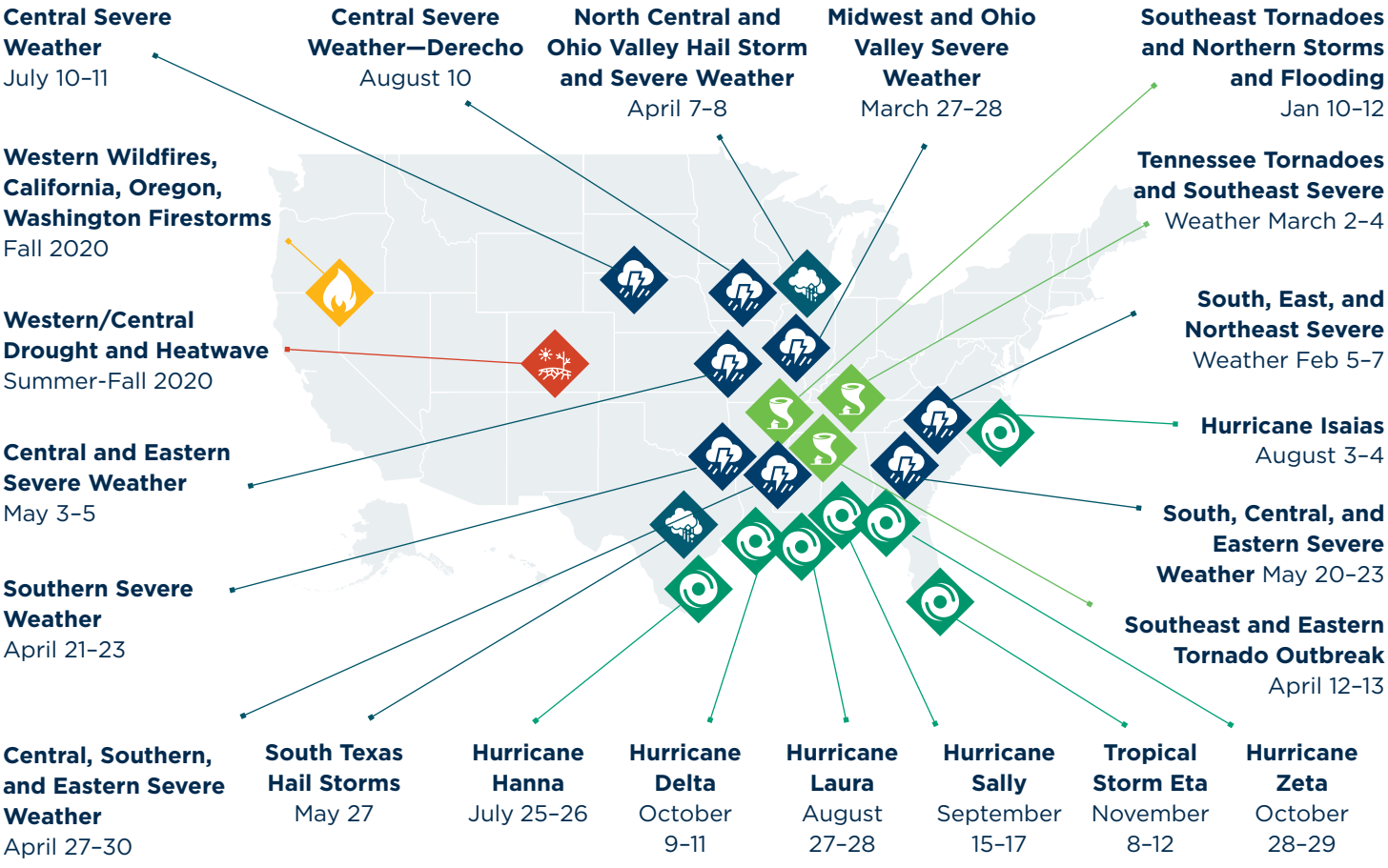


Figure 2, NOAA NCEI[2]

Climate scientists forecast[3] that unless global greenhouse gas emissions (GHG) are reduced dramatically, extreme weather events will continue to grow in intensity, frequency, and cost. Responding to these events is causing prolonged customer outages, high recovery costs, and additional stresses on utility operations and internal processes.

While utilities are working toward meeting clean energy goals and increasing DERs, new approaches to resilient service are being adapted. Utilities are deliberately planning how to optimally locate and leverage distributed generation on the transmission and distribution grid to provide resiliency services. They are also looking to third-party providers to invest in DERs if they can do so at a lower cost than the utility can address the resiliency need.

TRENDS

Utilities continue to invest heavily in reliability and resiliency. While the two are closely related, the terms are sometimes used interchangeably. Reliability is about preventing disruptions and their duration, and resiliency guards against high-impact events that can be geographically and temporally widespread.

In some modeled scenarios, climate change-related extreme weather created a gap of as much as 34% between supply and demand of electricity[4]. As climate change worsens, the extreme scenarios are more likely. Many utilities are investing more in grid modernization technologies, including grid hardening and implementation of new technologies to serve as enablers for improved resiliency (Figure 3, North Carolina Clean Energy Technology Center[5]) and operational performance.

While some utilities are receiving regulatory support to make targeted investments after significant events have occurred, there is still considerable work required to align regulators and utilities on how best to recover the investment in actions taken to address threats to resiliency. In a recent hurricane response effort, only 3.28%[6] of total funding was used for materials—meaning proper resiliency strategies must address more than just engineering design.

TAKING ACTION

Most utilities have mastered the ability to optimize operations for reliability. Focusing on improving resiliency, however, will help reduce the impacts of major events that exceed grid design thresholds for reliability. Preparing for a major event takes more than having crews and control center teams in place ready to react. Successful resiliency strategies look at critical components of the system, including setting goals and success metrics across many internal and external operations and organizations, and carefully planning grid hardening investments needed and the process improvements required to meet stated goals.

With increased attention being paid to the recovery aspect of resiliency, focus is shifting toward minimizing damages from events and streamlining recovery efforts using digital workforce and mobile applications. Tabletop exercises for cyber and physical events and process optimization for storm response is increasingly important. In parallel, the hardening of technology systems to handle increased outages and customer call volume is becoming more common as a resiliency mindset is adopted.

Total Number of Grid Modernization Actions by Quarter

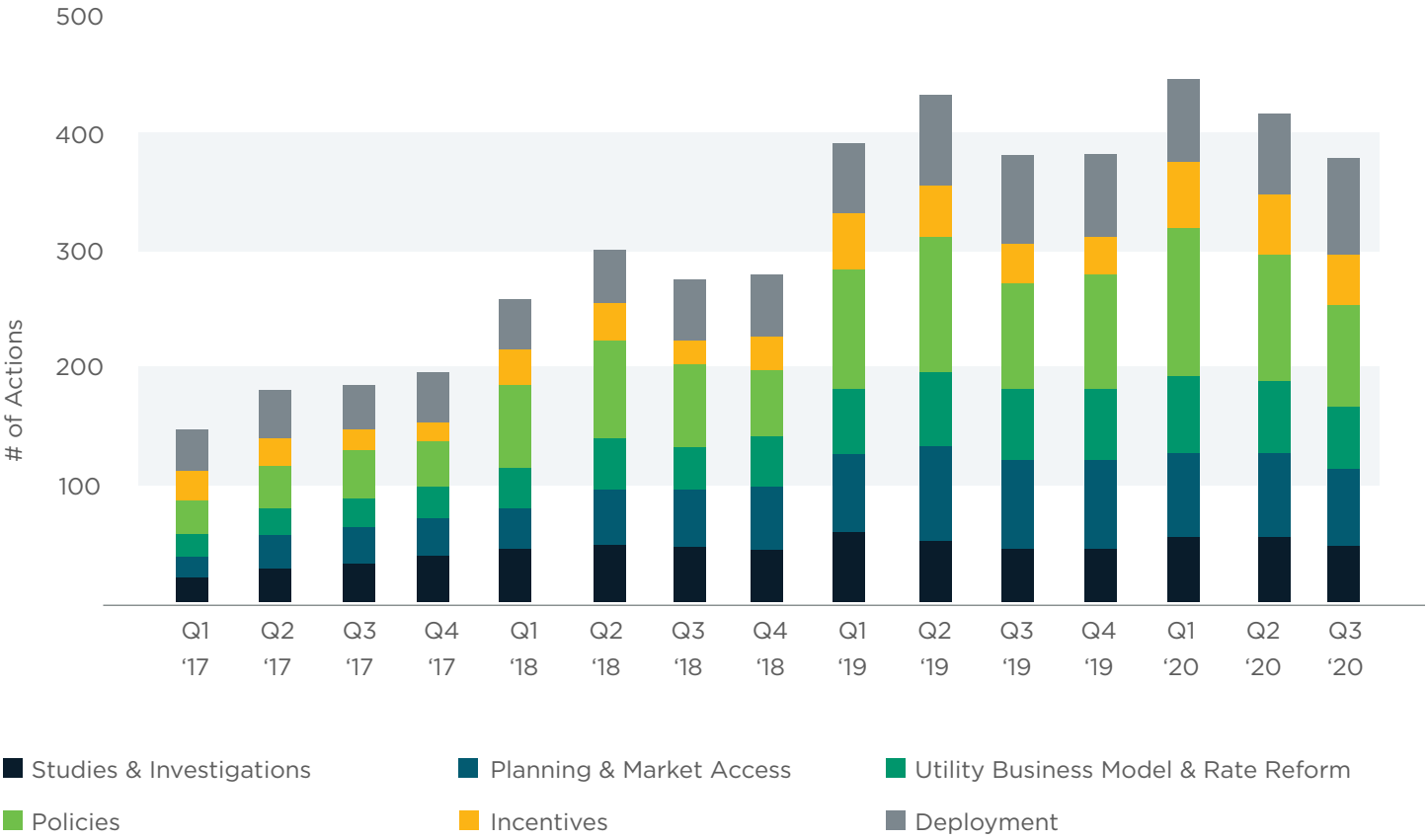


Figure 3, North Carolina Clean Enery Technology Center[5]

As utilities continue to address resiliency needs through grid hardening and other physical investments, it's difficult and costly to try and engineer their way out of increasingly extreme and damaging weather scenarios. Reconsideration of asset management strategies to focus on risk-based decision-making, leveraging predictive analytics and smart grid technology to make more strategic asset decisions, and predicting where investments are most impactful will be vital to improving performance and meeting customer and regulators expectations.

Utilities need to understand their customers' needs and experiences during an outage to streamline and optimize touchpoints and information exchanges, keeping two-way communications open and accurate throughout restoration efforts. This helps maintain customer trust and satisfaction during storm restoration efforts.

CHAPTER 2

Integrating distributed energy resources

CHALLENGE

Over the past several years, DERs connecting to the grid has increased[7] across utilities of all sizes and regions in North America. Although it's reshaping the industry, the integration of DERs supporting aggressive clean energy goals while maintaining safe, reliable, and affordable energy for customers is becoming progressively challenging.

Most distributed generation added to the transmission and distribution grid—like solar and wind—is intermittent and requires other complementary DERs like energy storage and demand response with differing rate structures like time-varying rates to balance electricity supply and demand. These resources must work in concert to meet the same criteria that conventional generation has been successfully meeting for more than a hundred years.

Many aspirational GHG reduction targets require greater electrification of energy use, particularly in buildings and transportation. However, there are ongoing hurdles of customers lacking awareness of suitable electrification options (e.g., electric vehicles, electric water heaters, storage, fuel cells, etc.), technology maturity, and economics that need to be addressed for meaningful impact. Investments in energy storage, hydrogen-fueled vehicles, fuel cells in buildings, and small modular nuclear power generation, among other technologies, are also emerging as viable market strategies in support of decarbonization. Using hydrogen in vehicles or buildings to generate electricity is coming more in focus as breakthroughs in technology drive down costs.

To successfully integrate cleaner technologies, a harmonization of customer and utility DERs with grid operations is critical. A utility's ability to design and influence mutually beneficial DER adoption and behavior will dictate whether DERs are perceived as representing an opportunity or a threat.

TRENDS

An increasing number of states and businesses are committing to clean energy goals and decarbonization. According to the Natural Resources Defense Council (NRDC), one in three people[8] in the U.S. already lives in a state or city publicly committed to transitioning to 100% clean electricity.

Utilities are responding with an increasing number of DER services and programs for residential and commercial and industrial (C&I) customers. The transportation and building sectors are being electrified with new DERs, enabling meaningful GHG reductions.

And it's not just states and utilities leading; even the auto industry and vehicle fleet owners are joining the shift to electric vehicles: For example, GM has committed[9] to all electric production by 2035.

Customers are taking a more active role in monitoring and controlling their energy use, with some customers demanding more control and choice in how they source and when they use energy. Some customers are investing in DERs to sell back to the grid or to customers nearby. Distributed generation and other complementary DERs will play a significant role in

DER Strategy and Lifecycle

Strategize and Plan for Increased DERs	Develop Mutually-Beneficial Programs	Engage Customers to Adopt DER Products	Safely Connect New Customer DER	Harmonize DERs with Grid Operations
• DER Profiles/ Forecasting	• DSM 2.0 Product Dev	• Cust Propensity Modeling	• Dynamic Hosting Capacity	• Grid Network Model
• Capacity Exp Modeling	• DG Product Development	• Digital DER Marketing	• DG Interconnection Portal	• Op Constraint Mgmt.
• Production Cost Modeling	• Trans Elect Product Dev	• DER Product Store	• Interconnection studies	• DER Solution Optimization
• Delivery System Analysis	• Bldg Elec Product Dev	• Cust Engagement Tools	• EV Charging Connection	• DER Dispatch and M&V
• Locational Net Benefit	• Third-Party Procurements	• DG Interconnect Feasibility	• DER Telemetry/ Monitoring	• DER Security Management
• Non-Wires Analysis	• DER Program Convergence	• Cust Relationship Mgmt	• DER Data Management	• RTO-Utility Coordination

Figure 4

helping customers better control their energy use while lowering monthly bills, reducing carbon emissions, and providing more reliable service.

The good news for customers is that renewable energy technology and rest-of-system costs continue to decline, strengthening the value proposition and overall business case. DER aggregation models enable practical ways of harmonizing customer DER with utility grid operations and new market constructs (e.g., Federal Energy Regulatory Commission (FERC) Orders 841[10] and 2222[11]), and are better valuing DERs through stacking of benefits.

TAKING ACTION

Silos are being broken down across utility organizations when designing DER programs to maximize utilities' and stakeholders' value. From strategy and planning to customer engagement, connection, and operations, a holistic approach is emerging among leading utilities to enable the successful integration of large numbers of DERs on the grid (Figure 4).

Utilities are designing DER programs that maximize value for the utility, customers, and society. This involves taking a multi-pronged approach to the economic and financial analysis and shaping win-win-win DER programs. Utilities are using the business case to articulate and inform customers and regulators of the value of DER and identifying the key levers that influence a such an outcome.

FERC's rulings on aggregated DERs have the potential to significantly impact how load management can be used to provide system flexibility and resiliency. Harmonizing DERs with grid operations through IT/OT system enhancements—communications, interconnection platforms, ADMS, and DERMS—will be needed to ensure safe, reliable service.

CHAPTER 3

Electrifying transportation

CHALLENGE

The Southern Alliance for Clean Energy reports that more than 273 million[12] registered motor vehicles use 145 billion gallons of gasoline annually. Consumer and commercial transportation also contributes 28%[13] of all carbon emissions in the U.S., according to the Environmental Protection Agency (EPA). Alternatives to the internal combustion engine are required if decarbonization goals are to be met.

As more residential customers, commercial businesses, schools, and transit agencies look to transition toward electric vehicles, more electric power generation and transmission and delivery grid infrastructure investment are needed to manage complex grid operations with more uncertain loads. Creating the necessary programs and grid infrastructure required to support electric vehicles will take time. The investment in grid infrastructure will deliver multiple benefits, including more jobs, lower energy costs, new utility revenue streams to generators and distribution utilities, and lower GHG emissions.

When considering the potential return on investment for such investments, a proactive utility EV program can harness a vast collection of EV chargers as an aggregated DER, a virtual power plant of sorts, and provide a more flexible controllable load that makes more efficient use of the grid.

TRENDS

In December 2020, CNET reported that the average price paid for a new passenger vehicle rose to more than $40,000[14] for the first time. Meanwhile, with EV battery prices declining and the range of EVs increasing, greater consumer demand for charging infrastructure is proliferating. Utility Dive reported that the number of EV models on the market is expected to triple in the next three years from 40 to 127[15], with forecasts of price parity between light-duty EVs and their equivalent conventional vehicle in the near-term horizon.

While overall growth for electric vehicles slowed in 2020 due to the pandemic, EV sales market share was better than that of conventional vehicle sales. According to a BNEF report[16], EVs are projected to hit 10% of global passenger vehicle sales in 2025, 28% in 2030, and 58% in 2040. Nearly 60% of U.S. households have two or more cars, and many can accommodate home charging.

Personal passenger EV popularity is not the only growing sector. Leading transportation and shipping companies, including Amazon, DHL, and Ikea North America, have advanced their fleet electrification commitments. The U.S government committed[17] to replacing the entire federal fleet of 645,000 vehicles with EVs. School bus electrification is also growing, as is transit bus conversion to electric.

Not to be lost in the benefits from EVs are the reductions in smog, improved air quality, and reduced emissions contributing to climate change leading to improved public health and a decrease in ecological damage. EVs reduce GHG emissions compared to internal combustion vehicles, and the amount of emissions avoided is expected to continue growing as generation gets cleaner.

TAKING ACTION

Utilities taking an active approach in building the economic, environmental, and social case to drive regulatory policy and investment behavior change stand out as leaders in the transportation electrification market. Implementing an end-to-end EV program (Figure 5), one that leverages cross-departmental collaboration with a utility, can meet both operational and customer needs.

Transportation Electrification Strategy and Execution Lifecycle

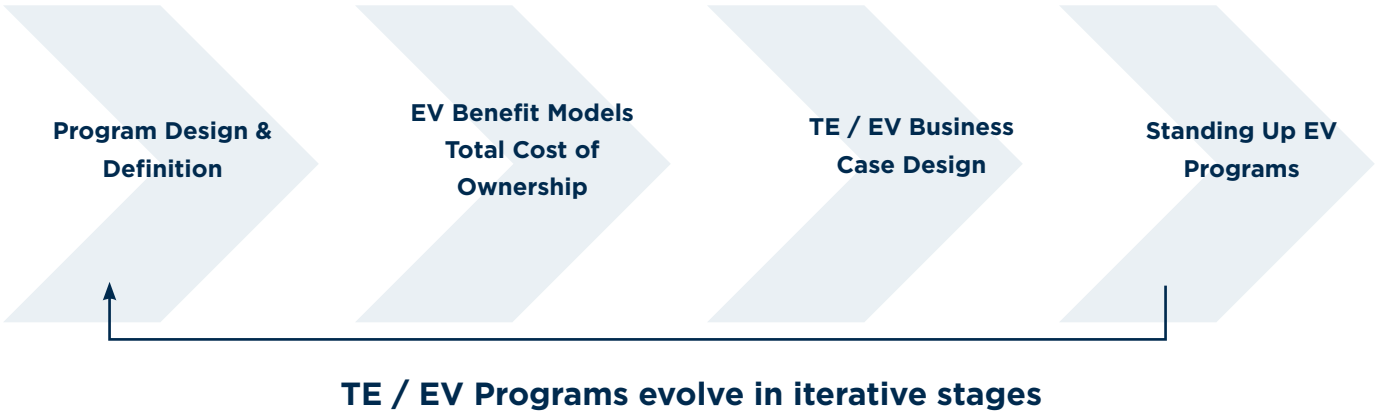


Figure 5

The business case for electrifying transportation continues to improve with greater vehicle availability, lower vehicle costs, and supportive regulatory policy. Utilities are using EV fleet calculators to increase awareness and adoption as customers consider electrifying their fleets. (Figure 6).

EV Business Case Analysis

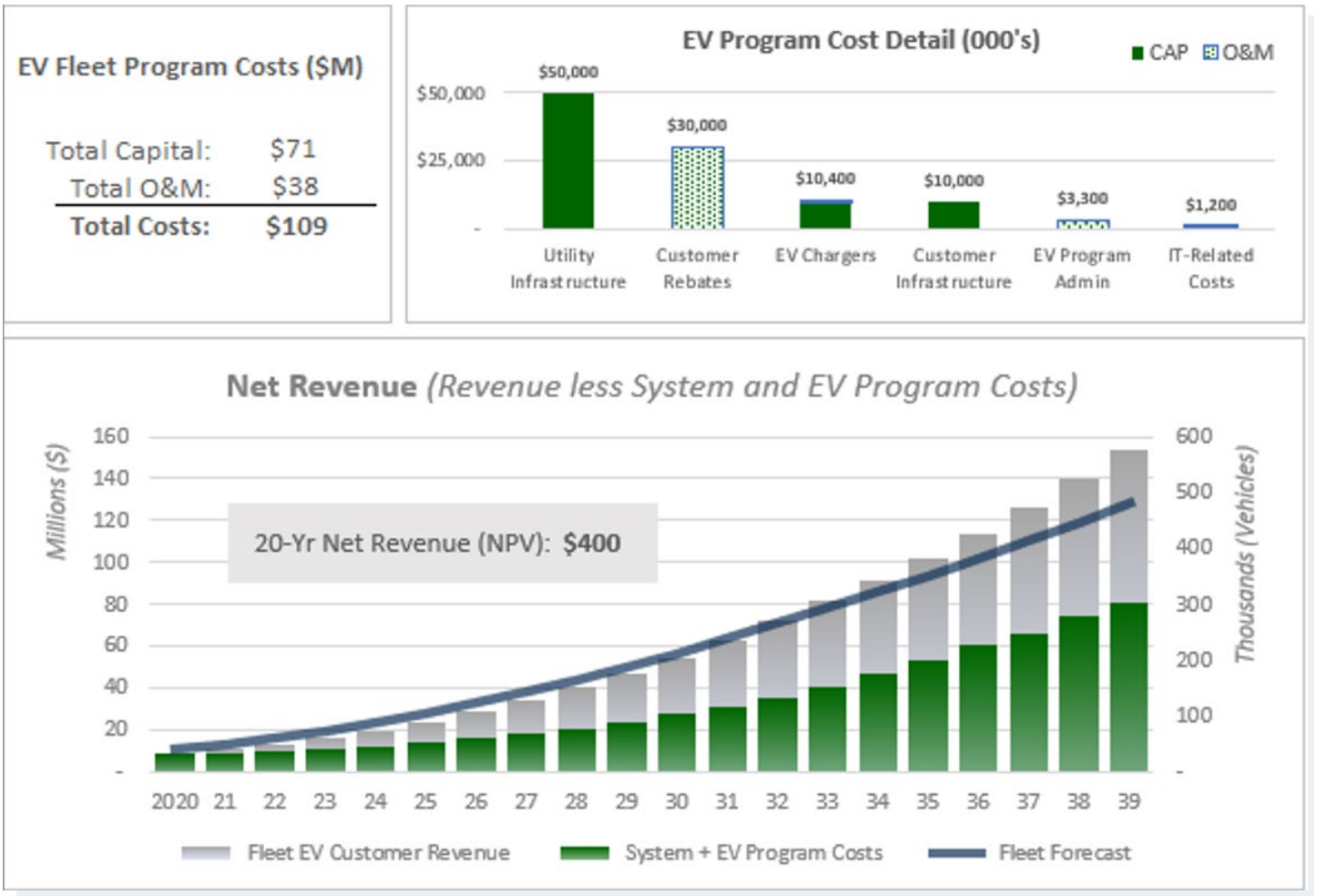


Figure 6, Total Cost of Ownership Tool

CHAPTER 4

Delivering on the customer promise

CHALLENGE

Decarbonization and clean energy goals present utilities with opportunities to serve customers better and align more closely with their interests. Utilities with a passive and transactional relationship with customers have an opportunity to fully engage in helping customers achieve their clean energy and environmental goals. Customers do not have a one-size-fits-all perspective when it comes to what they want.

While some customers are looking for clean energy and electrification, others may be looking for different ways to save money or simply want safe, reliable power at any moment. This goes for both residential and commercial customers, including industrial and small business customers. Tech-savvy consumers looking to connect a DER to the grid have vastly different needs than a C&I customer looking to electrify their fleet. Utilities that understand their customers stand a better chance of improving their customers' experience.

TRENDS

New business models are emerging in the utility industry to meet customers' evolving energy needs and social and environmental interests, while also aligning with public policy and legislative goals. Moving beyond being just a provider of electricity to an all-in-one digital energy platform provider is one means of meeting these needs. This includes finding new ways to engage customers and balance between digital channels and self-service, and person-to-person support leveraging best practices from other industries whose relationships with customers are active and continuing to change.

Additionally, utilities are leveraging advanced analytics tools to develop timely insights and build more relevant customer cohorts—including attitudinal and behavioral data—to identify alignment more effectively between target customers and programs and services.

TAKING ACTION

There is no silver bullet for a successful customer experience strategy. What works for one utility won't necessarily work for another. Right-sizing customer service investments requires careful reflection and examination into many factors—such as regulator and state policy, competitive markets, products and services, and customers themselves—to ensure utilities realize its benefits.

Many utilities have adopted and are leveraging customer personas and journeys, allowing them to engage and meet customer needs on their own terms. This enables utilities to meet expectations with easy, convenient, and affordable products, services, and experiences.

Some utilities leverage data and insights—both quantitative and qualitative—to better identify with their customers. Analytics are used to define more relevant customer cohorts to personalize products and experiences and improve investment efficiencies.

CHAPTER 5

Discovering value through data

CHALLENGE

Utility executives are tasked with achieving clean energy goals while maintaining or improving reliability, reducing costs in an asset-intensive industry, and improving the customer experience. Putting the necessary digital workforce processes and technologies in place and transitioning from spreadsheets and legacy software is a challenging and potentially costly proposition.

The smart-technology revolution is disrupting the industry with new digital solutions, collecting, storing, transferring, and analyzing data at an increasingly faster pace. As the distribution grid power flows are impacted by DERs, utilities are upgrading IT/OT systems and putting in place scalable analytics platforms configured for ease of use and traceability.

Some utilities take a siloed approach to data activation and implement standalone analytics use cases, leading to broad inconsistencies and divergent perspectives among utility business and IT functions. Fragmented processes, siloed data, and varying tools lead to inefficiencies, leaving these utilities plagued with inefficient data workflow and slow time to market for insights. Other utilities are aggressively adopting new technologies to simplify and streamline internal operations and to pull rich insights from data.

TRENDS

Utilities are moving toward a convergent and platform-based business model. The importance of IoT integration and leveraging data in the decision-making is gaining momentum. However, utilities only leverage between 2% and 4%[18] of data acquired from intelligent grid devices for analytics to enhance grid operations efficiency, according to Smart Energy International.

Data is a critical asset and core to many projects, from enabling advanced metering infrastructure (AMI) to creating more personalized customer experiences. As utilities look to adapt to new business models, they must understand their data. Utilities are looking to bolster data governance programs with a renewed focus on data definitions, data quality, privacy, and data workflow.

Analytics-based technology requires data science and technology skills to support the evolving business model. Data needs to be converted into useful information to support informed decision-making. Since AMI's arrival, many utilities are still barely tapping into the plethora of data generated from smart meters aside from using it to create bills. This is often due to the investment required and change needed to create an enterprise-wide internal data analytics function.

TAKING ACTION

Data is the linchpin of a clean energy future. From delivering energy efficiency programs to lower customer bills and operational costs, leveraging predictive maintenance creating significant long-term savings, and forecasting weather to prepare systems against extreme weather events. Utilities have unique value and qualitative benefits to consider in selecting and designing the use cases of the most significant value.

Data governance is a powerful capability for utilities if delivered as an enabling function. Across the utility, employees can search for and discover data assets, learn more about the data they have, and assess data quality. Business stewardship increases trust and improves overall data literacy across the utility. A business-driven analytics approach focusing on identifying the decisions essential to a utility's operations and strategic investments can improve with supportive data analytics. With the help of analytics, utilities can enable a cultural change and become a data-driven organization allowing for a more efficient and empowered workforce and an improved customer experience.

CHAPTER 6

Securing IT/OT systems and data

CHALLENGE

Strategies being implemented to decarbonize and meet clean energy goals mean more devices connected to the grid. Large numbers of new connectivity points—like EV charging stations—means a larger number of access points for intrusion threats and cyberattacks. Since the utility grid is interconnected, it is at greater risk, and large portions of the grid can be accessed and compromised. Smart devices must have robust cybersecurity programs in place to assess the emerging threat landscape and minimize vulnerabilities. Corporate and operational networks need to be isolated from one another when necessary to reduce risks.

TRENDS

Communication networks that were traditionally closed are migrating to Internet Protocol (IP) with Ethernet connectivity. The utility's infrastructure attack surface continues to expand as intelligent distribution systems, sensors, and other smart devices aid in the visibility of the grid and assets and assist with ensuring power delivery in the most efficient and reliable manner.

As the networks expand, so do their vulnerabilities, making the need for security—both physical and cyber—of paramount importance to utilities. The 2020 breach of IT service provider SolarWinds[19] is the latest reminder of the looming threats utilities face.

TAKING ACTION

It's critical to have an appropriate strategy in place to maintain operations through a cyber event. Guaranteeing safe and reliable distribution to customers requires a cybersecurity strategy beyond just compliance with current regulatory guidelines. These guidelines provide the minimum baseline level for a utility to comply with and may offer a rudimentary framework for building its cybersecurity plans. Still, they do not provide for a necessary comprehensive cybersecurity program.

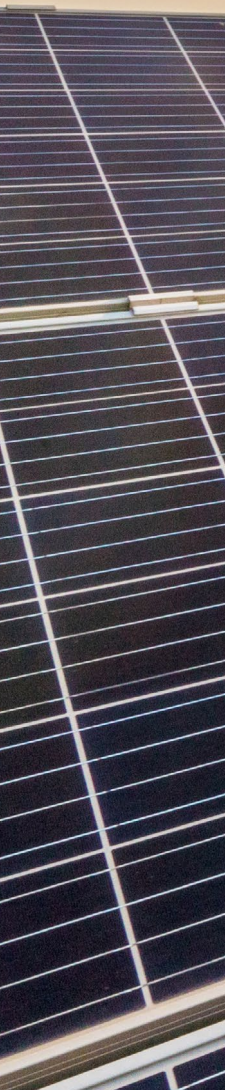
Utilities implementing smart devices are accounting for related security protocols and identifying areas to improve while increasing the grid's resilience. Additionally, utilities are increasingly aware of these smart devices' supply chains to ensure components within those devices do not provide backdoor access. As NIST[20] points out, the area of supply chain cybersecurity involves the organization's IT group, sourcing, vendor management, and supply chain continuity and quality. It consists of working with vendors more closely and ensuring they know where their device components are sourced.

A holistic security approach considers people, processes, and technology resources necessary to develop a risk-based set of standards and culture. Security can be the cybersecurity team's job, but it must be supported through cultural awareness and commitment of all personnel involved in the IT and OT networks. For some, it is a considerable cultural shift.

CONCLUSION

Although clean energy targets are 20 to 30 years away, the journey begins now to achieve a more flexible and robust gird, more jobs in clean tech industries, and overall improvement in the environment.

Meeting the challenge of decarbonization requires a fundamental shift in utility operations, customer engagement, rate setting, and collaboration across all stakeholders. Technology will continue to proliferate, and the pace of change will accelerate, as will the threat landscape. Utilities, however, will continue to adapt and evolve and continue to serve the population well as they have for decades.



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CONTRIBUTORS

PAUL DECOTIS
Senior Director, Energy & Utilities
pdecotis@westmonroe.com

DAN BELMONT
Managing Director, Energy & Utilities
dbelmont@westmonroe.com

ERIC ANDERSON
Senior Manager, Energy & Utilities
eanderson@westmonroe.com

SAM UYENO
Senior Manager, Energy & Utilities
suyeno@westmonroe.com

SHELLY HAGERMAN, PHD
Principal, Energy & Utilities
shagerman@westmonroe.com

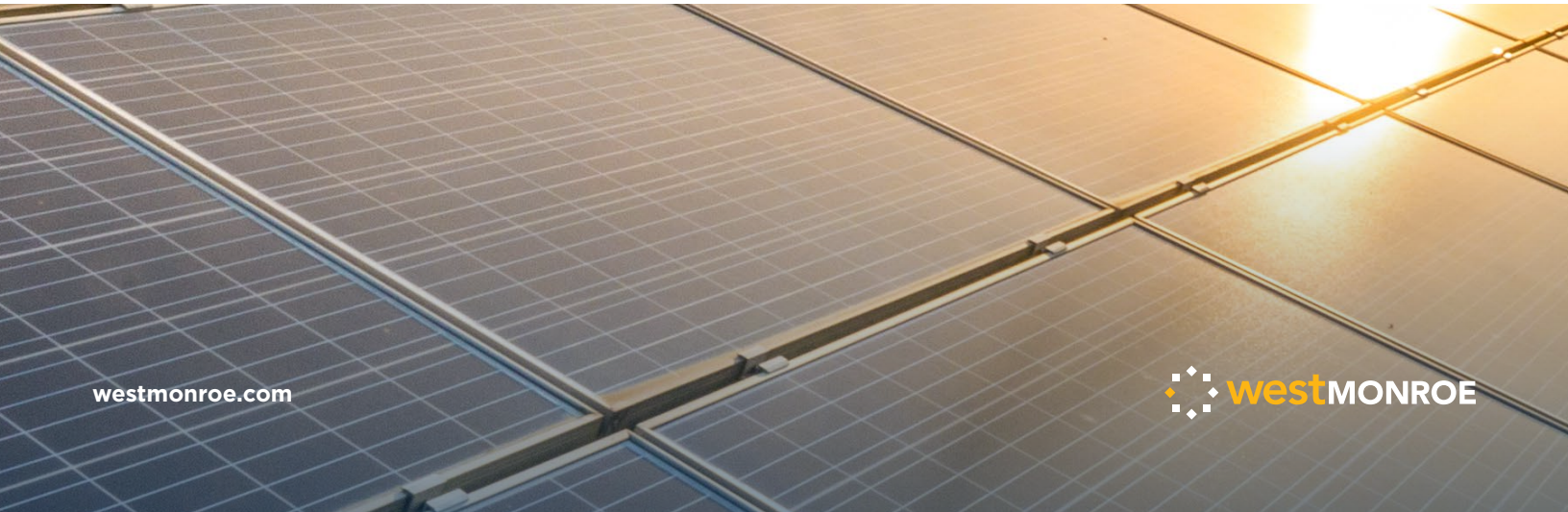
ANDREW DILLON
Innovation Fellow, Energy & Utilities
adillon@westmonroe.com

MICHAEL MANFREDO
Senior Principal, Customer Experience
mmanfredo@westmonroe.com

KAUMIL DALAL
Director, Technology
kdalal@westmonroe.com

CAMERON CROSS
Senior Manager, Technology
ccross@westmonroe.com

KATHY NELSON
Principal, Energy & Utilities
knelson@westmonroe.com



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