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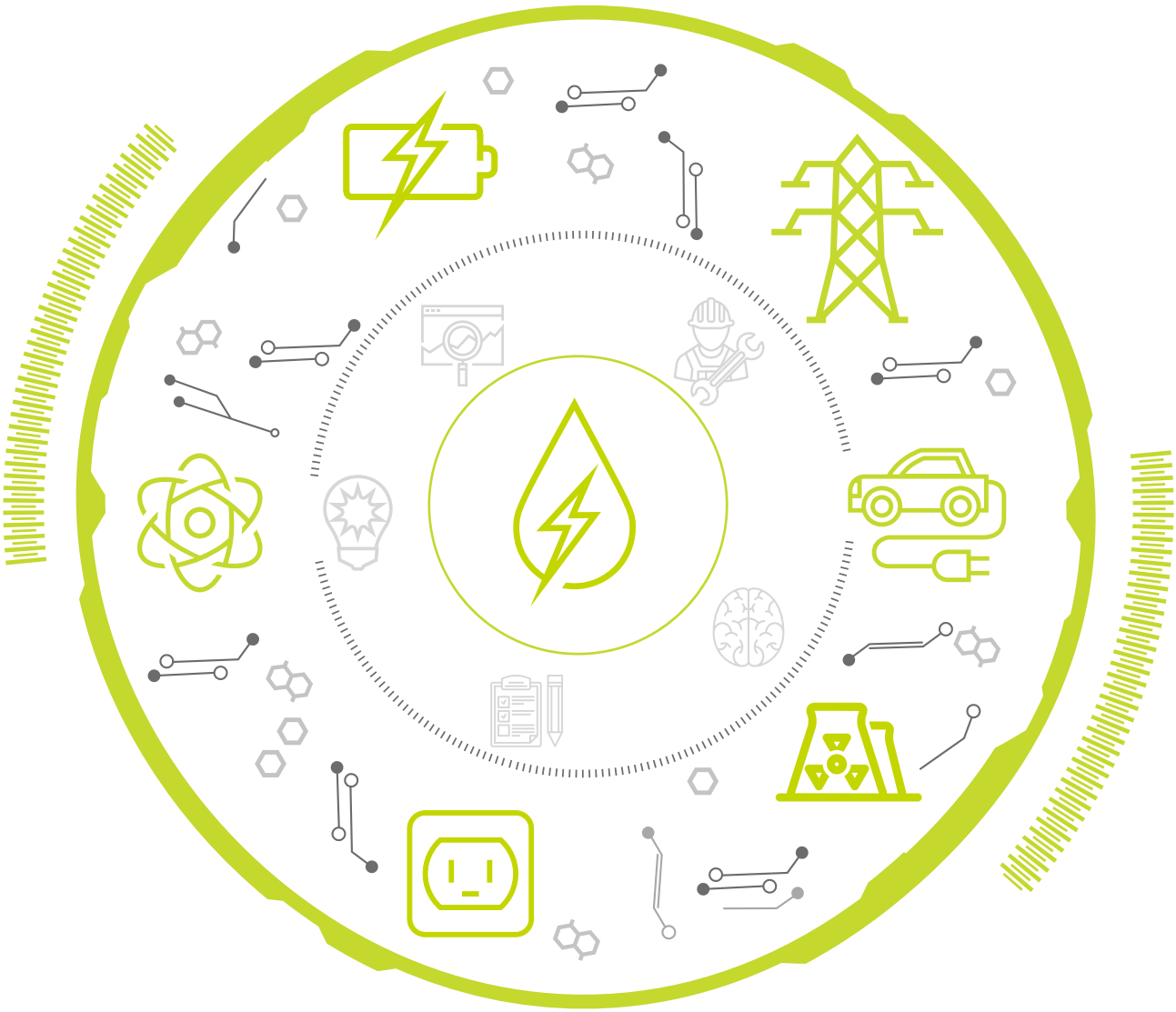

2018 outlook on power and utilities

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As we stand several years into an electric power industry transformation driven by technological, regulatory, and competitive forces, we see an industry that is already profoundly changed. The grid is "smarter," electricity sources are cleaner, and customers have more choices than ever before. But the change is likely just getting started. Most utility executives believe their companies will look very different in as little as three years, and certainly by five or 10 years down the road. What will that change look like and how will the industry manage it? One way to approach that question is to consider some of the key drivers of change likely to continue to impact the industry in the near term, and then look at the changes we can expect over a longer time horizon. How can the industry continue to meet these challenges and take advantage of emerging opportunities? Let's start with some key near-term drivers of change:

The changing generation fuel mix has been one of the most visible trends we've witnessed

In the past five years, US generation sourced from non-hydro renewables (largely wind and solar) has nearly doubled, from around 5 percent in 2012 to almost 10 percent in 2017. At the same time, about 50 gigawatts of coal-fired generation capacity has been retired since 2012[1] and natural gas's share of generation in the United States surpassed coal on an annual basis for the first time in 2016, and was about even with coal in 2017 (at roughly 31 percent each). This is largely due to low natural gas prices, which are also behind a steady decline in wholesale power prices.

Declining power prices have helped offset rising costs in customer bills

Wholesale power prices have fallen across the United States, including about 56 percent, 50 percent, and 47 percent in the ISO New England, New York ISO, and PJM markets, respectively, since 2014.[2] These savings have in turn nearly offset the cost of record-breaking utility capital expenditures in recent years for upgrading, modernizing, and decarbonizing the grid. Declining power prices have likely made the increase in customer bills far less noticeable than it otherwise would have been. In the coming years, despite current federal policy initiatives, the electric power industry is expected to stay the course toward cleaner energy sources. When it comes to new build, almost all planned generation capacity for the next five years is renewable or natural gas-fired. Why? Because wind, solar, and natural gas are often the lowest cost resources, and both experience and research have shown they're what utility customers want.

Distributed energy resource (DER) penetration may have the biggest impact

Speaking of what customers want, DERs will likely continue to climb the list and may impact more aspects of utility planning than any other trend. Whether it's distributed generation, energy storage, microgrids, energy efficiency, electric vehicles, smart appliances, or demand response, residential and commercial

electricity customers seem to increasingly see these products and services as a way to manage their energy use, save money, reduce their carbon footprint, and boost reliability and resilience. While initially many utilities and system operators saw DERs as intermittent or otherwise unreliable, that may be changing. Many are now beginning to explore how, when paired with technology such as smart inverters and advanced distribution management systems, DERs can add flexibility and resilience to the grid. And resilience is a key goal in light of recent severe storms, as noted below. Energy storage, increasingly being deployed either at grid scale or as a DER, also holds promise to boost flexibility and resilience. If new DER-owning "prosumers," or producing customers who are now feeding electricity back to the grid, begin to receive payment or credits for the grid services they provide, customer engagement and willingness to explore other new utility products and services will likely rise.

Many consumers and businesses are betting big on renewables despite federal uncertainty

While the federal government seeks to unwind some of the current clean energy initiatives, customer enthusiasm for renewables seems to be increasingly driving growth. The annual Deloitte Resources Study of US business and consumer energy use and attitudes has recorded increased interest in renewables every year since 2012. In the 2017 study, 44 percent of residential respondents said they were extremely/very interested in purchasing solar panels, and 41 percent were extremely/very interested in purchasing a share in a community solar installation.[3] For the younger, "millennial" age group, those percentages rose to 64 percent and 53 percent, respectively. And if they had a choice in electricity suppliers, nearly 60 percent of residential consumers cited electricity supply coming from renewable sources as a reason to switch.[4] As for businesses, almost half of Fortune 500 corporations now have a target for either sustainability or renewable energy or both. Even for those who do not have such goals, renewables are often the least-cost option and they can allow corporations to lock in energy prices and avoid volatility. From 2012 through late 2017, corporate buyers contracted for nearly 10 gigawatts of renewable energy, and the market is expanding beyond large multinationals and technology companies to smaller organizations in a growing variety of industries. As the price of battery storage declines, individual, corporate, and community solar customers are increasingly combining storage with solar, adding a new dimension of flexibility for their own use and potentially for the grid as a whole in the future.

Strengthened calls for resilience are beginning to translate into results

In the wake of Superstorm Sandy in the Northeast in 2012 and Hurricanes Harvey, Irma, and Maria in Texas, Florida, Puerto Rico, and the US Virgin Islands in 2017, electric utilities and their customers seem more determined than ever to protect the grid from severe weather events. After Superstorm Sandy's devastation, utilities intensified efforts and spent tens of billions of dollars to harden physical grid assets and deploy smart technologies to avoid future outages and enhance their ability to recover rapidly. Since then, 70 million smart meters have been installed nationally to provide utility operators with greater visibility into the location of outages, and drones can help them survey storm-struck areas to assess and aid restoration efforts. These technologies, combined with information sharing within the industry and with government agencies, as well as with the public via social media, have cut storm-related outage duration for electricity customers in Florida and elsewhere already, and will likely continue to do so. Despite this progress, customers may not always take notice; they just know their power was out and may not have realized it took less time to restore than it has previously. Moving forward, many utilities are also innovating to meet growing customer demand for resilience by providing distributed (often renewable) generation, storage, and microgrids.

Commitment to reduce cyber and physical security risk is deepening

In a 2017 industry survey, utility respondents rated "physical and/or cyber grid security" as the most important issue they face, after ranking it sixth in the two previous years.[5] As we have seen, "bad actors" seem to be increasingly, and sometimes successfully, attempting to breach corporate and government information and operating systems, including those that control critical infrastructure such as the electric grid. And the proliferation and increasing decentralization and interconnection of smart energy assets creates more entry points for malevolent actors to enter utility systems. As a result, electric utilities are working together and with the US government to detect, prevent, and prepare for these risks. Some of the most proactive utilities are performing risk assessments and developing cyber security programs and road maps, often aided by frameworks provided by the National Institute of Standards and Technology or the North American Electric Reliability Corporation. And many have begun sharing intelligence and pledging mutual assistance among themselves and in cooperation with federal government agencies, typically through the Electricity Subsector Coordinating Council. Utilities are expected to continue to focus resources and intensify efforts to prevent cyber and physical attacks on the grid in 2018.

Over less than a decade, the electric power industry has made significant progress addressing challenges and harnessing opportunities arising from the industry transformation. Change has come unevenly across the United States, with the pace often determined by regional differences in market and regulatory structures, resource availability, customer preferences, and the retail price of electricity. Utilities in states such as California and Hawaii have been at the leading edge of the transformation, partly due to abundant solar and wind resources, as well as relatively high retail electricity prices that make new technologies economically viable sooner than they would be in other areas. Utilities in other states will likely continue to watch and learn lessons from these early adopters. In other areas that have high electricity prices, such as the US Northeast, utilities are following their own paths to transformation, as are utilities in other states with abundant renewable resources, such as Arizona.

As the industry transformation continues to unfold, these trends will evolve and others will likely emerge. Uncertainty will be a constant. But fortunately, some bright spots on the horizon can help illuminate the path for electric power companies as they move forward in the next three, five, or 10 years. Two of the most promising are the projected demand lift from transport electrification, and the potential benefits of digitalization.

First, in the transportation sector, the age of the electric vehicle (EV) is dawning. Although EVs accounted for just 1 percent of US and global light duty vehicle sales in 2016, sales are growing rapidly and new models have lit up customer interest due to falling prices, increased driving range, and the overall "cool factor" that comes from combining advanced technologies with exceptional design. Supportive policies in many US states and abroad, as well as goals announced by several automakers and countries such as China, the UK, France, and India to phase out sales of fossil-fuel-powered vehicles in the next two decades, will likely add momentum.[6]

Bloomberg New Energy Finance projects global electricity consumption from electric vehicles could rise 30,000 percent, to 1,800 terawatt hours (TWH) annually by 2040 from 6 TWH in 2016. While that projection is at the high end of a wide range, if current trends toward shared, autonomous vehicles play out as projected, EV adoption rates could accelerate since the two trends are complementary. And utility benefits are not limited to increased electricity demand: a burgeoning fleet of EVs with their onboard batteries could help utilities balance the grid, integrate renewables, and improve power quality, while potentially enhancing customer engagement, as mentioned above.

Second, many US electric power companies have already taken the first steps toward digital transformation—a multi-stage journey that can ultimately help them predict, manage, and control increasingly decentralized and complex networks, make more informed decisions, and enhance customer relationships. Digital transformation builds toward a set of interconnected, data-driven solutions that mature from traditional monitoring to intelligence and active control. Here are just a few changes we'll likely see in the utility of the future:

- Generation will evolve toward a **more diverse and decentralized network of lower capacity, more flexible units with the intelligence** to self-ramp, self-balance/stabilize, and self-diagnose—they will be enabled by comprehensive monitoring, intelligence, and automated controls that increase heat rates, availability, and demand responsiveness.
- The future grid will be a **communications-enabled self-healing network, able to increasingly act as a balancing entity,** seamlessly managing two-way power flows, complex demand management/response, and asset health that dramatically reduces asset intensity and operating costs while increasing reliability.
- Utilities will **enhance their relationship and knowledge of their customers** by implementing advanced customer self-service, mobile applications, data analytics, communication, and energy management solutions.
- The utility will be a **digitally enabled shared services organization that will provide fully automated and integrated corporate services,** predictive analytics, and forecasting, and will use robotics to minimize manual intervention and optimize headcount.
- The growing ecosystem of electricity asset owners, prosumers, and consumers will be able to price and trade energy among themselves in decentralized markets through a **transactive energy system.** Technologies such as blockchain and smart contracts will facilitate decentralized coordination between parties through distributed optimization and control.

In sum, the electric power industry is well into a profound period of transformation, but it may still have a long way to go. One significant piece of the industry that has yet to catch up in this transformation is the utility regulatory structure, which could limit regulated electric companies' capacity to evolve, since incentives may not align with new priorities. The traditional utility regulation model of cost recovery and allowed rate of return on investments will likely need to evolve and adapt to recognize and incentivize new technology options such as utility involvement in energy storage, two-way power flows, and behind-the-meter customer solutions. Innovation in pricing structures and utility remuneration can enable wider deployment of innovative customer-service technologies.

When we look back at 2017, we see a year marked by multiple well-entrenched trends, including the changing fuel mix, declining power prices, increasing customer demand for renewables, the proliferation of DER, and strengthened commitment to boost resilience and cybersecurity. As we move into 2018, we expect digitalization to increasingly enter the spotlight, as electric power companies map out new ways to deploy rapidly advancing technologies to address challenges and harness opportunities. In the longer term, we expect power companies can look forward to positive momentum from transportation-sector electrification, as car buyers increasingly take a second look at electric vehicles. And regardless of the time frame, the electric power industry will continue to be guided by its central mission—to provide customers with secure, reliable, resilient, affordable, and environmentally responsible electricity.

Let's talk

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Endnotes

1. Based on historical coal-fired power plant capacity data from SNL Energy. US coal-fired capacity reached a peak of 309,000 MW in 2012 and is projected to fall to 259,000 MW by the end of 2017, accessed November 2017.
2. "SNL Spot Power Index: on-peak monthly average price," SNL Energy, accessed November 2017. Note: Compared annual averages for 2014 with 2017 average through October.
3. Deloitte Center for Energy Solutions, *Deloitte Resources 2017 study: Energy management: Sustainability and progress,* July 2017, p. 17, https://www2.deloitte.com/content/dam/Deloitte/us/Documents/energy-resources/us-deloitte-resources-2017-study-energy-management.pdf, accessed November 2017.
4. Ibid., p. 10.
5. Herman K. Trabish, "Why utilities say grid security is the most pressing sector issue of 2017," *Utility Dive,* April 10, 2017, https://www.utilitydive.com/news/why-utilities-say-grid-security-is-the-most-pressing-sector-issue-of-2017/440056/, accessed November 2017.
6. Alanna Petroff, "These countries want to ban gas and diesel cars," *CNN Money,* September 11, 2017, http://money.cnn.com/2017/09/11/autos/countries-banning-diesel-gas-cars/index.html, accessed November 2017.

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