The Utility as The Network Integrator

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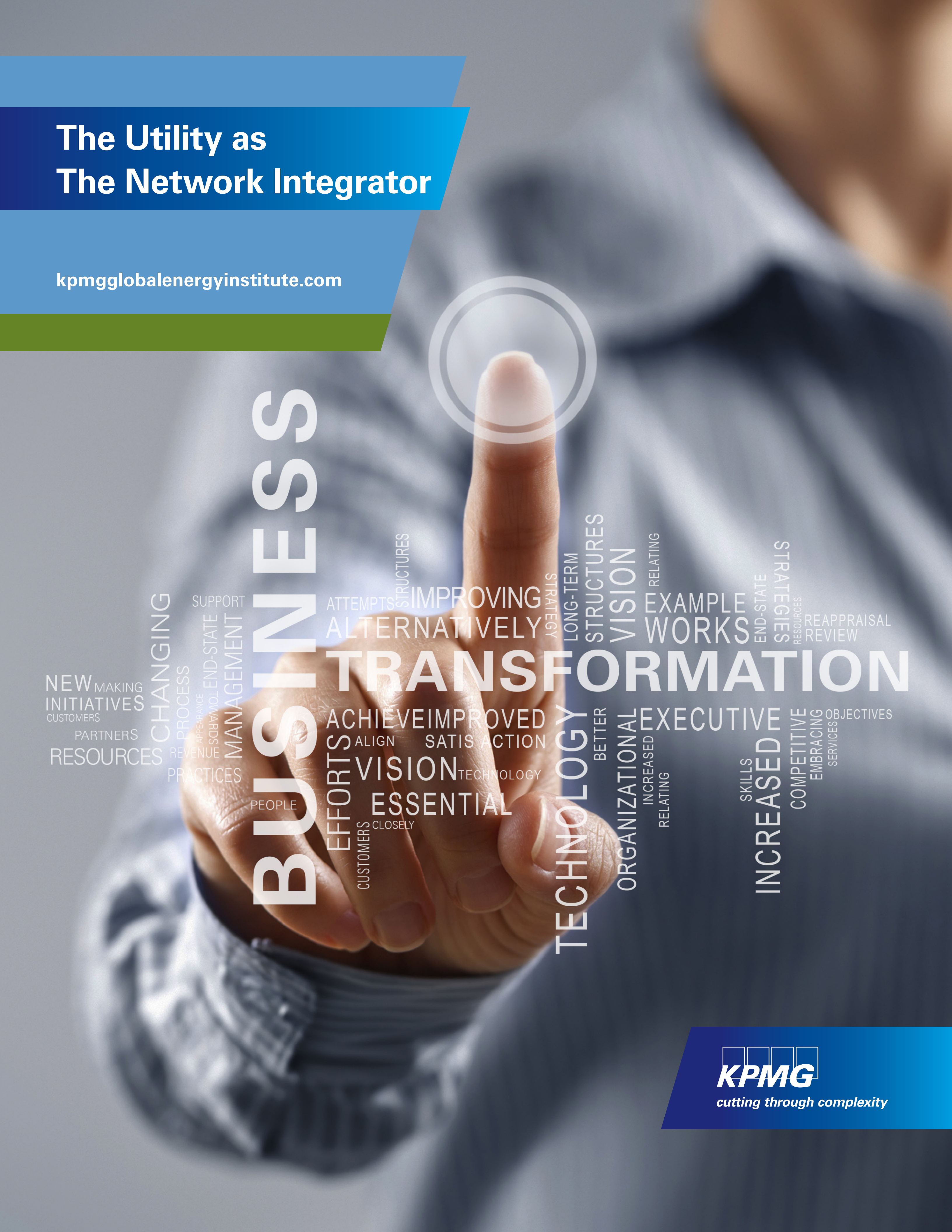

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cutting through complexity

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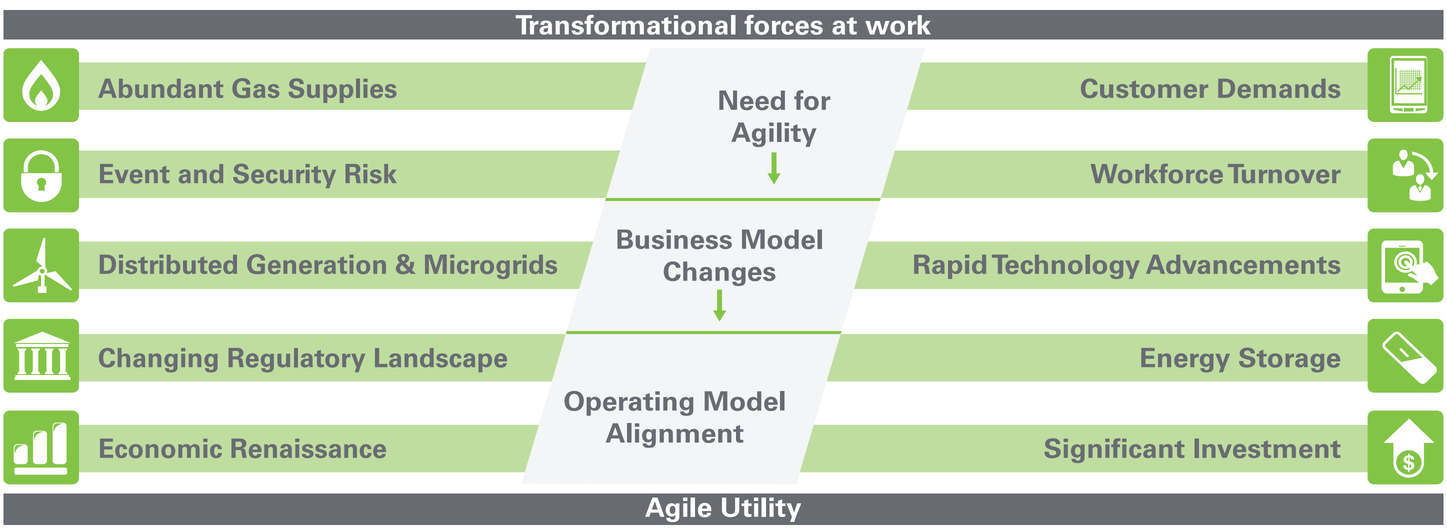
1 Overview

The onset of renewable generation, distributed generation, energy storage, and peak demand reduction technologies pose significant challenges to effective grid management. These emerging energy resources complicate distribution planning and the efficient dispatch of local and utility-scale generation. Electric utilities and the electric industry as a whole must transform their operating models, strategies, and infrastructure to be able to manage the increasingly complex landscape of modern energy delivery.

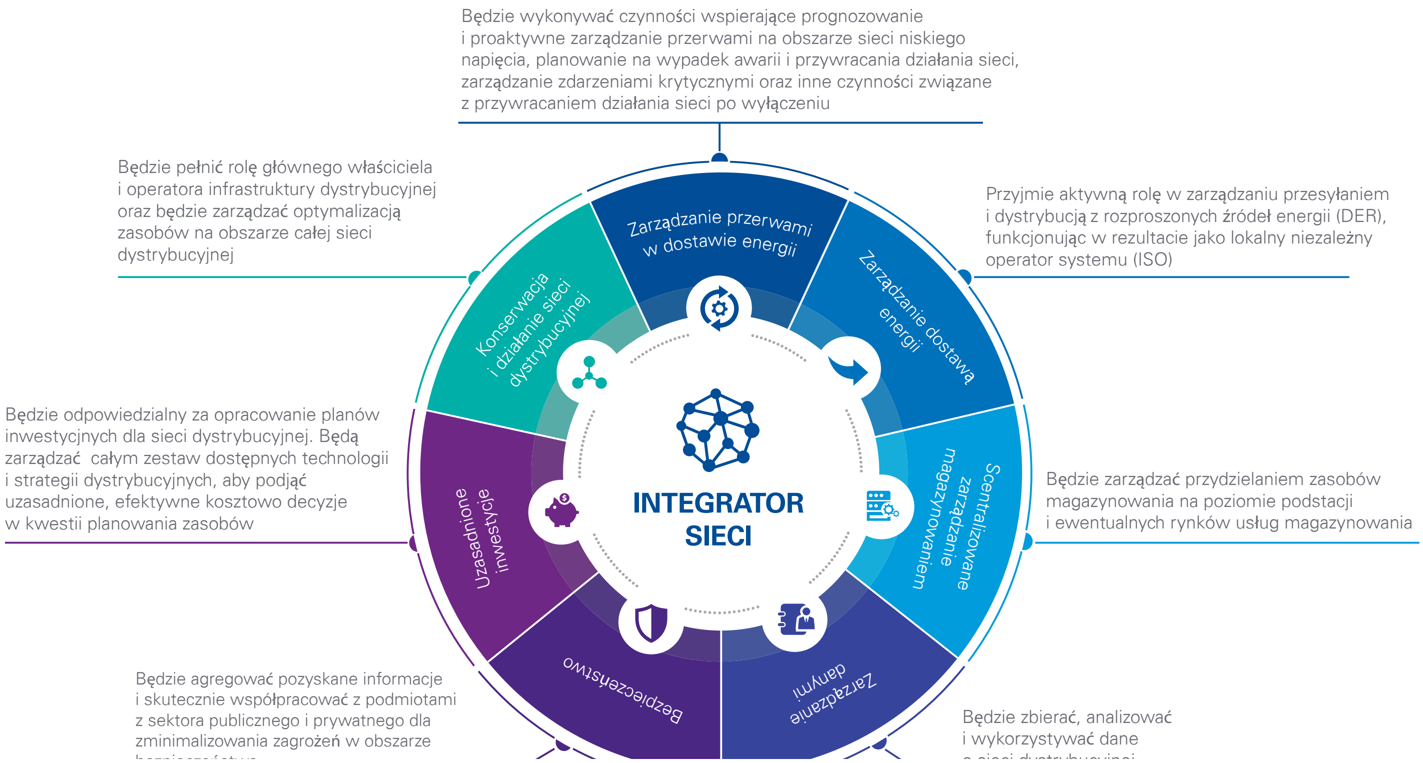
Complementary state and federal policies have successfully facilitated the proliferation of these new energy resources, particularly of renewable resources and distributed generation. State policy is broadening to compel adoption of demand response and energy storage as well. Meanwhile, federal regulation is moving beyond carbon emissions reduction to insist on higher standards for system reliability and disaster preparedness. These regulatory drivers ultimately reflect consumer demand for more sustainable, resilient, customizable energy resources. As a result, the industry has opened to nontraditional, third-party players. These market entrants are deploying creative marketing and financing mechanisms to win customers interested in tailored energy products and services, cutting into utility market share.

Together, these developments create an opportunity for utilities to step in as market enablers, overseeing the evolution of the electricity sector and plotting a tenable long-term strategy for energy delivery. Utilities must transform into Network Integrators. The Network Integrator function will be anchored by traditional utility experience in grid operations and maintenance, and will be the driver and enabler of new energy markets, standardization, resiliency, reliability, and centralized management of the distribution grid.

To capitalize on this opportunity, Network Integrators must invest in robust infrastructure that can accommodate the rapid adoption of these new energy services, resources, and seize a leadership role in standardizing this infrastructure. They must enable a more intuitive, customizable experience for energy consumers in their service territories. They must develop deep competencies in the technologies and processes through which energy consumption and grid data is collected, analyzed, and subsequently deployed for customer engagement. The Network Integrators that embrace these new responsibilities will be able to chart a stable, profitable path forward in the perpetually shifting electricity sector.



2 Core Functions



The primary responsibility of the Network Integrator will be to provide reliable, resilient, and safe energy delivery that is cost-effective and leverages standardized technologies. The avenues through which this objective is achieved will expand. Network Integrators must work to expand their competencies in the following areas:

- **Distribution grid maintenance and operations** – Network Integrators will remain the owner and operator of distribution infrastructure (e.g., transformers and distribution lines). Network Integrators should be proactive and creative in deploying distribution grid-specific innovations that support reliability and resiliency, including automation technologies, smart grid infrastructure and others. In most markets, this responsibility will not include ownership of generating resources.

- **Outage management and resiliency** – Network Integrators will perform functions related to outage management, disaster planning and recovery, critical event management, and other activities related to outage restoration. Network integrators will also be responsible for implementing distribution-level infrastructure and processes to enhance grid resiliency. Incorporation of safeguards such as system redundancy will enable Network Integrators to avoid load-shedding events entirely.

- **Energy delivery management** – Network Integrators will assume a greater role in managing the dispatch of distributed energy resources (DER), in effect functioning as local independent system operators (ISOs) or regional transmission organizations (RTOs). Energy delivery management will require extensive coordination with retailers, customers, and other stakeholders. For example, this role will include collaboration with curtailment services providers, to constitute the calling of curtailment events and the scheduling of demand response.

- **Centralized storage management** – Network Integrators will manage the dispatch of storage resources at the substation level. (This responsibility does not include ownership of the storage resources.) Network Integrators will also manage any storage market(s) that may emerge around the aggregation and subsequent bidding of on-site storage into a broader electricity market.

- **Data management –** Network Integrators will collect, analyze, and deploy distribution grid data for improved stakeholder engagement (e.g., generators, transmission operators, retailers, etc.)
- **Informed investment –** As the owners of distribution planning for a given territory, Network Integrators will be responsible for the development of an investment plan for the distribution grid. They will navigate the array of distribution technologies and strategies available to make informed, cost-effective resource planning decisions. As part of this role, the Network Integrator will independently and objectively manage the bidding and selection process for substation-level assets. In addition, the Network Integrator will design and implement an incentive/penalty program to encourage strategic energy resource development that serves to improve the performance of the distribution grid.
- **Security –** Network Integrators will aggregate intelligence and effectively collaborate with the public and private sector actors to help minimize security threats. As part of this role, Network Integrators will help to drive standardization of technologies and processes that enable grid security. Because stopping all attacks would be impossible, Network Integrators will also prioritize grid resiliency as an important component of a robust security strategy.

3 Markets and Geography

There will be only one Network Integrator in a given geographic footprint; therefore, these organizations will continue to be regulated. The Network Integrator model will likely emerge in a market that has some or all of the following characteristics:

- A high penetration of DER (solar, energy storage, and otherwise)
- A progressive utility commission favoring the increase of distributed generation and renewable generation in the state's energy mix
- A progressive ISO or RTO supportive of widespread use of demand response strategies
- Significant consumer demand for customizable energy solutions across the spectrum of generation, storage, distribution, efficiency, and metering
- A deregulated electricity market in which retail electric providers must compete for customers on the basis of not only cost, but also such characteristics as customer service, reliability, and energy mix
- Elevated need for interstate energy imports and exports in a given region.

Utilities across the country have already begun to evolve to meet the demands of the 21st Century Network Integrator:

- New York's Reforming the Energy Vision (REV) Act is designed to modernize the state's power grid, through a series of programs and initiatives for the state's utilities to improve reliability, resiliency, security, and environmental impact. Among other things, the REV Act's goals include greater efficiency of regulatory markets; modernizing the power grid to better enable customer choice, power quality and reliability, cybersecurity, and other factors that support the digital economy; expansion of distributed energy resources; and facilitation of third-party players in the power markets that will bring innovation of products and services to customers in the state.
- In March 2013, the Maryland governor's office proposed Utility 2.0, a smart grid pilot project that would decouple utility revenue from the sale of electric power (among a host of technological upgrades). Instead, performance parameters would determine the rate of return. The performance parameters would be cost, reliability, customer service, adoption of smart grid technologies and services, and integration of renewables. The weighting of these factors would be determined by customers themselves, according to their own perception of the factors' relative importance.
- In June 2014, Bloomberg.com reported that CenterPoint, American Electric Power, San Diego Gas & Electric, Pacific Gas & Electric, and DTE Energy—among others—have launched significant smart grid initiatives, and are investing tens of millions of dollars in infrastructure upgrades for the purposes of reducing outages and automating operations.
- California's utilities are experimenting with a variety of energy storage technologies to capture excess solar production in the middle of the day. In June 2013, California's public utilities commission set a 2020 target of 1,325 MW of storage, and has incentivized storage technologies ranging from ice, to pumped hydro, to concentrated solar thermal. Facing a similarly high penetration of renewables, Oncor in November 2014 proposed up to 5,000 MW of grid-integrated, distributed storage in Texas.
- NextEra Energy is proceeding with plans to develop a grid-tie undersea cable system in Hawaii between Maui and Oahu. In announcing their intent to purchase Hawaiian Electric Industries in December 2014, NextEra committed to increasing local generation and reducing oil imports. According to the EIA, Hawaii had the highest electricity rates in the United States in 2013, and in 2012 imported 93 percent of the energy it consumed. By developing more renewable energy projects and improving inter-island transmission capabilities, NextEra aims to reduce emissions and improve system reliability in Hawaii.

- Motivated by the solar net energy metering debate, utilities such as Austin Energy in Texas, Arizona Public Service, and Xcel Colorado have commissioned research to refine their understanding of the cost to operate the grid versus the cost to supply energy (as summarized in a Rocky Mountain Institute study published in September 2013). California and Minnesota have undertaken these studies at the statewide level. A handful of utilities have been successful in their attempts to assess a fixed charge for grid interconnection—the first step toward transparent rate design that could eventually facilitate further itemization of energy delivery costs.
- PG&E experienced an attack on a transmission substation in 2013. In the same year, 40 percent of all cyber attacks discovered by the Department of Homeland Security targeted the energy sector. The heightened awareness over the potential economic damage that could be wreaked through an effective attack on the power grid prompted PG&E to partner with the federal government in February 2015 on an initiative to enable deeper intelligence sharing between the public and private sectors on cybersecurity threats.

4 Stakeholders

The Network Integrator is connected to all electricity providers and consumers in a given territory through the exchange of data. However, the Network Integrator may not maintain a direct relationship with all energy consumers. In this way, the Network Integrator function of a utility is comparable to that of a low-voltage ISO or RTO, overseeing the flow of energy resources on its grid. Its stakeholders are generators, energy storage providers, metering service providers, retail product and service companies, ISOs and RTOs, and transmission operators. It should be noted that it is possible that some of these functions could be shared by a single company. These functions, and their relationship to the Network Integrator, are outlined below.

- **Generators:** In this context, generators range in size from substation-level assets to aggregators of residential on-site resources. Network Integrators will manage the dispatch of these resources at the distribution level for network stability and reserve power. This includes the design and management of an incentive framework by which project development is encouraged where the greatest gains in grid performance can be achieved. Network Integrator oversight of energy bidding will depend on the regulatory context. Network Integrators could manage the market between retailers and generators in deregulated areas, but will not oversee bids in a regulated territory. Network Integrators will also manage any market(s) that may emerge around the aggregation and subsequent bidding of generation into a broader electricity market.
- **Storage providers:** A storage provider might be a single storage project, or it could constitute an aggregation of on-site storage resources. As part of their responsibility to maintain the balance of power in the low-voltage grid, Network Integrators could work with these providers to manage the dispatch of storage resources at the distribution level. Similar to the Network Integrator's relationship with generators, they could manage an incentive program by which storage providers are financially motivated to develop resources in congested areas and discouraged from developing resources in oversupplied areas. Network Integrators could also manage any market(s) that may emerge around the aggregation and subsequent bidding of storage into a broader electricity market.
- **Metering service providers:** The collection of consumers' energy consumption data will be administered by metering service providers. Network Integrators will liaise with metering service providers to obtain consumption data relevant to the broader performance of the distribution grid.
- **Retail product and service providers:** Retail product and service providers maintain the billing relationship with energy consumers, not the Network Integrator. The retail function sells energy-related products and services to consumers (e.g., demand response programs, solar PV systems, energy contracts, etc.). They will liaise with the Network Integrator to monitor and evaluate the impact of new products and services on grid performance, and the Network Integrator will help ensure their adherence to network standards. It should be noted that retail product and service providers may be active in deregulated markets where retail electric providers are already operating.
- **ISOs and RTOs and transmission operators:** The Network Integrator may import or export electricity from its distribution grid, necessitating interaction with major electricity markets and transmission operators. Network Integrators will interact with these interstate organizations around transmission planning and interconnection, outage management, and the purchase or sale of generation when the Network Integrator is operating under a deficit or surplus, respectively. The Network Integrator will also provide ISOs and RTOs with the information needed for effective resource planning across the broader region.

For this model to operate properly, Network Integrator revenue must be decoupled from the volumetric provision of energy. Instead, the Network Integrator will derive the revenue necessary to offset capital expenditures and avoid stranded costs through charges assessed to its stakeholders for facilitating their efficient participation in grid operations. These charges will constitute tiered network access fees and charges for various support services. Network Integrator data will also help to inform charges assessed between other energy resource providers and consumers within the service territory.

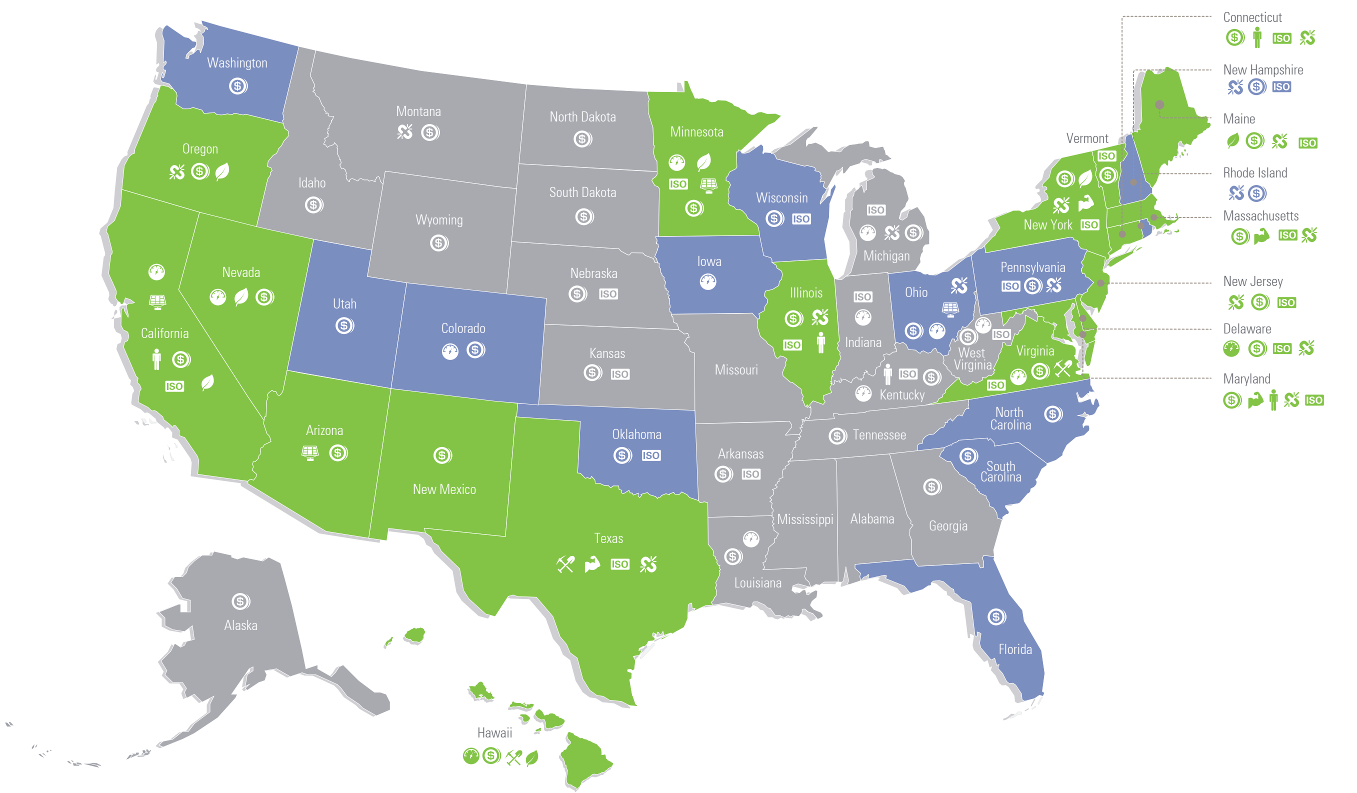
5 Regulation

In the Network Integrator model, the relationship with the state regulatory authority will evolve to focus on reliability and resiliency. However, ratemaking today does not complement this model. Volumetric rate recovery must be abandoned in favor of a framework that rewards grid performance.

The conservative "1-in-10" resource adequacy criterion that has guaranteed reliability through overbuild of generation will be replaced by price-driven, grid-based solutions to peak load reduction that are managed by the Network Integrator. In turn, the Network Integrator will be regulated through incentive-based returns that reward grid performance as opposed to fuel consumption. The RIIO ratemaking mechanism deployed by the United Kingdom's Office of Gas & Electricity Markets in 2010 is an approximation of this model. Utility revenue is set equal to incentives, innovation, and output. For example, if a network company delivers a project under budget it is allowed to retain some savings as additional revenue, and consumers also benefit because the project costs less to develop. In this case study, companies are incented to attract investment and drive innovation.

Additionally, regulators will more closely monitor Network Integrators' disaster management and recovery planning. Network Integrators will partner with regulators to develop holistic resiliency standards that consider both engineering capabilities (e.g., islanding) and "soft" strategies (e.g., the efficacy of disaster communications). Regulators will ensure Network Integrators are prepared not only to respond to storms and other physical dangers, but also to emerging threats like cyber attacks.

LIMITED/NO REGULATORY CHANGE | MODERATE REGULATORY CHANGE | SIGNIFICANT REGULATORY CHANGE



- Use of fixed mandatory-minimum grid access fees
- Financial incentives (loans, grants, credits) for renewable generation
- Renewable generation portfolio standards
- Net metering policies to promote DG
- Use of semi-autonomous rate adjustment mechanisms (trackers/riders) to reduce utility capital investment cost recovery
- Grid modernization/resilience/ microgrid measure
- ISO Operates within ISO/ RTO transmission/wholesale market
- Deregulated energy markets
- Use of innovative rate designs to encourage efficient customer use/demand management

6 Key Drivers

The principal drivers of utility transformation into the Network Integrator function are as follows:

- **Regulation and renewable supply objectives –** Renewable portfolio standards and net energy metering have encouraged renewable project development at the local level. Backed by environmental regulation and tax incentives at the national level, wind and solar now enjoy widespread adoption. Public policy is evolving to support other emerging energy resources as well.
- **Customer demand –** Residential and commercial customers seek distributed and/or renewable resources for a variety of reasons, including sustainability, status among peers, the perceived self-sufficiency it affords, and long-term economic viability. This drives new products, services, and investments by utilities and nontraditional players, which, in turn strengthens the need for a Network Integrator.
- **Third-party capital investment –** Nontraditional industry players like Tesla, Solar City, and Google-backed Nest have the operational latitude and the available capital to take risks, drive innovation, and respond to customer demand in ways that utilities cannot. Their investments in the electricity sector are driving change in the market both directly and indirectly.
- **Disruptive technology –** The decreasing cost of energy storage and distributed solar are speeding the adoption of these technologies, which in turn is altering the scale, time, and location at which energy is generated and consumed. Also, the sophistication of data collection tools and the granularity of the grid and consumption data available for analysis are also rapidly improving, which in turn can illuminate new pathways to more effective customer engagement.
- **Risk of power supply disruptions –** After natural disasters like the Northeast blackout of 2003 and Hurricane Sandy in 2012, utilities are under pressure to improve disaster preparedness, streamline the recovery process, and speed restoration of power. Grid cybersecurity is also a top concern for industry executives and policymakers. Black & Veatch's annual survey revealed that only about a third of utility respondents had integrated systems featuring the segmentation, redundancies, and monitoring capabilities needed to insulate them from a cyber attack.

7 Key Risks

Risks that jeopardize the immediate or long-term success of utilities' evolution into Network Integrators include:

- **Investment recovery** – A Network Integrator's incentive to experiment with innovative grid technologies may be legally constrained by state regulation that prohibits recovery of a program expense that does not result in benefits or that benefits a limited subset of the customer base.
- **Regulation** – The ratemaking overhaul necessary to itemize the cost of grid infrastructure, operations, and maintenance in preparation for the launch of a pure Network Integrator model would absorb years of regulatory proceedings. As it stands, the complexity of rate cross-subsidization that exists in many states renders rate design transformation a politically fraught process.
- **Overinvestment** – While some Network Integrators may be tempted to overinvest in infrastructure, they may be wise to consider less expensive data-driven strategies. These can include improved forecasting of renewable generation and behavioral demand response programs.
- **Cultural resistance to change** – Utilities have historically been conservative, risk-averse organizations, which is largely an outcome of their heavily regulated environment. The Network Integrator must be sufficiently agile to embrace new distribution technologies, as well as adapt to the influx of new market entrants and other technologies beyond their immediate control.
- **Resource constraints** – A significant amount of time and money will be required to enact this transformation. Making this investment will be particularly challenging because many utilities are presently suffering from revenue loss related to the adoption of distributed generation, the cost of compliance with renewables targets, and flat load growth.
- **Financial market response** – Significant changes to traditional utility business models will likely result in a response from utility shareholders and the capital markets. How will current and future investors in the sector react to changes that potentially affect cash flows, capital structures, regulatory models, risk profiles, and other factors?

8 The Call to Action is Now

The obvious next question is: "so what?" What steps should utilities take to evaluate these disruptive forces in the industry? What steps should utilities take to determine how relevant the Network Integrator concept is to their current or future operations? We see the response as two-fold:

The **strategic response.** All utilities should:

- Assess the disruptive forces at play in order to determine both the short-term and long-term impacts to their business models
- Assess the rate of change to the areas covered by the Network Integrator's core functions (distribution grid management; outage management and resiliency; energy delivery management; centralized storage management; data management; informed investment; and security)
- Assess the changing dynamics of the utility-customer relationships in the markets in which the company operates
- Determine how to monitor the pace, complexity, and impact of coming changes to regulatory models, customer demands, technology products, and nontraditional market entrants
- Conduct scenario planning exercises, focusing on the known and the unknown.

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The **tactical response.** Based on the above actions, utilities should also consider the following:

- Evaluate and standardize processes—lock down the "known"
- Simplify the organization structure to increase its ability to adapt to change
- Promote innovation by incorporating leading practices (from within the industry and outside the industry)
- Attract and retain innovators and leaders from outside the industry
- Improve dialogue and partnership with regulators
- Standardize technology and reduce (or eliminate) customization.

As utilities assess the changing landscape of the industry, we believe they should **continuously** perform the following activities as part of ongoing operations:

- Assess ever-changing customer demands
- Monitor marketplace activity for acquisitions, consolidations, and movement by traditional and nontraditional competitors and market participants
- Foster collaborative relationships with regulators to maintain alignment with emerging regulatory trends
- Assess whether the organization has the right technology to support business objectives
- Assess whether the organization has the right talent to get the job done
- Determine if the organization is agile enough to respond to disruptive forces in the industry.

Each utility's answers to these questions will help to determine whether they will lead the push for change and agility in their respective markets, or whether they will risk being marginalized by changing market forces.

KPMG stands ready to assist power and utility companies as they begin to evaluate their own journeys toward becoming a Network Integrator.

The KPMG Global Energy Institute (GEI)
Launched in 2007, the GEI is a worldwide knowledge-sharing forum on current and emerging industry issues. This vehicle for accessing thought leadership, events, Webcasts, and podcasts about key industry topics and trends provides a way for you to share your perspectives on the challenges and opportunities facing the energy industry—arming you with new tools to better navigate the changes in this dynamics area.

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