The agile utility

Future-state industry model and the evolution of the utility as a network integrator
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Overview

The North American electric utility industry has undergone significant change in recent years, but is on the cusp of even further transformation.

Disruptive forces related to changing customer demands, regulatory change, rapid technology advancement, and capital sourcing are creating a new industry environment to which utilities will increasingly need to adapt.

Individual utilities and markets will respond to these disruptive forces in different ways and at different paces, but the industry model as a whole will evolve over time to become flatter, more agile, and more able to respond to internal and external market forces. It is expected that the role of the traditional utilities will evolve into more of a network integrator.
The onset of new energy resources—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.

Regulatory policies have successfully facilitated the proliferation of these new energy resources, particularly renewable resources and distributed generation. Policy is broadening to compel adoption of demand response and energy storage as well. Additionally, 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 non-traditional 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. In this regard, utilities will need to 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.
Drivers

Rapid technological advancements, coupled with greater customer awareness of energy consumption, are driving an increase in customer demand for energy-related products and services.

In turn, the market viability of technologies such as distributed generation and energy efficiency products has increased the ability of customers to minimize reliance on electrical grids is forcing utilities to respond. The increased use of rooftop photovoltaic (PV) solar panels illustrate the rapid pace of technology and its effect on customer behavior and demands (and ultimately on utility operations and revenue). Once deemed too expensive for the average residential consumer, advances in panel efficiency and reductions in material cost, combined with innovative financing arrangements promoted by new market entrants such as SolarCity and Vivint, have made the prospect of rooftop PV solar a financially feasible option for homeowners in some markets, while presenting new challenges to the current capital-intensive utility business model.

Much of the previously mentioned technology change is being backed by non-traditional sources of capital investments in energy. Influential technology companies such as Google, Microsoft, and Apple are investing heavily in distributed renewable energy options in an effort to both reduce power costs and enhance power reliability to key data centers. Likewise, large retailers such as Walmart and Costco have made the reliability and resiliency of power to their operations a key area of investment. In both instances, the result is significant investments in PV solar and wind generation capacity.
Beyond the market for renewables, new players and new capital sources are contributing to the development of new products that will facilitate customers’ ability to reduce reliance on the traditional grid model. Tesla, widely known for marketing electric vehicles, is also at the forefront of battery storage research and development. The company’s substantial production investments in a Nevada-based “gigafactory” seek to change the economies of scale for battery manufacturing and make market viability for grid-scale energy storage a reality. Others, such as industrial giant Honeywell and Google-backed Nest, have developed connected in-home products that enhance consumer understanding of energy use and provide the information necessary to reduce energy demand. This push into energy products connected to the “Internet of things” is also furthered by start-up companies backed by alternative investors such as large private equity and venture capital firms and wealthy individual investors.
All of these developments are playing out in an **ever-changing regulatory landscape**. U.S. states and Canadian provinces such as California, Arizona, Alberta, Ontario, Quebec and British Columbia have begun responding to market forces by crafting legislation that promotes net metering and facilitates the installation of residential PV solar panels, small wind turbine or other renewable micro-production units. These changes do not occur without tensions; both California and Arizona are at the center of debates over how to properly compensate homeowners contributing electricity to the grid and utilities responsible for maintaining distribution lines. In Canada, net metering initiatives to date are nascent and limited to electricity exchange programs.

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The agile utility – Future-state industry model
Other jurisdictions have been motivated to force changes in the utility industry by more extreme circumstances. Widespread power outages caused by Hurricane Sandy and severe winter storms have led states and provinces such as New York, Connecticut, Massachusetts, Quebec and Ontario to mandate enhanced grid reliability and resilience that, in turn, promotes the implementation of distributed generation and microgrids.

Individually, any one of these changes, whether technology-, customer-, or regulator-induced, could force changes to how a utility operates. When combined, these drivers constitute a significant threat to the utility industry status quo, one that its members cannot afford to ignore.
While the future model of the electric utility industry may look different based on market or geography, several key components and themes will appear as market participants seek to become more agile.

The following “functional entities” will likely emerge—some new, some evolved from current-state. The Network Integrator will be at the forefront of the harmonization and integration of the various stakeholders’ expectations of capability and technology.

— **Network Integrator:** The “transformed” distribution utility that will serve as the integrator of the diverse mix of generation entities, transmission entities, and retail and customer demand with the primary responsibility to provide reliable, resilient, and safe energy delivery that is cost-effective and leverages standardized technologies.

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 Independent System Operator (ISO) or Regional Transmission Organization (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.

— **Transmission Operations:** The Network Integrator may import or export electricity from its distribution grid, necessitating interaction with major electricity markets and transmission operators (the traditional high-voltage, grid operator). Network Integrators will interact with these cross-jurisdictional 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.
**Generation**: Generators for Network Integrators will range in size from substation-level assets to aggregators of residential on-site resources and will complement the traditional grid level (thermal, nuclear, etc.), renewable grid-level (solar, wind, hydro, geothermal), distributed (grid-level) generation and customer generation. Network Integrators will manage the dispatch of distribution-level resources 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. 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**: As part of their responsibility to maintain the balance of power in the low-voltage grid, Network Integrators could work with a single storage project or aggregation of on-site storage resources/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.

**Retail Product and Service Providers**: Marketers and sellers of power as a commodity, as well as “new” products and services (e.g., storage service, backup service, rooftop solar, demand response programs, energy contracts, others) will maintain the billing relationship with energy consumers, not the Network Integrator. 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.

**Metering Service Providers**: The collection of consumers’ energy consumption data will be administered by metering service providers that will also be responsible for the maintenance of the equipment along with meter data storage and analytics. Network Integrators will liaise with metering service providers to obtain consumption data relevant to the broader performance of the distribution grid.

**Market Operations**: “Traditional” ISOs and RTOs that manage grid interconnections, perform energy market settlement, and other activities will interface with the Network Integrator as it provides them with the information needed for effective resource planning across the broader region.

**Energy Wholesale Markets**: Network Integrators could evolve their role to supply distribution level energy into wholesale operations, utility traders, and financial traders that participate in energy markets.

It is important to note that while some entities may continue to be vertically aligned, market forces will put pressure on all participants to compete in ways they have not had to consider in the past—potentially leading to new participants, expansion or consolidation of market positions, and overall market upheaval. 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.
Core Functions of the Network Integrator

Will perform functions to support proactive and predictive outage management across the low voltage network, disaster planning and recovery, critical event management, and other activities related to outage restorations.

Will serve as the primary owner and operator of distribution infrastructure, and will manage asset optimization across the distribution network.

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.

Will aggregate intelligence and effectively collaborate with both public and private sector actors to minimize security threats.

Will manage the dispatch of storage resources at the substation level and the storage market/s that may arise.

Will collect, analyze and deploy distribution grid data for improved stakeholder engagement.

Will assume a greater role in managing the dispatch of distributed energy resources (DER), in effect functioning as ISOs or RTOs.
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 ISOs or 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 as 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.
Impact of changes

Under these anticipated industry environment changes, utilities will need to make changes to their operating model to adapt.

Deregulation of electricity and natural gas markets has provided an initial preview of what this change looks like. In deregulated markets, the potential for customers to choose their power generation source combined with third-party control of transmission routes has removed the need for utilities to maintain generation assets. By shedding these, utilities are better able to focus on power distribution and customer billing. As the effects of the previously detailed developments become more pronounced and deregulation expands to more jurisdictions, utilities can expect to make further changes to how they operate.

Customer and regulator demands for improved grid reliability and resiliency will force utilities to increasingly focus on improving their distribution capabilities and infrastructure. Two key means of enhancing grid reliability and resiliency are expanding distributed generation and implementing microgrids. Distributed generation requires the installation of localized power generation sources throughout a distribution grid so as to minimize the potential for blackouts such in instances consistent and in equal measure to where more centralized power generation facilities support a wider distribution network.

Regulation

In the Network Integrator model, the relationship with the jurisdictional 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 where 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 approach, 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.

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

— **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, 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 non-traditional players, which, in turn strengthens the need for a Network Integrator.

— **Third-party capital investment:** Non-traditional 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.
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 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 rate-making 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 jurisdictions 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?
5 Agility is key

The key to success in this changing and uncertain environment is to ensure that agility is built into the strategic business models, target operating models, and key transformation initiatives of power and utility companies.

Those firms that exhibit **business model agility** (whether in the power and utility industry or in other sectors), tend to demonstrate: an openness towards new market opportunities; an ability to frequently monitor change; and strong, proactive relationships with customers, regulators, and key stakeholders.

Similarly, firms that exhibit **operating model agility** tend to deploy: simplified, standardized processes and technologies; innovative, flexible organization, culture, and people; governance functions that enable the business; and operations that are aligned to business model strategy.

Companies can improve enterprise agility in several ways:

- **Monitor key developments and changes** of the disruptive forces and scenarios occurring in the industry. Develop a list of key variables that can detect, guide, and point towards key developments and changes of the transformational forces and scenarios occurring within (and outside) the industry, and develop real-time systems and processes to track changes to these variables.

- **Deploy flatter and more flexible operating models** with the ability to enable faster decisions and execute actions to respond to changes in customer demand, regulatory shifts, technology advancements, and other market changes or disruptive forces.

- **Proactively engage with customers** by implementing enhanced programs, tools, and processes that enable meaningful customer sentiment and feedback, and enable employees to track and respond to trends in customer sentiment.

- **Reward innovation** by implementing incentive programs oriented towards rewarding new ideas regarding efficiency, safety, innovation, and customer service.

- **Increase investment in innovative technologies** that are aligned with strategic goals and targeted business models. Given the rapid pace of change in enterprise technology, power and utility companies should also consider those technologies that exhibit agile capabilities as well.

Above all, agility must be an organizational and cultural trait. Companies that adopt agility as a strategic value driver and enterprise core competency—rather than treat it as a one-time initiative or project—will be better prepared to respond to the current and future challenges and opportunities facing the industry.
We see the response as twofold.

The strategic response. All utilities should:

— Assess the disruptive forces at play to determine both the short-term and long-term impacts to their business models.
— Determine how they will monitor the pace, complexity, and impact of coming changes.
— Conduct scenario planning exercises, focusing on the known and the unknown.

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

— Evaluate and standardize processes – lock down the “known”.
— Simplify the organizational 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 be asking the following questions of their organizations:

— Are we able to respond to changing customer demands?
— How are we monitoring marketplace activity?
— How are we monitoring risk?
— Are we conducting scenario planning?
— Can we anticipate what our regulators are planning?
— Do we have the right technology to support our business objectives?
— Do we have the right talent to get the job done?
— Are we 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 be marginalized by changing market forces.

As power and utility companies begin to assess their role in the changing industry marketplace they will see both challenges and opportunities in the disruptive forces presented.
Leadership in the Power & Utilities Industry

KPMG has built one of Canada’s largest energy practices and services leading organizations in the generation, transmission, distribution, and retail energy and electricity sectors. Clients range from new start-up firms to major power and utility corporations.

KPMG also has an impressive track record assisting companies with acquisitions, divestitures, and organizational changes. We understand the ongoing regulatory challenges that impact companies in the energy industry, and we regularly represent clients in regulatory proceedings. In turn, we help regulators understand industry and stakeholder perspectives.

Our commitment to the Power & Utilities industry is evident by the contributions we make through our local, national and global network. Our professionals regularly generate thought leadership, sharing insights with clients and the market place by way of publications and other materials.

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 dynamic area.

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