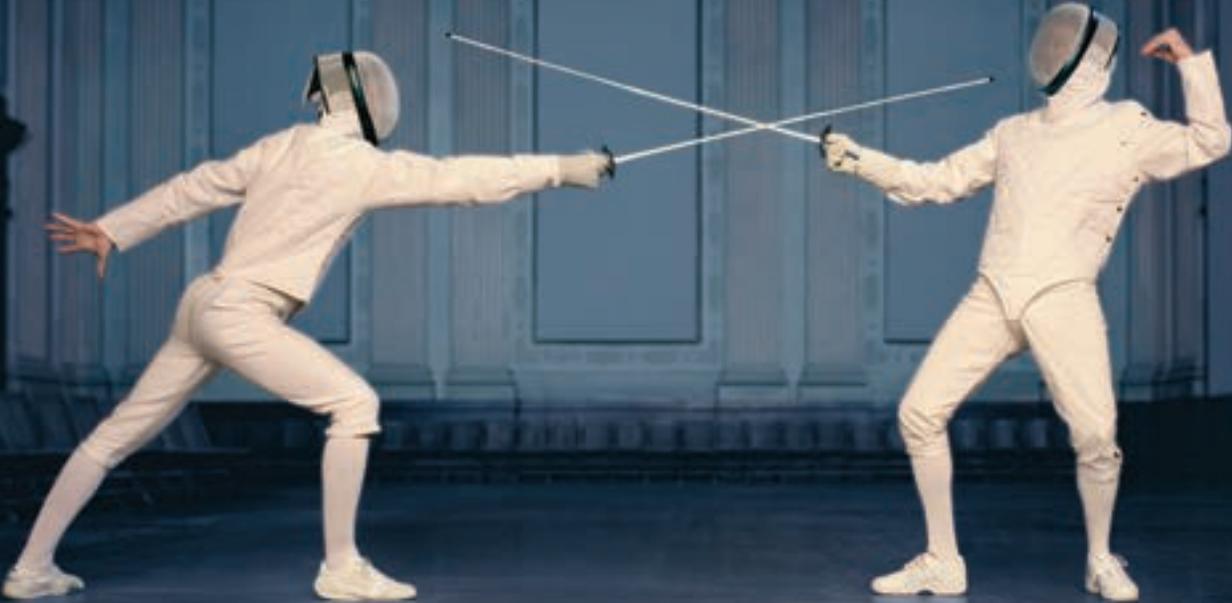
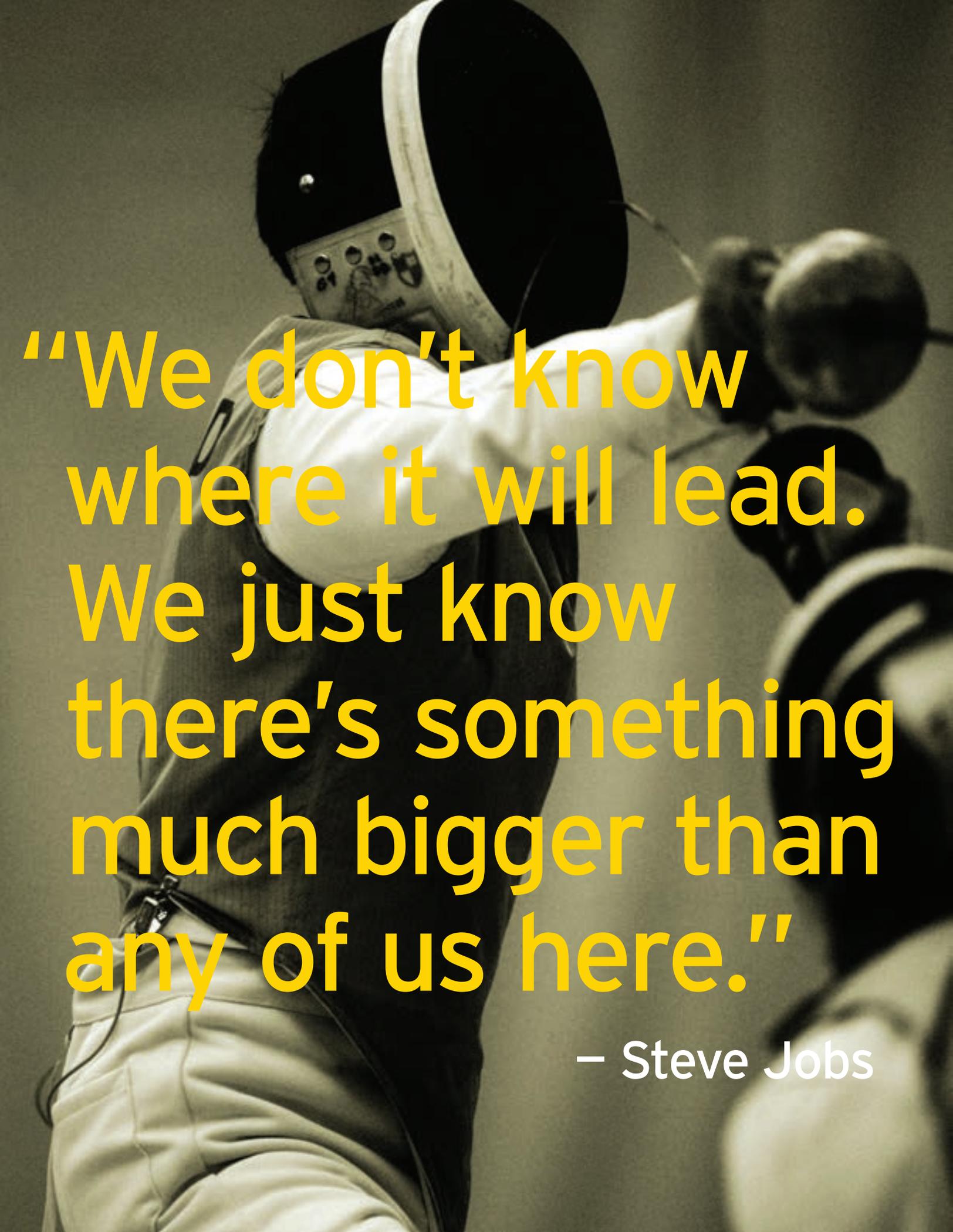


# From defense to offense

Distributed energy and the challenge of transformation in the utilities sector



Building a better  
working world



“We don’t know where it will lead. We just know there’s something much bigger than any of us here.”

– Steve Jobs

## Executive summary

For decades, the electric power sector – whether regulated or deregulated, wholesale or retail – operated on a simple premise: we have the power, and when our customers need it, we will provide it. Within this context, even with limited or no load growth, the electric power sector had been counting on long-term earnings growth, and therefore, shareholder value creation via the so-called virtuous cycle: capital investment (or rate base growth) leading to satisfied customers, in turn leading to accommodating regulators. Now, in 2014, US power markets are in the early stages of a transformation driven by the adoption of distributed energy.

Most predict that by 2020, utilities will reach a tipping point where power from rooftop solar PV will become cheaper than power from the grid in most parts of the US. As a result, conventional centralized, dispatchable, fossil- or nuclear-based generation will gradually be impacted by the customer adoption of distributed energy resources (DER). In fact, some foresee a future cliff for traditional generation when DER is combined with affordable storage technologies.

Over time, DER adoption, combined with the impact of energy efficiency initiatives, will change the sector's value chain. The current integrated one-way model, comprising generation, marketing and trading, transport, distribution and retail, will become multidirectional, with both conventional and new entrants as well as "prosumers" – consumers who are also producers – acting as generators.

This DER adoption will impact how electricity is produced and consumed, transforming utilities' business models and how they create value for customers and shareholders.

As befits a sector where conservatism is a useful trait, many power companies

are working to preserve the status quo. For some, this means getting rid of net metering – a model that allows DER adopters to sell power back to a utility at retail rates, which could potentially result in a cost shift from customers who adopt DER to customers who don't.

Most agree that net metering and tiered volumetric rates do not provide a sustainable long-term business model for electric utilities. However, even if net metering goes away, disruptive challenges associated with DER will remain. Utilities need to move from lobbying against the transformation to leading it.

The threat DER poses to incumbents is significant, and attempting to deny the situation with status quo forecasts or blocking the inevitable outcome by penalizing customers who adopt DER is futile. It's time for the sector to move over to the offensive by developing DER-friendly strategies and business models that focus on creating customer as well as shareholder value.

There is no one-size-fits-all solution, but there are a variety of strategies that utilities can follow in dealing with the changes associated with distributed energy.

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### Five imperatives for utilities



# A fundamental shift

The value proposition for DER in the form of distributed solar PV has never been more attractive, and this trend will continue.

At first, DER adoption was driven by state and federal incentives and tax credits, as well as environmentally conscious consumers. The incentives reduced the customer capital outlay, improved the economics of DER systems and enabled early scaling in the sector.

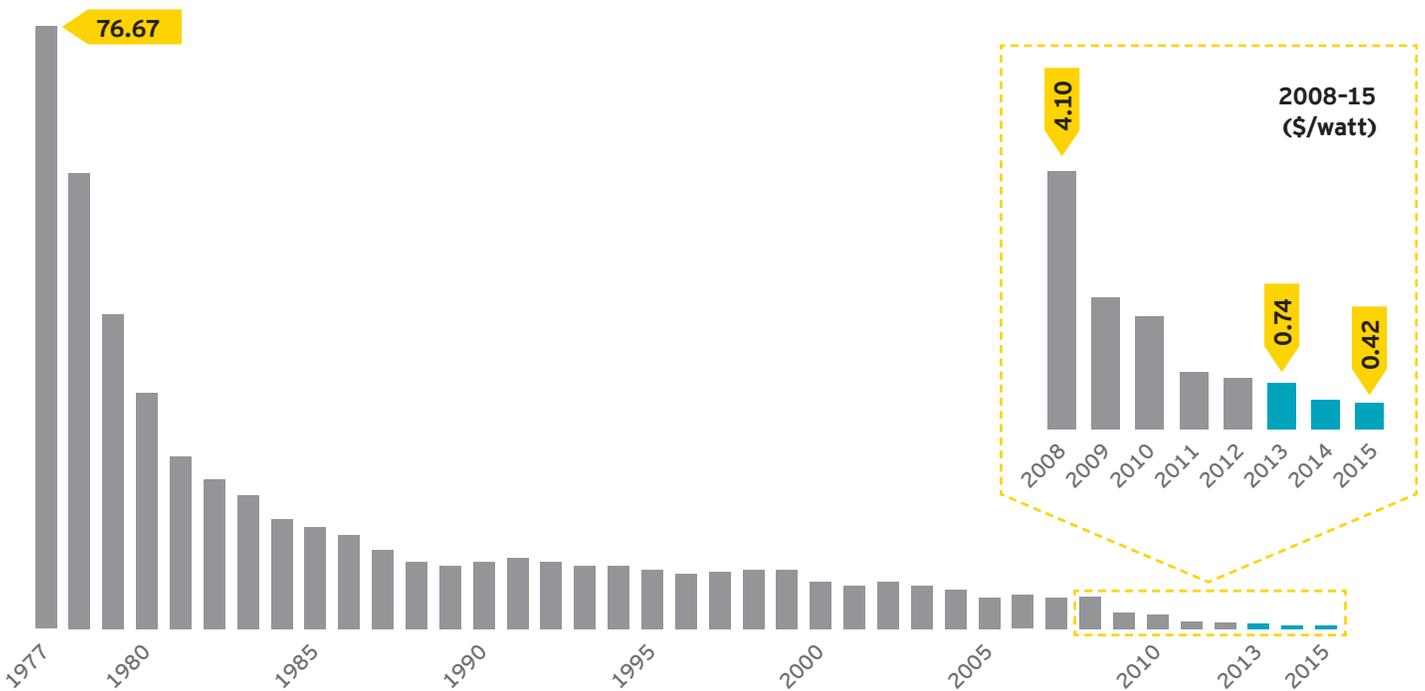
In addition, fierce competition among module manufacturers in established solar markets such as Germany led to significant reductions in module costs – more than 80% since 2008 (Figure 1).

Increasing numbers of installations in the United States have also driven down the balance of system costs (installation labor, permitting, interconnection and inspection). A comparison of balance of system costs in the US to those in Germany

suggests that these costs will decline by 10% to 15% annually in the coming years.

Further supporting the case for customers to adopt DER, a number of utilities have instituted time-of-use and/or critical peak pricing. High-price periods under these rate models typically coincide with optimum solar PV energy production periods, making it easier for distributed solar to beat the utility price of electricity.

**Figure 1 Price of crystalline silicon PV modules 1977-2015 (\$/watt)**



Sources: Bloomberg New Energy Finance, National Renewable Energy Laboratory, Greentech Media, EY analysis.

■ Forecast

At the same time, innovative business models and attractive value propositions are spurring DER adoption. New system financing and leasing options have broken down the barriers associated with up-front costs.

In 2003, SunEdison constructed and brought to market the Power Purchase Agreement (PPA), where a developer arranges for the design, permitting, financing and installation of a distributed solar system. The developer then sells the power generated to the host customer at a rate less than the local utility's rate. Many distributed solar developers have begun offering similar financial options.

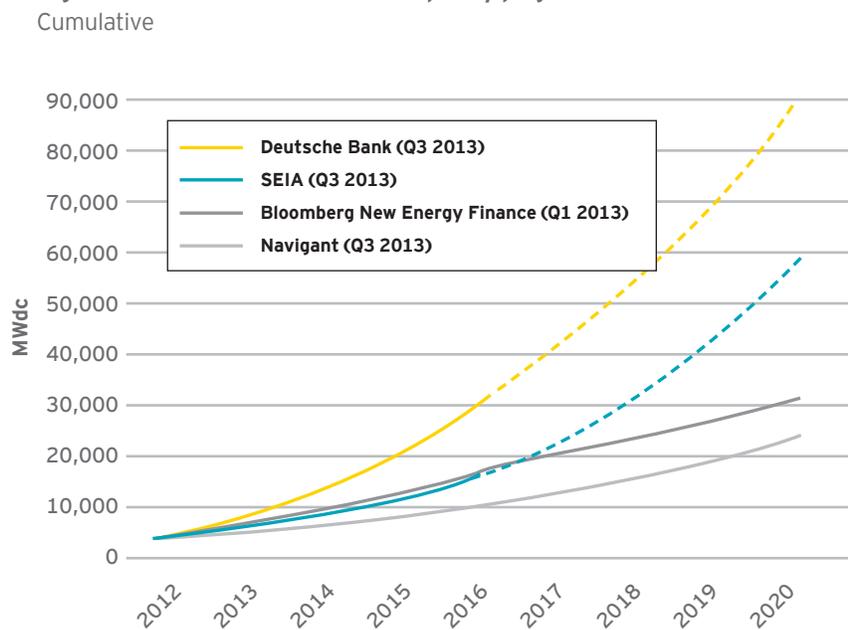
Similar to a mortgage, lease agreements and PPAs allow users to repay system costs over time and require little or no money down. Customers can be cash flow-positive immediately, dramatically reducing the investment hurdle to adopt DER. Today, third-party-owned (i.e., leased) projects account for the majority of the rooftop solar market in California.

These innovations and compelling value propositions are core reasons for the tremendous growth of the distributed energy sector.

While no one knows when utilities will really start to feel the pain of consumers detaching themselves in whole or in part from the grid, there are many estimates as to how fast they will leave (Figure 2).

Accurately forecasting DER adoption overall and within a specific utility's jurisdiction is difficult.

**Figure 2 US distributed solar PV capacity projections**



Sources: Solar Electric Industry Association, Navigant, Greentech Media, Bloomberg New Energy Finance, Deutsche Bank, Edison Electric Institute, Solar Electric Power Association, Energy Information Administration, EY analysis.

Note: Out-years in the Deutsche Bank and SEIA forecasts represent extrapolations.

Moreover, envisioning how US power markets and electricity delivery systems will operate in the "end state" is incredibly complex. Nevertheless, a fundamental shift is underway.

The increasing scope and power of customer decisions brings a new dimension to the electric utility business

environment. In the past, utilities exercised a high degree of control over investment decisions and operational management. In the future, utilities will be coordinating a vast array of supply- and demand-side resources owned and operated by independent prosumers. It's just a question of when.

## Five imperatives for utilities

Utilities will increasingly feel the impact on profitability as the customer adoption of DER reduces revenue from usage-based rates. Accordingly, utilities need to develop strategies and outline initiatives to accomplish the following five imperatives.

1

### Position the utility to compete

Traditional thinking related to utility spend goes something like this: cuts in operations and maintenance (O&M) are only worthwhile in the short run because any gains go back to the ratepayer in the next rate case; and any capital investment that can pass the prudence test by regulators is good, because capex means rate base growth, which means earnings growth. However, in a competitive market with new entrants, this philosophy doesn't work.

Utilities that own central station generation assets are the most exposed. But wires-only utilities should be concerned about the pricing and value proposition of new entrants' DER offerings

as well. With increasing DER adoption, power plant owners and wires-only utilities both need to identify the potential for stranded capital investment and take steps to mitigate it.

Accordingly, utilities need to do anything they can to minimize the trajectory of their rates while not jeopardizing service quality, customer satisfaction or safety. This means reducing or optimizing both O&M and capital investment.

While the term "transformation" is something of a buzzword today, the concept of being a low-cost, or, at a minimum, a high-value service provider

as a competitive strategy is inviolable. All of the elements of the operating model – business processes, organization design, in-source/outsource decisions, the performance management model – need to be taken apart and put back together again, but at lower cost and high or improved service levels.

The critical success factor for US electric utilities will be changed behaviors. Utility leadership teams need to design and commit to a transformation roadmap that will create a more efficient and effective utility operating model and the ability to compete.

The concept of being a low-cost or, at a minimum, a high-value service provider as a competitive strategy is inviolable.

# DER will force changes in the planning, design and operation of the distribution system.

## Transform the grid

2

DER will make both operations and long-term planning more complex because it has a higher degree of output variability than traditional sources. To transform the grid, utilities need to implement new innovative solutions to match the requirements that large-scale adoption of DER will bring.

Today, the electric grid is largely static and ill-equipped to manage local sources of generation. DER requires a more configurable network to better manage load flow and maintain power quality. As DER grows as a market force, the grid must evolve into a more distributed, digital and dynamic system that provides two-way communication between customer DER and the utility. Enhancing and modernizing the grid represents an opportunity to plan system upgrades strategically, minimize total cost and improve network flexibility.

System operators will need increased awareness into real-time status of variable DER in order to make certain the

distribution network remains balanced. Utilities are investing in distribution management systems that aim to provide enhanced situational awareness, but these systems require real-time data from nearby points on the network (or the DER locations themselves) to accurately adjust for the variability of DER. This variability will make balancing the system (e.g., routine load flow analysis, scheduling and dispatching generation, maintaining voltage and frequency, determining appropriate levels of spinning reserve) more challenging, and utilities are likely to incur additional costs in their efforts to do so. This complexity will increase over time as greater numbers of DER installations become part of the system.

Utilities also need to change the way long-term plans are developed as they aim to transform the one-way, "closed" energy distribution system into a more dynamic "open" architecture through the phased implementation of smart circuits, PMUs, synchrophasor technology, dynamic line ratings, volt-VAR optimization systems

and D-SCADA, for example. To be able to effectively plan for the long term (e.g., generation, transmission, substations and distribution system upgrades), utilities will also need to forecast output from installed DER, as well as potential output from future DER installations.

Managing this integrated and complex system will require new architectural approaches to acquire readings, manage the data and provide operators with the right levels of situational awareness. It will involve implementing controls to manage the challenge of intermittency and variability that could have disastrous effects on grid operations, system security and reliability. Grid analytics will become increasingly important as an operational "real-time" tool and in support of long-term planning. Regulators and stakeholders will need to support and fund pilots and full-scale implementation so that the grid can be transformed to meet these new requirements.

### 3

## Manage the transition

When a renter breaks a lease, there are buyout costs that are part of the deal. But people pay those costs because the overall value proposition of moving to a new place is worth it.

Utilities have legacy assets that were built under a well-understood and accepted traditional utility model. While positioning for the changes that lie ahead, utilities need to take actions that seek, to the greatest extent possible, full cost recovery for these legacy assets, including return of capital investment via accurate cost-of-service and rates that avoid subsidization and free riders, for example. The transition needs to be managed – utilities need to recover investments made and costs incurred in a pre-DER world.

Working with regulators and stakeholder groups, utilities will need to execute against an integrated regulatory strategy:

- ▶ Replace net metering with transparent pricing for all energy delivery-level ancillary services and

backup power supply for bundled utility customers, utility DER customers and customers that install DER via third parties; make sure this pricing model is adaptable for when storage becomes commercially viable

- ▶ Implement a wires cost recovery mechanism that is non-volumetric, independent of energy consumption from the grid (e.g., all fixed costs, including return on equity (ROE) recovered through demand or interconnection charges)
- ▶ Improve the economic viability of backup power capacity regardless of the technology (e.g., coal-fired power plants required for transmission grid support)
- ▶ Put in place proper incentives to support capacity additions, as well as appropriate cost recovery/returns associated with ancillary and related services and supporting systems (e.g., operating reserves (regulation), contingency reserves)

Most important, regulators must preapprove investments to modernize the grid, implement new technologies and provide backup power in order for utilities to receive returns on investment and return of capital. The Federal Energy Regulatory Commission's formula rate mechanism for transmission is one such regulatory mechanism involving preapprovals with a clear line of sight related to returns. At the state level, Illinois' Energy Infrastructure Modernization Act is a legislative and regulatory example of formula rates, with transparent allowed ROE calculations, quarterly rate adjustments and approved capital investment tied to performance outcomes.

Regardless of the DER adoption trajectory, an electrical grid is still a societal must-have. Unlike cable TV, you can't cut this wire completely. The regulated utility will remain, and the regulatory model needs to evolve in a way that enables DER while allowing regulated utilities to continue to provide essential grid services.

## Utilities need to recover investments made and costs incurred in a pre-DER world.

# Delays in processing permits and scheduling inspections, for example, result in the utility, not the solar provider, being blamed.

## Focus on the customer

### 4

For some time now, utilities have acknowledged the importance of the customer. Often this importance has been expressed in terms of reliability or customer service. More recently, in connection with the virtuous cycle discussed earlier, utilities have recognized that customer satisfaction is a critical success factor for any regulatory strategy to deliver on intended objectives of cost recovery and acceptable returns.

However, with the increasing adoption of DER, the customer-utility relationship will change. Reliability will continue to be important, and so will customer satisfaction. But as the roles shift, customers' consumption patterns will help define their capability as suppliers. In addition, combined with price signals from the utility, receptive customers will be able to complement energy from DER with managed energy consumption patterns via load control and measurement devices.

Different customer segments will respond to DER and energy management products and services differently. In their resource planning efforts, the utility will need to consider how quickly customers install solar panels or how willing they are to

manage their energy usage. To maximize the possible benefits of a pro-DER strategy, the utility will need to focus on the customer.

Associated with carefully defined and quantified customer segmentation strategies and tailored business streams, utilities will need to identify customers in terms of value-based segments. This will require a dramatically increased knowledge of customers and the development of enhanced insight into customer behaviors and preferences, beyond today's typically available demographic data.

To better understand behavioral motivation and customer preferences and to customize product and service offerings, utilities will need to increase their sophistication and proficiency in data management and related analytical capabilities through the use of big data.

Utilities will also need to align organization elements and commit the required resources to create and manage a broader and hopefully differentiated range of product and service offerings, as well as a broader range of pricing options and sales strategies and tactics.

Energy from DER and managed energy usage provides an opportunity for the utility or third parties to aggregate DER production and demand response potential into market offerings.

Accordingly, utilities will need to deal with and coordinate a more diverse set of marketplace actors than ever before. Further, utilities must increase the diversity and sophistication of their sales channel and account management capabilities, including greater use of low-cost channels, outbound marketing and alliance networks and partnerships.

Deep customer insights, active product service development, marketing execution and fulfillment and service excellence are core capabilities that any company needs in any sector. To manage the utility-customer system in a world of increasing DER adoption, utilities will need to transform their operating model, and in so doing, build strengths today for tomorrow's marketplace.

# Only a few utilities have begun to stake a claim to some of the value created by DER market penetration.

## 5

### Innovate and accelerate

The ongoing transformation of the energy landscape spells challenges for earnings growth and returns for utilities. At present, utilities are either fighting, enabling or accommodating the adoption of DER in their service territories. Only a few utilities have begun to stake a claim to some of the value created by DER market penetration. To do more than fight or simply enable distributed energy, utility companies need to answer classic questions of strategic direction in the following three areas:

1. What business or businesses are we in? What products and services do we provide, and what markets do we serve?
2. What are our strengths? How will we compete?
3. How do we tailor our future operating model and structure?

Answering the first question harkens back to deliberations that utilities went through during the sector's "retail wheeling" phase. When some states opened retail markets and made power generation competitive, utilities faced a choice: keep generation and run it as a separate business that operates in competitive power markets, or sell generation and be solely an energy delivery utility. Some chose the former; others chose the latter and exited the business of power generation and sales in competitive markets.

Distributed energy means that utilities, even "energy delivery-only" utilities, face a similar question: if competitors provide customers with distributed energy services through a business and financial model that involves customer acquisition, panel installation (including permitting, inspection and interconnection), monetization (including tax credits and tax depreciation) and system operation and maintenance, does it matter?

Some will stop and say "The regulators won't let us," but solar companies' PPA/leasing model is only one way to overcome first-cost barriers. Would the answer to "Does it matter?" change if regulators permitted utilities to install solar panels on the homes of customers with low credit scores and put the cost of the panels in rate base?

Alternatively, if the answer to the "Does it matter?" question is yes, then the other questions become important.

Beyond installing solar panels, there are a range of other complementary service offerings that can be considered, including energy efficiency reporting, in-home diagnosis and upgrade services. For example, off of its customer base, one California-based solar company has conducted more than 16,000 home energy evaluations and performed more than 2,500 energy efficiency upgrades

that address heating and cooling systems, duct sealing, water heating, insulation, high-efficiency furnaces, weatherization, pool pumps and lighting. The company also markets and installs charging stations for electric vehicles (more than 2,000 sold to date).

Beyond the pure sale and installation of solar rooftop panels, utilities can examine and consider strategies to help customers manage solar energy generation. Some solar companies are likely to follow the lead of solar players in Europe in helping to aggregate available load and energy use potential in connection with demand response and virtual power plant offerings.

Utilities will need to consider these opportunities (and challenges) but also answer the other two questions posed.

Transformation driven by the adoption of distributed energy solutions will change the basis of competitive advantage and create new value pools and potentially lucrative opportunities. This will require a business model that can adapt to changing conditions – one that shifts the focus from being a passive supplier of a product to an active manager of that product, including managing the supply and demand, price, marketing and even the timing of energy consumption to maximize capacity utilization and optimize a system that will be dominated by DER and gas-fired generation.



## Summary

For the US electric power sector, the question is not if or even when the change will come, but rather, how fast.

Distributed energy is on a trajectory to become a cheaper source of power than bundled utility service offerings that are based on today's power supply portfolio. Many predict that DER will reach parity with utilities' average rates by 2020, particularly when combined with other factors like energy efficiency and energy management services and technologies. Increasingly, utilities will feel the impact on profitability as the customer adoption of DER reduces revenue associated with electricity provided by the utility.

Now is the time for utilities to start transforming their business models to be able to compete. They must fundamentally redefine and aspire to the standards of competitive leadership, undergoing a radical shift in the way they think about performance. Incremental improvement programs will not suffice and defend or deny strategies will not be sustainable.

Senior management should align around a point of view and a way forward. Success can then be built around the following imperatives:

- 1. Position the utility to compete.** Utility leadership teams need to design and commit to a transformation roadmap that will create a more efficient and effective utility operating model, one that will be able to offer new products and services and compete against new entrants.
- 2. Transform the grid.** As DER grows as a market force, the grid must evolve into a more distributed, digital and dynamic system that

provides two-way communication between customer locations and the utility.

- 3. Manage the transition.** Utilities need to take actions that seek, to the fullest extent possible, full cost recovery of legacy assets to recover investments made and costs incurred in a pre-DER world.
- 4. Focus on the customer.** To maximize the benefits of a pro-DER strategy, utilities need to increase their customer knowledge and the range of their offerings.
- 5. Innovate and accelerate.** Utilities should adopt a business model that can adapt to changing conditions - one that captures and provides value in connection with distributed energy.

Management theory has consistently questioned the ability of incumbents to transform versus succumbing to the forces of creative destruction and becoming irrelevant from both a customer and shareholder perspective. The view is transformation is a daunting challenge and suggests that there will be winners and losers.

However, utilities have no choice but to adapt or become extinct like so many businesses in other industries that failed to transform; those dinosaurs became the stuff whereof business school case studies are made.

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