

Choose, aggregate, transact:

Increasing options for
electricity customers

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Executive summary

Growing demand for renewable energy is driving business model change up and down the electric utility value chain. Many utility customers want to participate in energy generation and consumption in new ways. They often want to choose the resources in their energy supply mix, participate in aggregated forms of distributed energy, and access transactive energy platforms. It is evident in the US and other markets around the world that these trends represent a transition from passive consumption to active customer participation in energy markets. This transformation is both enabled and driven by increasing penetration of distributed energy resources (DER). In response to this new paradigm, many electricity providers are adjusting their business models.

To adapt, many electricity providers are discovering ways to leverage these three types of customer participation to retain and engage customers, monetize distributed

resources, and test non-wires alternatives. Customer retention and engagement are top of mind for many industry executives as DER service providers have enhanced value propositions through cost reductions and bundled product offerings such as solar-plus-storage. In response, many electricity providers have made investments to integrate DER solutions into their portfolios of service offerings. They are also exploring how to monetize DER by bidding aggregated resources into wholesale energy markets and expanding into new customer segments. Finally, residential and commercial and industrial (C&I) customer demand for renewable energy—coupled with their desire for enhanced participation—is driving business model change by prompting utilities to explore how DER, aggregation platforms, and transactive energy technologies can replace or defer traditional transmission and distribution investments.



Introduction

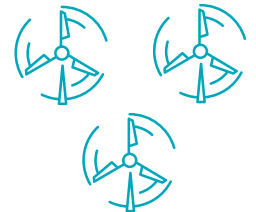
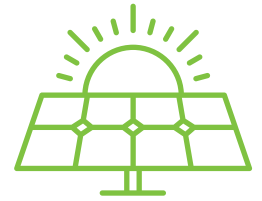
The first wave of growth for renewable energy was driven by state renewable portfolio standards (RPS) and the availability of federal tax credits. In certain markets, state-level mandates continue to motivate utilities to procure renewables and tax equity remains an important aspect of project financing. However, it is becoming increasingly clear that customer demand could drive the market long after procurement goals are met and tax incentives expire. This customer demand seems driven in part by declining costs. Since 2008, on average, the levelized cost of energy (LCOE) for land-based wind has dropped by 41 percent, distributed solar photovoltaic (PV) by 54 percent, utility-scale solar PV by 64 percent, and battery storage by 73 percent.¹

Additionally, concerns about climate change have emerged as a significant driver of customer demand in the residential and C&I segments. The *Deloitte Resources 2016 Study* cites that 65 percent of residential survey participants are “very concerned” about climate change and their personal carbon footprints. Corporations are also ramping up engagement when it comes to climate change concern. More than 500 companies globally—with combined annual revenue exceeding \$8.1 trillion—made carbon reduction commitments as part of the We Mean Business (WMB) coalition’s Take Action campaign. Eighty-seven of those companies are members of RE100, a business consortium formed to promote renewable procurement. These companies alone will likely create demand for approximately 107 terawatt hours (TWh) of renewable power globally per year.² To make an even more compelling case, 71 Fortune 100 companies set renewable procurement targets or sustainability goals.³ Bloomberg New Energy Finance (BNEF) estimates that by

2025, companies will need to sign another 17.4 gigawatts of wind and solar power purchase agreements in the US to fulfill their publicly announced renewable energy commitments.⁴

Furthermore, in some markets, state-level regulation is driving a sea change in the way industry participants respond to customer demands. In New York, as part of the state’s Reforming the Energy Vision (REV) policy, the Public Service Commission on May 19, 2016 approved a set of Earnings Adjustment Mechanisms (EAM). They were characterized as “historic structural reforms to the regulations governing electric utilities, providing more choice and cost-saving opportunities for New Yorkers by expanding clean and renewable power.”⁵ Of course not every state regulatory body is enacting such transformative policies.

All this comes at a time when electricity providers are challenged by flat to declining demand for electricity and feel pressure to manage costs, grow earnings, and continue paying dividends to public shareholders. As a result, many electricity providers are exploring new ways to capitalize on the increasing customer demand for renewable energy⁶ and business models are evolving through technology advancements, partnerships with DER solution companies, and experimental program models. In response to customers’ motivation to participate in energy generation and consumption in new ways, many electricity providers see profitable opportunities to provide customers with more options to choose renewable resources, benefit from distributed resource aggregation, and access transactive energy platforms.⁷



Expanded choices meet customers' demands for renewables



To address customer demand for renewable resources, many electricity providers are strategically investing in and acquiring capabilities that allow customers to choose their energy supply mix. Since 2010, European and US utility companies have reportedly invested over \$2.9 billion, by way of partial ownership or acquisition, in DER companies.⁸ These strategic investments can allow for expanded access to C&I customers including corporations, hospitals, schools, and other large end users. While the majority of electricity providers' DER investments were equity infusions made by their unregulated businesses or venture capital funds, the largest share of these investments were acquisitions of behind-the-meter C&I solar developers made with the intention of weaving renewable product offerings into corporate strategies. This is one approach electricity providers

are taking to both capture a share of the growing distributed solar market and retain customers who otherwise would have engaged third-party DER service providers to install solar—and increasingly, energy storage—at their facilities. The potential for DER applications to disrupt electricity providers' businesses is significant, so they are making strategic decisions to align with the disrupters before they are disrupted themselves.⁹

Residential customers that reside in deregulated states with retail choice often have the option to buy clean energy directly from a competitive retail electricity provider. This is not the case in regulated markets, though various vertically integrated utilities do offer green pricing programs with premiums averaging around 1¢–2¢ per kilowatt hour (kWh). Participation by

residential customers grew by 6.3 percent from 2014-2015. However, most of this growth came from the 10 largest utility green pricing programs, which account for about 68 percent of sales. Mid-sized and small program growth actually showed a 7 percent and 12 percent decline, respectively, suggesting that some utilities are losing residential participation despite the aggregate increase in sales (Figure 1).¹⁰ The decreasing popularity of the majority of these programs is prompting some vertically integrated utilities to provide alternative options for residential customers to choose their supply mix. A partnership with a third-party marketplace for solar and other DER providers is one increasingly popular approach.

Ameren Corporation, a public utility holding company in the US, with operations in Missouri and Illinois, is testing the feasibility of bringing customers more options to choose their resource supply mix based on price signals and carbon intensity. For this two-phase pilot, Ameren deployed utility-leased DER at its own facilities and integrated a tertiary controller to the distribution system similar to those used to dispatch large central generators in the Energy Management System (EMS) layer of the electric grid. Initiated in 2016, phase one involved the deployment of distributed generators and battery storage. Phase two—which is ongoing throughout 2017—will experiment with advanced load management. The pilot is unique because of the distribution-level controller's ability to dispatch decentralized energy sources connected to Ameren's medium-voltage distribution network. Ultimately, innovators at Ameren envision integrating this system with a customer-controlled interface, such as a tablet, to put decision-making power in the hands of customers. Using advanced algorithms, the utility's monitoring and control system—coupled with a distribution operations digital dashboard—enables utility operators to choose an optimum supply mix from DER resources based on

resource cost, carbon-intensity, and climate conditions. The utility also provides the option to buy electricity from the grid based on locational marginal price (LMP) and other characteristics of the generation mix.

For Ameren, this controller technology and future customer interface has the potential to offer a compelling value proposition to residential and C&I customers. It provides facilities managers the opportunity to optimize behind-the-meter DER resources to meet sustainability and carbon reduction goals. And for residential customers, Ameren sees the potential to connect this advanced controller technology with smart inverters tied to rooftop solar PV and battery storage systems. Such a platform would have the potential to give Ameren customers the resource options they demand, while allowing the utility to seek regulatory approval for grid integration of low-carbon resources. Therefore, if scaled beyond an internal pilot, Ameren would offer its customers value that goes beyond the traditional role of utilities in North America. However, regulatory barriers remain in Illinois where the utility is restricted from owning generation in the state's deregulated market.

For example, by partnering with EnergySage, an online marketplace that enables comparison shopping among pre-screened solar installers and financiers, utilities empower their customers with access to objective solar information and guidance. Utilities benefit from monetizing solar interest in their market, serving their customers with branded, turnkey solar tools, and gaining unique data and insights into solar activity in their service territory. The utility could even theoretically bid into the marketplace itself by offering on-bill financing for residential solar systems and create an additional revenue stream. Such online marketplaces are extensible to other energy products and services such as heating and cooling systems and home electric vehicle charging stations. These types of partnerships allow utilities to bring more choice to their customers, improve customer satisfaction, and facilitate consumer protection while delivering value to their businesses.



Green Pricing Sales Growth by Program Size

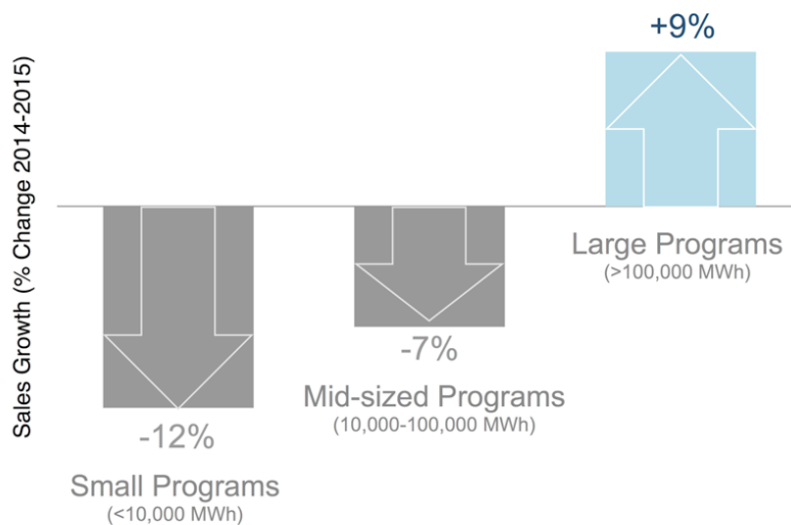


Figure 1. Green pricing sales trends (percentage change in program sales from 2014 to 2015) by program size⁴

Aggregation can open new markets, lower costs, and improve grid efficiency



As demand from customers to choose their energy resource mix fuels further penetration of distributed, renewable resources on the grid, electricity providers and customers alike see the opportunity to extract more value from DER through aggregation. This next frontier of participation includes customers that pool their buying power and demand to choose renewables, as well as utilities that engage DER aggregators for grid balancing and other customer services.

Corporations and other C&I customers with interest in buying renewable power do not always have the financial resources to invest in or own power assets. Some are addressing this market barrier by creating what has become known as a buyers' syndicate—a group of companies or organizations that partner to pursue renewable energy purchasing deals. Syndicates purchase power from renewable resources, rather than owning the assets themselves, and typically involve an intermediary that is responsible for organizing and liaising between the off-takers.

For example, in October 2016, three large C&I customers based in the Greater Boston area partnered to sign a power purchase agreement (PPA) for 60 megawatts (MW) of solar from a North Carolina solar farm owned by one of the nation's largest utility companies. Such geographically dispersed transactions are financial contracts that fully or partially fund the development of renewable facilities and count toward customers' renewable procurement goals.¹¹ Similar arrangements have also been assembled in markets outside the US. In Europe in November 2016, a consortium of four large international corporations joined together with two local Dutch co-operatives to sign a PPA for 350 megawatt hour (MWh) per year of wind power from Windpark Krammer.¹² This aggregation of buying power could expand access for C&I customers such as universities, hospitals,

and small businesses that were previously unable to afford renewable procurement. Greater access to C&I customers may allow electricity providers to sell renewable energy into broader markets and create new revenue streams.

Another form of aggregation that has been driving business model change is community solar. According to the 2016 Deloitte report, *Unlocking the Value of Community Solar*, these programs present an opportunity for residential and C&I segments to invest in a solar array or receive credits on their electricity bill for solar power not located at their home or business.¹³ Community solar programs come in many shapes and sizes and can be either utility or third-party led. They are largely viewed as a way to access the 77 percent of US residential households that are ineligible for rooftop installations due to low FICO scores, lack of homeownership, or any other reason.¹⁴

A leading third-party community solar company, Clean Energy Collective (CEC), is not only developing and managing programs on its own, but also working with utilities to deliver community solar to customers through its proprietary Community Solar Platform. "Utility-led programs are commanding a greater share of industry growth, and CEC's Community Solar Platform is allowing utilities to approach community solar in different ways," according to Tom Hunt, senior vice president of Corporate Development, CEC. "By standardizing the technology, investor-owned utilities (IOUs) are able to roll out and manage larger, comprehensive community-renewable programs to address rising customer demand. The customer acquisition, bill crediting, program management, and other functionalities also give them the option to procure large PV projects and assimilate them into their community solar programs." These enhanced capabilities—coupled with the option to own community solar assets and

potentially include them in the rate-base—allow utilities to monetize these programs through a regulated return or service fees. As program structures evolve and standardize, the customer retention and engagement benefits of community solar will likely become more apparent, which could further enhance the value proposition of these programs.

As described above, buyers' syndicates and community solar programs can demonstrate the benefits of aggregated demand. Supply-side aggregation may also present an opportunity to drive value to utilities, while producing customer benefits through lower costs and a more efficient grid. Through dynamic optimization of DER assets, Enbala Power Networks¹⁵ can provide real-time energy balancing by controlling and optimizing previously untapped behind-the-meter resources. For example, a utility in the Maritime region of Eastern Canada is partnering with Enbala to balance the high penetration of wind energy connected to its grid. Enbala's Renewable Firming application can engage C&I loads—such as the heating, ventilation, and air conditioning (HVAC) systems found in C&I customers' buildings—to provide approximately 3 MW of renewable firming capacity to the utility. Where permissible, this capacity could be bid into wholesale energy markets, creating a revenue stream for utilities. Through its platform, Enbala can integrate renewable energy while simultaneously optimizing behind-the-meter loads. And as customer demand for renewables drives further penetration of behind-the-meter solar-plus-storage systems, electricity providers will likely have greater opportunity to compensate customers for participating in these aggregated platforms. Furthermore, if more storage capacity comes online, Enbala's platform could enable utilities to monetize the benefits of peak demand management, voltage regulation and renewable firming applications.

"The growth in distributed generation, solar, wind, and other forms of distributed energy is phenomenal, and utilities need software systems capable of managing all that energy," said Enbala President and CEO Bud Vos. "We believe we'll see hundreds of thousands or even millions of distributed energy assets connected to the grid in the very near future. To truly unlock the potential of the grid edge, utilities will need to optimize these assets with a very high degree of accuracy in seconds, or even sub-seconds, to ensure that power is moving to the right places at the right time."

Engie, the global energy conglomerate previously known as GDF Suez, has developed its strategy around three priorities: lower its exposure to commodity prices, prioritize low-carbon energy resources, and focus on downstream customer solutions to grow earnings.¹⁶ To achieve this, the company intends to increase its global renewable energy portfolio by 70 percent by 2030. It also has made several acquisitions to adapt to a more customer-centric marketplace. For example, the acquisition of Retroficiency has allowed Engie to leverage data-driven insights to improve large end users' efficiency programs. OpTerra Energy Services brings comprehensive, turnkey energy efficiency and distributed generation solutions for C&I customers. Green Charge Networks rounds out Engie's DER portfolio by adding energy storage optimization capability.¹⁷ Through its command-and-control system, Green Charge Networks helps customers reduce their electric bills by up to 30 percent while also providing grid-balancing services. With each of these acquisitions, Engie is hoping to build its capabilities

to meet customer demands for decarbonized, decentralized resources, while acquiring the tools necessary for renewable energy integration such as firming and ramp-rate control.¹⁸ Engie's strategic efforts to bring greater value to customers could simultaneously enable a more efficient grid and broaden the company's exposure to C&I customers.



Engaging customers through transactive energy platforms



A shift away from passive consumption to active participation by way of DER ownership and aggregation opportunities has prompted some consumers to seek compensation for their new forms of involvement. Furthermore, as distributed solar PV and battery storage continue to penetrate the grid and automated technologies play a greater role in the lives of all consumers, they are often demanding more efficient digital forms of active energy management. This is of particular importance to the millennial generation. More than 38 percent of this cohort surveyed in the *Deloitte Resources 2016 Study* say that they get some energy management tips through social media, compared to only about a quarter of the general population.¹⁹ As consumer preference for digital interactions shape the way we pay for and consume products and services, transactive energy platforms will likely become a more pervasive mechanism for customer participation in energy markets. The GridWise Architecture Council broadly defines transactive energy as a system of economic and control mechanisms that allow a dynamic balance of supply and demand using value as a key operational parameter.²⁰ Within these platforms decisions are made based on assessment of value and can be analogous to or represent actual economic transactions.

Blockchain, a technology that enables transactive platforms, is generating growing interest in many industries, including the electricity sector. Made famous by the cryptocurrency, Bitcoin, blockchain is a distributed ledger or database technology that chronologically records and links transactions in a secure fashion. Blockchain can enable peer-to-peer (P2P) models of power production and distribution. It has the potential to generate smart contracts—the digital, automated agreements encoded on the blockchain that define the terms of the transaction just as any traditional contract would—as well as other financial instruments. It can also facilitate the

exchange of metering data and unlock value in smart home devices. The technology first gained traction in the US electricity sector when a small group of neighbors in Brooklyn, NY used the Ethereum blockchain platform to trade behind-the-meter solar energy through programmable smart contracts.²¹ Enabled by smart meter data and Internet-of-Things (IoT) devices, the Ethereum platform has the potential to conduct secure, transparent, and efficient energy trading amongst neighbors, albeit on a small scale.

Blockchain is often described as an opportunity to “cut out the middle man” or transact independently of traditional intermediaries such as banks, financial traders, or in this case, utilities. However, there is considerable opportunity for electricity providers to adopt the technology. Grid Singularity is a not-for-profit entity enabling utility adoption by designing an open source, blockchain-enabled platform for the electricity sector. As explained by Grid Singularity co-founder Dr. Ana Trbovich, “Building upon the Ethereum platform, Grid Singularity and select partner companies are developing a public energy blockchain that is maintained by distributed authorities. The energy blockchain aims to facilitate scale, necessary for commercializing many of the prospective use cases referenced by the industry today, while keeping all the advantageous features of blockchain, namely authenticity and security.” In early 2017, Grid Singularity teamed up with the Rocky Mountain Institute (RMI) to form the Energy Web Foundation (EWF), which was established as a nonprofit organization that aims to accelerate the adoption of blockchain in the sector by working with utilities, regulators, customers, and blockchain developers. With the support of EWF, the energy blockchain could be an open source operating system for a range of applications in the energy sector.

Just as in the early days of the Internet, the functional capabilities of the blockchain have yet to be determined. The potential of

the technology is just beginning to unfold in the electricity sector as small startups demonstrate the potential of blockchain and incumbent utilities begin to pilot various applications. Assuming advancements are achieved, it is likely that electricity providers could first test use cases such as peer-to-peer exchanges of excess solar energy, utility-facilitated trading of grid flexibility among large end users, and automatic diagnosis of network failures. Experts anticipate that blockchain could accelerate the transition to a distributed renewable energy future. However, the rate of acceleration will largely depend upon technology advancements, the establishment of industry standards, and the effective education of government-backed program managers and regulators.²²

In addition to residential customers and utilities, some government agencies may be starting to appreciate the value of establishing transactive energy platforms. Australia’s new Decentralized Energy Exchange (deX) seeks to develop a digital marketplace for grid services provided by a network of virtual distributed resources such as rooftop solar panels and battery storage. The project is partially funded by the Australian Renewable Energy Agency (ARENA) and aims to reduce energy costs, drive investment in renewable energy, stabilize the electricity grid, and buffer it against surges in demand such as the recent heatwaves.²³ The Australian government convened electricity network operators, software providers, and an energy retailer to deploy this transactive marketplace. ARENA’s investment seeks to give customers the opportunity to extract greater value from their DER by effectively renting their assets to the utility when and where they are needed most. In June 2017, the utility servicing Canberra and Melbourne’s Mornington Peninsula plans to deploy distributed solar-plus-storage coupled with the deX platform as a non-wires alternative to traditional transmission and distribution investments.

Conclusion



Evolving forms of customer participation—including demand for options in their energy supply mix, aggregation opportunities, and access to transactive energy platforms—may continue to motivate electricity providers to adjust their business strategies. As providers adapt to more sophisticated consumer expectations by enabling new forms of market participation, they are likely to generate value through customer retention and engagement, DER monetization, and non-wires alternatives. Increased investment in DER solutions—and the resulting higher valuations secured by companies making those investments—demonstrate the necessity of adopting business models to accommodate customer preferences for renewables and other DER. With so many innovative developments taking shape at such a rapid pace, it appears the race to create the most effective business models has only just begun.



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