



Welcome to the ENGIE Energy Revolution

The world has primed the energy market for a change. The retail electricity landscape is getting more and more complex, accompanied by increased demands and expectations from a broad range of market participants. As a result, the energy economy of the future looks very different than it does today, in no small part because technology has reshaped the way we navigate life in any number of ways.

This raises a critical question: “Is the industry prepared to fully react to this new landscape, and can we apply our energy knowledge and expertise and put it to work for the greater good of everyone?” At ENGIE, we believe we can, and in doing so will ensure that customers have the power they need, when they need it, at a reliable price, without interruption. But doing that will require a new conversation about value and a shift in focus from managing solely price risk to managing price and quantity risk. We call this transition the Energy Revolution. It is not only a new approach to thinking about customers’ relationship with energy but also about how we as an industry can partner with our customers to better manage costs, consumption, and environmental impact.

Integrating Modern Concepts Into The Utility Grid of the Future

At its core, the Energy Revolution is about how we can work in concert with customers to advance three critical objectives:

Decentralization: A new paradigm for generating and distributing power at the fringes of the grid.

Digitization: The conversion of complex information into a digital form that

can be easily accessed, shared, and acted upon.

Decarbonization: Reducing the environmental impact of electricity generation and consuming energy.

Historically, power systems have been built on three pillars of infrastructure: Electric generation, transportation, and distribution. It was a centralized model, one in which electricity flowed in a

single direction from a single source, the plant, to a market of single end users, the customers. When society needed assurances that supplies would remain secure, the industry responded by building more plants, lines, and wires. Capital investments in 2016 alone totaled \$117 billion, according to SNL Energy, an expenditure driven to a great degree by the need to replace half-century-old infrastructure and improve natural gas transmission and distribution

The Energy Revolution believes that the old response to shortage and reliability concerns – i.e., to only build more, and more expensive, infrastructure – is no longer the only response to the challenges of the future. Instead, we seek to expand the role that customers can play in helping to control costs and assure supply (through decentralization) and contribute to reducing the carbon footprint associated with power generation (through decarbonization).

capabilities. Moreover, the Brattle Group has forecast that an investment of an additional \$2 trillion or more will be needed to address future needs.

Despite the cost, the system has worked for the most part. Regulators made correct decisions designed to ensure security of supply, manage costs, and to protect the environment. Utilities of all sizes generated electricity at a common frequency of 60 hertz. Regional transmission organizations and independent system operators controlled and monitored the grid. Competitive markets introduced efficiencies in generation. For example, barely two decades ago, a single power plant was fossil-fueled, generated perhaps 900 megawatts of electricity, and employed 200 people. Today, a combined-cycle gas plant uses cleaner-burning natural gas, generates 1,000 MW of power, employs 25 or so people, and can be started up or shut down in a matter of hours rather than days. In other words, the industry is producing more power, with greater efficiency, at lower costs. That would have been virtually impossible had markets not been liberalized.

But even with those successes, the system failed to take advantage of a fourth pillar: *customers*. The Energy Revolution believes that the old response to shortage and reliability concerns – i.e., to only build more, and more expensive, infrastructure – is no longer the only response to the challenges of the future. Instead, we seek to expand the role that customers can play in helping to control costs and assure supply (through decentralization) and contribute to reducing the carbon footprint associated with power generation (through decarbonization). For this to succeed, however, the industry must better engage with customers to help them make conscious decisions about how they can make generation more

flexible, more efficient, and more reliable than ever.

A New Definition Of Value

As suggested above, a central aim of the Energy Revolution is to make the power system more customer-centric. An essential first step in that process is to reconsider what constitutes true “customer value.”

As the energy landscape has evolved in recent years, electricity providers have often responded by offering products and services that deliver near-term – but not long-term – value to customers. We believe that model is not focused enough on the three basic demands that customers make of providers – *lights, climate control, and the full use of life’s modern amenities* – nor does it satisfy their need to have those obligations met in a clean, cost-effective, and secure way. As such, it is likely unsustainable in the new energy economy. The challenge, then, is to adopt a new, more relevant definition of value that makes customers an indispensable part of the equation. The Energy Revolution provides a roadmap for doing that.

Risk Management Best Practice

Traditionally, electricity providers have worked to help customers manage price risk – how much they spend – and have done a very good job in that regard. As long as price alone was the only driver of the provider-ratepayer relationship, this may have worked. But in today’s energy world, price is no longer the sole concern, and “ratepayers” are better viewed as “customers” whose interests are not limited to the monthly bill alone. Beyond that, other stakeholders in the power system – regulators, environmentalists, grid operators, etc. – have an array of interlocking interests that are not a function of price alone. This new reality requires a major shift in industry thinking.

The Energy Revolution acknowledges the diverse demands of these diverse audiences. As such, we believe it is essential that the industry begin a conversation that centers less on price risk management and more on price and *quantity* risk management – not just what customers pay for power, but how and when they use that power. The fact is, if we can help customers use less energy at less expensive times of the day, we can help them reduce their overall energy spend. At the same time, however, we can ease stress on an aging, already stressed-out energy infrastructure, better ensure reliability, and reduce the carbon impact of generation.

But, once again, this will require another shift in thinking, an acceptance of the fact that our energy future cannot be built on expensive new construction alone. It must be constructed on a foundation of big data, expanded Internet-based tools and technologies, and an infrastructure that is smaller, cleaner, and more in the control of the end user. This cannot be achieved by new policy initiatives, new congressional mandates, new regulations, new transmission lines, or new generating facilities. Rather, we must change the ways customers interact with energy, and provide them the tools, technologies, and information necessary to have a significant, substantial, positive impact on the nation's energy future and those who have a stake in it.

Customer-Centric Technology Is Key

Managing this transition will in many ways be a function of technology and data. By digitizing and analyzing critical information about customer consumption habits – once again, when and how they use power – retailers can offer products that can optimize customers' roles in reducing

costs, ensuring a reliable supply, and minimizing environmental impact. But this will require the industry to take advantage of an opportunity that has so far largely eluded us: Communicating with customers in order to access relevant, real-time, actionable data. To achieve this, however, retailers will need a type of technology that, in effect, mirrors the body's neural network.

Consider the comparison. In many ways, the body is the perfect system. It efficiently delivers blood and is regulated by a neural network that is constantly processing information in order to naturally solve problems the body may encounter. Over time, technology has actually improved that efficiency through devices such as heart monitors and pumps that can provide data that fosters better health. Similarly, the current electric system delivers power through a relatively efficient system of generation, transmission, and distribution assets. But what it lacks is the widespread ability for providers to directly connect with customers by giving them real-time data that can be used to make better, smarter decisions about energy usage.

To be certain, some of these technologies exist today. We are seeing a proliferation of devices at the fringe of the grid – such as rooftop solar, smart thermostats, and batteries – that allow customers to generate their own power at their own sites (decentralization) or identify their usage patterns by criteria such as time of consumption and appliance. While that information has tremendous value, it is largely one-way; that is, the responsibility for optimizing or assessing its value is left with the customer. It is incumbent to leverage that value by determining methods in which the data can be shared with and analyzed by retailers, who can apply their expertise and knowledge to communicating better,

smarter generation and consumption strategies back to consumers – much as technologies improve the functioning of the body's neural network. Fostering the growth and customer-centric potential of these technologies is a centerpiece of the Energy Revolution.

Benefits for All

The Energy Revolution seeks to foster a new dialogue between retail electricity providers and stakeholders that focuses on managing both price risk (what they pay for electricity) and quantity risk (when and how much they consume it). By reducing consumption without compromising comfort, this has the potential to better serve a wide range of market participants in a number of ways that are vital to the nation's energy future:

Grid operators: Less stress on infrastructure. There is little doubt that the nation's energy infrastructure, the regional grids in particular, is facing more stress by the day. In 2016, the United States saw its largest increase in generating capacity since 2012, according to the Energy Information Administration. On a net basis, the United States experienced an average increase of 18.3 gigawatts per year from 1950 to 2015. By helping customers focus on managing usage – and providing them real-time information that empowers them to make smarter decisions about how much power they use and when they use it – the Energy Revolution can reduce demand and, as a result, reduce the need for additional capacity. That, in turn, can reduce stress on the grid and minimize the potential for blackouts or brownouts.

Regulators and the environment: Decarbonization and easier integration of renewables. A major issue facing regulators and other market participants is how to contribute to a



low-carbon future by integrating clean energy into the grid. Currently, some grids simply do not have the capacity to accommodate more solar and wind power. In California, for example, about 2.2 gigawatts of renewable energy was curtailed because of oversupply, essentially letting it go to waste. By reducing the amount of energy consumed, however, more renewable power can flow into the grid and be more easily and efficiently distributed. This has the added advantage of reducing the demand for fossil fuel-fired generation, thus further enhancing the potential for a lower-carbon future.

Businesses: Reduced costs, budget certainty. Power is one of the largest budget items for most American businesses. Commercial facilities alone – including hospitals, office buildings, warehouses, retail stores, etc. – use about a fifth of all electricity consumed in the United States. But by working with companies of any size to use electricity more wisely – and providing them the data they need to make informed decisions about when and how much they use – the Energy Revolution can help drive down their electricity costs and prevent volatility in monthly bills. That could free up more capital to create jobs or foster investment, as well as supporting operational and overall system efficiency.

Customers: Lower bills, reliable supply. Of all the beneficiaries of the Energy Revolution, the American people are ultimately the biggest winners. Smarter usage and reduced stress on the energy infrastructure add up to lower monthly bills, reliable and affordable pricing, dependable supply, and a grid that can withstand peak demand without blackouts. In other words, power will be available, when it's needed, at a predictable price.

Our Vision: To Make The World A Better Place
At ENGIE Resources, we believe strongly that the energy world of tomorrow is bright with potential. However, the only way to achieve that potential is to re-think our traditional ideas about power, about value, and about our relationship with customers. If we can successfully make that shift, we can help customers make smarter decisions about energy, helping cut costs and support a lower-carbon future. We can reduce stress on the energy infrastructure, assuring security of supply and making it easier to integrate renewable generation onto the grid. We can give decision-makers the confidence of knowing that the markets they oversee will serve society in the best possible way. By doing all of that today, and by transitioning to a new conversation defined by a new model of price risk, use, and consumption, we will change the energy landscape of tomorrow for the good of everyone.

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