# WHO MOVED THE POWER UTILITY'S CHEESE?

## Key Considerations for Succeeding in a Turbulent Energy Market

## Introduction

The energy market is experiencing a seismic shift, driven by decentralization, digitalization, and the constantly increasing use of renewable energy sources. Regulations encouraging the use of low-carbon energy sources and the opening of monopolized markets to competition, as well as stipulations requiring better service and lower prices for consumers, have further reinforced these trends.

The magnitude and pace of industry disruption have placed many incumbent power utilities in a precarious economic position. According to PWC's 2017 Power and Utilities Trends Report, end-use electricity consumption declined in 22 out of 28 EU countries between 2005 and 2014. At the same time, supply continues to rise due to growing renewable power investments. The result has been a drop in wholesale power prices, which undermines the economics of utilities' legacy power generation. In the U.S., for example, the Energy Information Administration (EIA) reports that since 2002 the electricity sales growth rate has hovered around 1 percent or less per year, and demand has declined in five of those years.

As revenues continue to drop, utilities realize that their traditional business models, based on vertically integrated operations, are less viable going forward. To succeed in this dynamic and disruptive ecosystem, utilities need to adapt their operations and business models to meet a new set of operational and consumer-driven requirements.

## Emerging Requirements for Utilities

Let's examine some of the new business and operational requirements that utilities should prepare for if they wish to thrive in tomorrow's energy market.

### Flexibility and control for consumers

Consumers want more choice and control beyond basic electricity service. They expect better service, less outages, lower costs and more options to choose from. In a digital world, consumers place higher value on having control of how and when they consume energy, from which sources and providers – and are willing to pay for this control. New technologies, like smart metering and a digital network infrastructure, let consumers and utilities "see" and better control where, when, and how electricity is being used so they can more efficiently manage consumption and cost.

As a result, consumer engagement has fast emerged as a critical area of focus for utilities. To date, no single strategy has emerged around how best to engage consumers. Personalized products and services, as well as utility online portals, apps, and integrated energy service platforms, are some of the ways utilities can better engage customers.

Flexibility is also important from an operational standpoint. As supply becomes more variable, transmission and distribution grids need to be more flexible to balance supply and demand. This includes, for example, encouraging residential and business customers to participate in DR programs to reduce load by leveraging the flexibility of home-based and grid-scale energy storage devices. This flexibility can help utilities avoid the construction of new expensive centralized transmission and distribution infrastructure.

### Smooth out the "duck curve"

The graph below, showing net load on the power grid during the day, illustrates the "duck curve" phenomenon. The lines show the net load – i.e., the demand for electricity minus the supply of renewable (solar and wind) energy – for different years. We can see that energy demand reaches its daily peak in the morning (between 6 A.M. and 8 A.M.) and early evening (between 6 P.M. and 8 P.M). There is a deep mid-day drop in net load as solar energy floods the grid, with a steep ramp-up as the sun fades in the late afternoon. As renewable energy becomes more common, the duck curve is appearing more often and is getting worse.

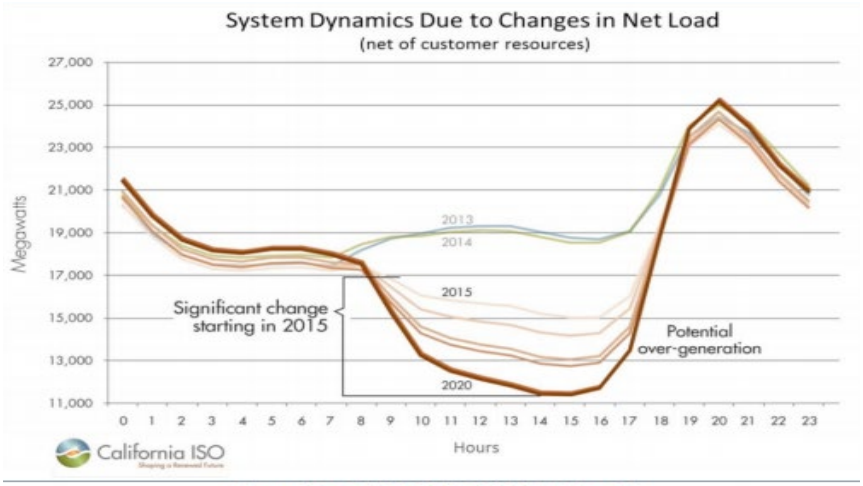
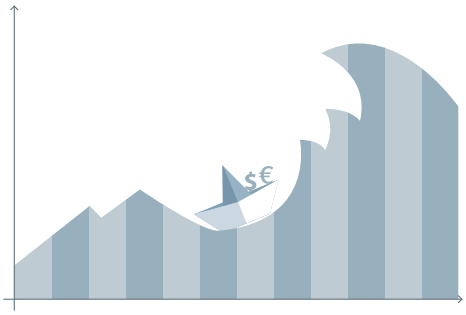



Figure 15: CAISO 2013-2020 Net Load

The duck curve is problematic for several reasons. Traditional grid assets, such as transformers and feeders, were built to supply a stable level of energy production and run power plants around the clock to support these loads. Sharp peaks and steep ramp-ups put these assets under stress and can even result in power outages. Another problem is that when demand is very low (i.e., mid-day), it is not cost-efficient to maintain baseline energy production, so grid operators need to ramp down (and sometimes even shut down) some of their plants. Following that period, the rapid increase in demand means that grid operators have to quickly turn back on these power plants, which can lead to instability in the power supply and high maintenance costs.




Smoothing out the duck curve is critical for maintaining grid stability and the health of critical grid assets, such as transformers and feeders. Advanced analytics and smart grid management capabilities, such as load forecasting and peak shaving, are required to optimize energy flow to the grid. With these capabilities, utilities can leverage home and grid-scale battery storage to supplement the grid to meet peak demand, optimize operational planning, lower energy costs and minimize outages. As photovoltaic and battery storage hardware continues to fall in price, this will become an increasingly viable option.

## Integration of DERs

The shift from centralized power plants to distributed energy resources (DERs) is already at a tipping point and is expected to drive a major shift in utility business models in the next decade. According to a July 2017 Navigant Research study, new DER capacity deployments (e.g., solar, wind, batteries, thermal storage) will surpass new centralized generation installments by the end of 2018, and outpace new centralized generation deployments going forward.

Rather than continuing to view DERs as a threat, utilities now need to find ways to turn the proliferation of DERs into an opportunity. Relying on their experience, utilities have a distinct information and technological advantage when it comes to selecting, deploying and integrating DERs.

In this context, it's important to understand the impact of DERs on the traditional grid and power network. The grids used today were built to flow in one direction – from the power plant (generation) to businesses and homes. These grids and their equipment assets were carefully planned to deliver low-voltage at the edge (i.e., adjacent to the home), taking into consideration the energy drop across the feeder. Now that consumers are also generating electricity using DERs, this fundamental balance has been disrupted. The changes in voltage levels can damage service transformers and feeders, as well as affecting home appliances.

Thus, utilities have a vested interest in connecting to DERs (due to regulations and customer expectations), as well as controlling them in order to ensure high-quality electricity for their customers. Efficient integration of DERs requires a new set of capabilities for managing energy flow across the grid, including load forecast, management and optimization as well as DER aggregation, analysis and integration. These functions may be handled automatically by smart grid management applications, smart DERs and smart appliances, rather than manually by operators in the control room. The utility of the future needs to be part of this game – if not, an aggressive upstart or new player will do it instead.

## Drive new revenues in a competitive market

Increased competition across the supply chain (i.e., generation, transmission and distribution) represents a major challenge for incumbent power utilities. Formerly enjoying the benefits of a natural monopoly, utilities now find themselves competing with a host of new players – such as VPPs, traders and aggregators – that are not burdened by fixed costs of operating the grid.

Moreover, declining grid consumption, partly due to the increased use of renewable energy, has eroded wholesale power prices and revenues over the past decade. As noted earlier, customers are becoming more energy efficient, potentially purchasing power directly from a third-party supplier, or producing their own power.

New types of data-driven and customer-responsive services are needed to survive and even prosper in this competitive environment. Forward-looking utilities are moving from a commodity-based model (i.e., selling kilowatts of energy) to a service-based model that leverages renewable energy and other smart "behind the meter" services. Here are a few examples of innovative, technology-driven services already being offered by utilities to enhance revenues or increase customer loyalty:

- **Energy trading** – Encourage consumers to become "prosumers" that produce, sell and store their own energy using battery technology. Prosumers can sell energy to one another (peer-to-peer) or to the utility. Intelligent monitoring, control and communication technologies enabled by the intelligent grid are required for effective energy trading.
- **EV charging stations** – Set up infrastructure required to support public fast charging stations for the growing number of EVs on the road (private cars and busses). Utilities are well-positioned to provision the required energy, as well as owning the stations and selling the electricity to EV owners.
- **Smart EV charging** - Encourage car owners to recharge their vehicles inexpensively when there are large supplies of renewable energy on the grid (e.g., power generated from solar panels on a sunny day). Car owners could even be paid or receive a credit to do so.
- **Solar battery sharing** - Sell large home batteries to customers that already have solar panels. The surplus power generated by the solar panels is stored in the battery and the utility can tap into a portion of that storage to help balance the electricity grid. Customers are paid for allowing use of their batteries.
- **Home energy monitoring service** – Install smart meters that allow customers to control their domestic heating settings through a smartphone app, with displays that show electricity and natural gas consumption in detail, along with other information like weather forecasts.
- **Power trading** – Since power cannot be stored on a large scale, generation utilities and aggregators have an opportunity to sell surplus power to other utilities with a power deficit in terms of meeting current demand. Power trading is based on market prices and varies continuously based on supply and demand.

## Conclusion - Intelligent Grid Management Is Critical

The scope and pace of the energy industry's transformation - driven by new regulations, increasing customer choice, appearance of new players and technology innovation - introduce challenges as well as exciting opportunities for incumbent power utilities.

To address new business and operational requirements, utilities require comprehensive intelligent grid management systems (DERMS) that can monitor, control and optimize the energy flow across millions of DERs. By leveraging home and grid-scale batteries, utilities can smooth out demand peaks and valleys (duck curve), avoid power outages and minimize energy costs. At the same time, smart grid management enables utilities to offer innovative business models, such as peer-to-peer energy trading, as well as supporting renewable energy and demand response initiatives.

Such a solution helps utilities to cope with rising grid complexity, regulations for cleaner energy and customer expectations for reliable service at reduced cost. To succeed in an increasing competitive, turbulent and complex energy market, incumbent utilities need to reinvent their grids and management systems.

## About mPrest

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By connecting the dots across multiple disciplines, mPrest delivers unified situational awareness, sophisticated analytics, end-to-end IT/OT integration and process management. Featuring unprecedented interoperability and real-time data optimization, mPrest allows organizations to accelerate time-to-market, improve system performance and reduce operational costs.

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