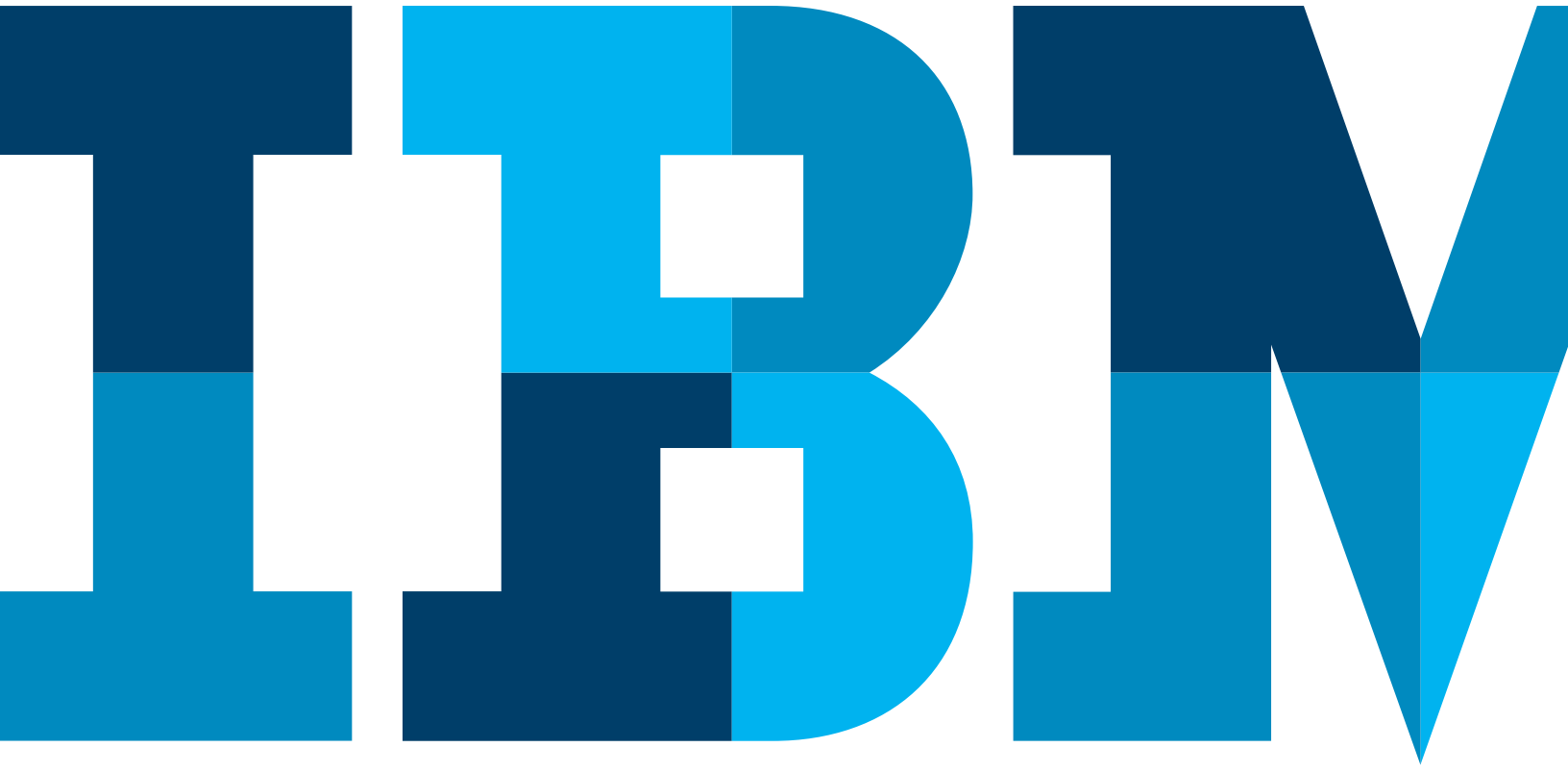
How energy, environment and utilities organizations thrive from disruptive innovation



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Industry challenges

We are all participants in the energy transition. The world's energy use is becoming more electric, sustainable and diversified. Its production is becoming more volatile, and is integrating with supply and value chains that were previously considered separate from the energy industry—transportation and water being two important examples. Increasingly, these shifts are driven by changes in social and political norms. In short, it's more complicated and ever more critical that these shifts are managed so that they result in more economical and efficient utilities.

The technological and business disruptions sweeping the electricity and energy industries overall are outcomes of advances in energy production technology and changes in how consumers use—and don't use—energy. These changes threaten the electric industry's 100-year-old business model. Consumers and regulators, however, still expect utility providers to offer safe, reliable, affordable and sustainable energy.

These challenges catalyze two-sided innovation. On one side, new entrants are innovating around the traditional utility business models, engaging customers with new technologies and methods. On the other side, incumbent utility businesses, which are frequently regulated, must also innovate to defend against the threat of disintermediation and loss of customers who can deploy their own energy production technologies outside the reach of traditional regulation. The days of the monopoly utility model are being challenged.

What exactly is disruptive innovation?

In the 1990s, Clayton Christiansen coined the term "disruptive innovation" in his book *The Innovator's Dilemma*. He defined it as something that creates a new market by harnessing new technologies and business models that overtake traditional, entrenched business models. It's distinctly different than incremental improvement of existing products, services and processes. His book outlines several examples and explains the fundamental dilemma of the incumbent: embrace new disruptive technologies, often at the cost of established business models that may still be producing profits, or perish. Incumbent utilities must undertake disruptive innovation—innovation that can radically alter the traditional value chain and the underlying cost structure of the industry.

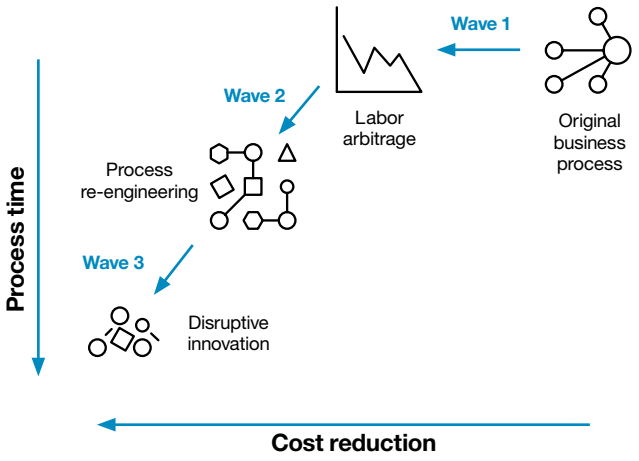

Figure 1: Illustration of the key approaches to business process transformation

In the electricity industry, disruptive innovation is a departure from the traditional waves of process improvement but required to effectively and sustainably compete in the electric utility industry of the future.

Wave 1: Process cost arbitrage

In the late 1980s, labor arbitrage was the first method of improving business processes. Essentially companies moved their operations to another global location where the underlying labor cost structure was significantly more favorable. This approach to outsourcing remains significant today.

Wave 2: Process re-engineering

Through the 1990s, the preferred method was to discard current processes and restructure them in a more effective way. Although excitement around business process re-engineering has waned, its practice is still alive and well.

Wave 3: Process extinction

With disruptive innovation, the business process is significantly diminished, if not entirely eliminated.

There are many examples where the use of advanced technology and, more recently, advanced analytics has allowed business processes to be eliminated entirely.

The travel industry is a good example. According to a CNN study[1], the number of travel retail locations has decreased by almost two-thirds from the mid-1990s. Of those remaining, their businesses have shifted from point-to-point travel arrangements to customized and all-inclusive services. The human-centered reservation process, and its costs, have been eliminated. But the richness of the customer experience has also improved. Now aggregators and comparison portals display multiple travel options without any human interaction.

Another example is video rentals. A few years ago, anyone who wanted to see a video would go to the video store on Friday or Saturday night and go through stacks and stacks of videos to decide which movie to watch. And, of course, one would always hope that the new release was still available, because there was a limited number of videocassettes or DVDs the video store had in stock.

Today, people simply use their voice-activated, remote control to order any movie they want, and it's digitally streamed to their TV screens or devices. Gone are the brick-and-mortar buildings that housed thousands of videocassettes or DVDs. Gone is the time and energy expended to drive to the video store and return home, thus eliminating millions of tons of harmful greenhouse gases. And, as in the example outlined for travel, one can easily argue that the entire experience is richer.

Disruptive innovation in the utility industry today

Energy and utility companies can apply disruptive innovation practices within an organization to combat the broader changes taking place throughout the industry.

One such example is the use of advanced weather forecasting linked with maintenance and asset records to go beyond forecasting the weather by projecting the damage profile of a storm. Most utilities today execute this process within a distribution operations center using methods built on years of experience.

However, by using advanced analytics, the disruptively innovative storm restoration process can also preposition material and crews in a more disciplined, efficient and effective manner. Indeed, the process of prepositioning and restoration management can be fully automated.

Another prevalent example in the industry is the use of advanced cognitive analytics to eliminate the need for human inbound call center interactions. Analytics can eliminate the need for a call in the first place. For example, when a utility provider is notified of an outage, detected through its advance metering infrastructure (AMI) system, it can proactively send text messages or emails to affected customers.

Providers report that, in many cases, this alert eliminates the customer call. When calls do come through, digital channels, supported by cognitive technology and predictive analytics, help process customer interactions. Cognitive call center operations have already been implemented in telecommunications and financial industries, and increasingly utilities are looking to implement them more broadly.

Technology enablers

Four general classes of technology are enabling disruption in the utility industry. As described in Figure 2, these technologies are enabling increasing threats of substitution, as well as lowering the barriers for new entrants. Both threats to the traditional business model make the resulting innovation disruptive versus incremental.

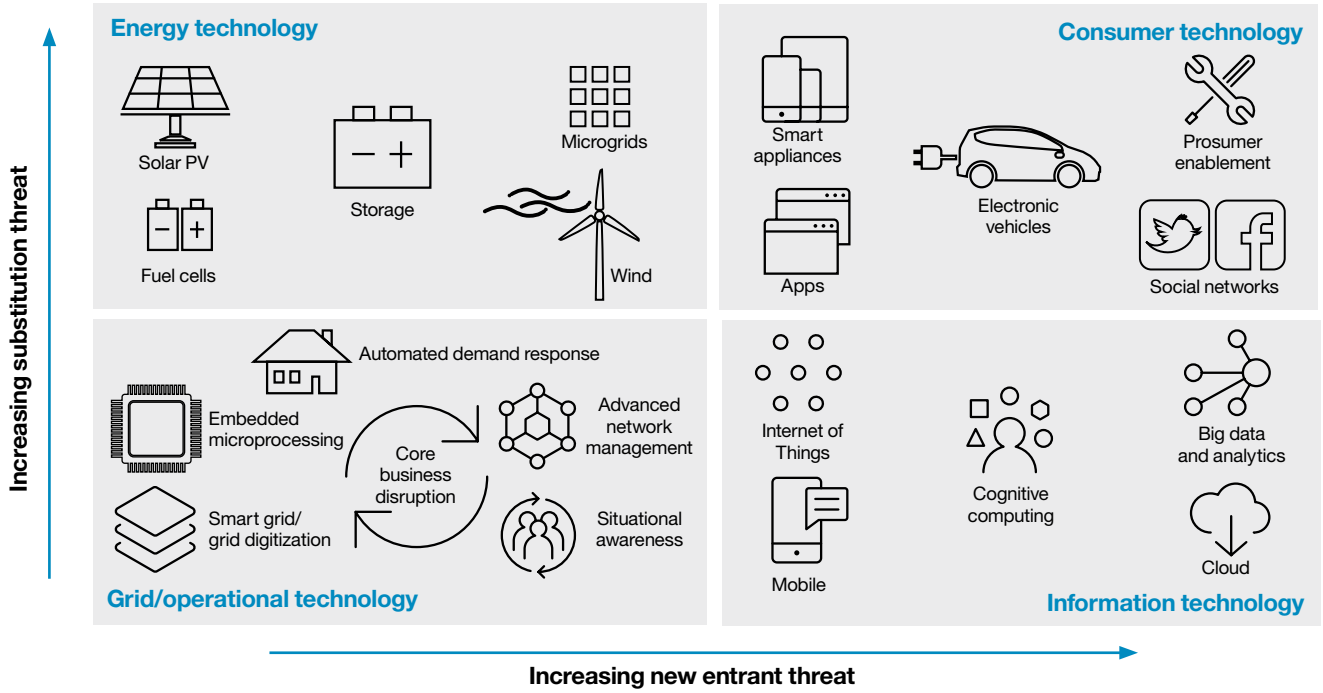

Figure 2: Matrix of technologies enabling disruption in the utility industry

Grid and operational technology

Smart grid and grid digitization, embedded microprocessing, advanced network management, and vastly improved situational awareness all provide significant innovation regarding how utilities operate. Although the typical connotation of disruption is negative, it can have positive outcomes, particularly if the disruption is leveraged to the advantage of operations. Since the outcome here is improved safety and reliability at lower cost, the disruption is beneficial.

Energy technology

Certainly, the popular example for this class is solar photovoltaic (PV), but it also includes wind, storage, microgrids and fuel cells. Each of these technologies adds a dimension to the production of electricity that increases the threat of substitutes to the traditional supply chain of centralized fossil, nuclear or other types of energy production sources. Taken to the extreme, they constitute the prime mover in what has historically been referred to as the utility death spiral.

Consumer technology

Consumers are becoming more informed and empowered about how they use electricity. Smart appliances provide information on how energy is being consumed. Home appliance apps allow energy use to be scheduled optimally. Social networks promote efficient usage patterns. In many instances, the consumer is also becoming a "prosumer." Depending on the situation, they might consume or produce electrical energy for their own use or return it to the grid for others.

Still another facet is the convergence of previously independent value networks being integrated into the consumption pattern of electricity. Electric vehicles are the best example of this. Today, transportation value and supply chains don't significantly intersect with electricity value and supply chains. But electric vehicles will change that situation dramatically, increasing pressure on the safety and reliability of the electric grid. Similar network convergences have far-reaching implications on the changing electric energy landscape.

Information technology

Information technology is fundamental to enabling disruptions in business models. The march of information technology is driven by currently accelerating technologies, such as cloud, mobility, the Internet of Things (IoT), big data and analytics, and emerging cognitive computing or artificial intelligence (AI). Some of the most popular examples of disruptive innovation in business are Uber and Airbnb, which primarily leverage information technology to radically disrupt an industry.

Each of the classes of technologies outlined above operate within its own relative domain of focus. However, it's illustrative and important to highlight that many of the classes of technologies can combine to create powerful scenarios of disruption that are either already apparent or rapidly emerging within the industry.

For example, one can combine the energy technology of storage, coupled with the consumer technology of electric vehicles and the information technology of the IoT. The result is a vehicle-to-grid scenario that's a popular topic. Or one can combine the situational awareness of grid operational technology, coupled with solar PV in energy technology, linked to consumer technology of prosumer enablement. The result is one of the more fundamental disruptions to the traditional value chain within the industry.

These examples highlight the more profound realities of disruptions within the industry: there's a confluence of multiple technology classes that are enabling and driving these disruptions. Their combinations are accretive to the disruption. This example is more evidence for the foundational and structural changes that the industry continues to face, now and in the future.

So where might this disruptive innovation go in the future?

The utility industry has embarked on an energy transition journey, both from a business model perspective and with regards to the underlying technologies. Significant disruptions are expected going forward.

Technological innovations will advance this transition. First, one of the primary outcomes of IoT technology is a radical improvement in the fidelity of grid situational awareness. This improvement offers the opportunity to significantly boost the efficacy and efficiency of monitoring and operating the grid. Incumbent utilities will benefit. The transition also offers new entrants the opportunity to introduce business models that leverage the information that the IoT can provide. It's likely that new information-services-based business models will emerge from unregulated providers, enabling the monetization of data on and about the grid without any grid operational responsibility.

Second, cloud computing and its associated business models are also radically transforming businesses globally. Although cloud technology offers significant advantages as an information technology, sometimes it's overlooked as an advantage in business model enablement technology. Cloud-based business models offer low cost-of-entry, agile operations as they develop, and have easy exit ramps if minimum viable products don't manifest a sustainable business. This option is a perfect incubation scenario for new entrants in any business.

In many industries, cloud options are already considered normal.

- **In 2016, 78 percent of the executives we spoke with describe their cloud initiatives as coordinated or fully integrated.[1]**
- **83 percent of high-performing organizations said their cloud initiatives are coordinated or fully integrated within the organization.[2]**
- **How sophisticated are today's organizations in integrating cloud solutions?**

More than twice as many high-performing organizations report fully integrating their cloud initiatives than low-performing organizations.[3]

Third, cognitive computing is powerful when adapted to problems that require significant expertise, have heavy human context interaction requirements and operate in an environment that requires continuous learning. The elements of cognitive computing, which enable understanding, reasoning, learning and interaction, are highly aligned with many of the processes the utility industry executes on a daily basis. Industries with similar human engagement characteristics, such as insurance, telecommunications and financial services, are already using cognitive technology. Utilities will also begin leveraging this technology.

These examples of technology enablers are not an exhaustive list. The technologies required to successfully navigate the energy transition already exist. Most are economically viable today or will become so in the very near future.

Questions about whether the electric utility industry is capable of innovation aren't uncommon. Whenever radical change is proposed, particularly in any industry where matters of safety and reliability are paramount, there are cries for gradualism and caution. In these forums, the word "disruption" becomes a point of contention in an industry focused on stability.

However, disruption need not be negative. Incrementalism extends the current. Disruption can create something new.

The grand energy transition, in which everyone is a participant, is focused on establishing the best balance. This balance has been referred to as the grand trilemma of the industry—the balance between affordability, sustainability and security of the energy supply. The fulcrum of this balance, and the pace of its manifestation, will vary from country to country. But the business and technical landscape of electricity production and consumption, which may be decades in the making, is a fundamentally—disruptively—different landscape from the preceding decades. When viewed in retrospect, it's likely that the winners in this new industry framework will be those who embraced disruptive innovation sooner than later.

About the author

Stephen J. Callahan is the Vice President of Global Strategy and Solutions for the energy, environment, and utilities industry, and an IBM Industry Academy member. Over his 30-plus-year career in industry management and consulting, he has led the development of business and technical strategy, and implemented complex processes and systems spanning transmission and distribution (T&D) and customer operations, finance, network and Smart Grid.

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2 *Tailoring hybrid cloud: Designing the right mix for innovation, efficiency and growth*, IBM Executive report, https://www-935.ibm.com/services/us/gbs/thoughtleadership/tailoredhybrid

3 *How sophisticated are today's organizations in integrating cloud solutions?*, IBM Institute for Business Value inforgraphic, https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=GB912368USEN&

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