

Utility Innovation

Utility Participation in Innovation Research & Development

Prepared by



THE SHPIGLER GROUP
STRATEGY MANAGEMENT CONSULTING SERVICES

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Executive Summary

Electric utilities were at the core of America's transformation from a rural, agrarian society to the world's most advanced industrial economy. They now provide the very metabolism of modern society. But electric utilities are at a remarkable transition point — described by some as a death spiral, and by others as a vast opportunity. The way it plays out will substantially determine how reliable and affordable it is to power the economy.

A whole suite of technologies has experienced dramatic cost and performance improvements in the last five to ten years, from renewable energy to the lights and windows in houses to the way whole building and industrial systems work. The price of solar electricity from PV cells has dropped 80 percent in the last five years; wind is down by about half. New LED lighting technologies that use only one-fifth as much energy as their predecessors are becoming ubiquitous. There are technologies for the grid, too, that deserve attention: it is now possible to divide the grid, historically prone to cascading failure at a massive scale, into connected microgrids that take advantage of scale, but can still function independently if there is a problem elsewhere in the system.

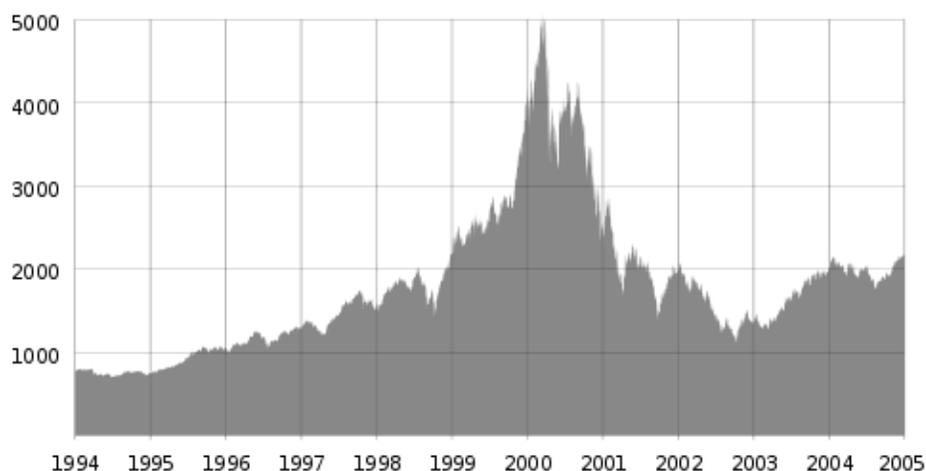
Increased capabilities of technology coupled with a changing business model suggest that utilities need to explore their roles and investment strategies in the field of innovation more closely than ever before. Customers too see the potential — a study among 1,500 customers found that 32% of respondents expect their utilities to adopt technologies that automate energy savings and 20% expect their utilities to build smarter communities. There is a downside in the data, however; nearly 40% of respondents do not view their utility as innovative, suggesting there is room for improvement. Nevertheless, as recent trends show, there are signs that utility innovation investment will become much more significant in the near future.

Historical Perspective

Historically, utilities have been very slow to adopt new technology and/or participate in innovation development. In 2013, utilities had collectively invested just .1% of revenue in research and development, a level roughly 1/30th of the national average of 3.3% of all industries¹. In some sectors of the market, the rate has actually been dropping as utilities deal with slowdowns or reversals of load growth. A conservative industry by nature, utilities have often been seen as being too slow to innovate. However, changes to the core business model of the utility industry threaten to change that trend.

Utilities have looked to involve themselves in new ventures for a variety of purposes. While those purposes may be linked to specific attributes of the utility, more often the key driver reflects the prevailing market sentiment. Overall, there have been three major phases of utility investment activity over the past twenty years.

The first phase, featuring aggressive investment strategies (most typically UTelco ventures), began in the late 1990s and ended in the early 2000s. At the time, the technology sector was becoming wildly overvalued, with a tremendous run-up of valuation of technology stocks, illustrated by the NASDAQ valuation during that time frame:



Utilities and critical infrastructure enterprises are fundamentally network-based “pipes and wires” businesses. By their very nature, utilities have large bases of infrastructure and diverse assets that can be exploited at various levels moving up the value chain from leasing assets to providing fiber-based services to providing retail services to customers and even as far as to providing content. As a general rule, as the companies move up this value chain, the need for

¹ Costello, K. (November 8, 2015). “Research and Development by Public Utilities: Should More be Done?” National Regulatory Research Institute.

expertise in the telecom field grows and the likelihood of partnering rises, as does the risk and potential for greater profits.

The UTelco sector essentially sprang up from three contemporaneous trends in sector organization. First, the state-driven deregulation (or impending deregulation) of the energy/power/utilities sector compelled forward-thinking utilities to seek new revenue streams in order to offset increased levels of competition and the possibility of declining profit margins in traditional lines of business. Also on the regulatory front, The Telecommunications Act of 1996 provided the explicit legal basis upon which utilities and critical infrastructure enterprises could enter the competitive telecom marketplace. Finally, the explosion of consumer demand for telecommunications services in the latter half of the 1990s illustrated to many network-based businesses the potential value of leveraging core assets in order to offer such services.

The next phase of activity for utility investments focused on more passive investments, with a combination of less risky telecom activities and involvement in other areas. Telecom activities began to focus more on leasing infrastructure, including right-of-way and attachments to transmission towers. Meanwhile, a number of utilities began to invest in real estate and property management ventures. Over many years, utilities had acquired vast amounts of land for various uses including power plant sites, water reservoirs, transmission lines, hydroelectric projects, and substation sites, and much of that land wound up being underutilized. As a result, many of these utilities saw an opportunity to leverage their holdings by creating business units focused on revenue generation from these assets. These new business units often focused activities on:

- Land acquisition and siting services for third parties
- Property disposal services
- Easement granting and leasing
- Land management services
- Office and warehouse space leasing
- Land tax management services

The motivation for these activities were twofold. On one hand, the utilities saw opportunities to generate additional revenue from their unregulated activities, allowing shareholders to gain rates of return higher than those allowed by state regulators on regulated assets. However, a larger driver for this activity involved earnings management. Wall Street has expectations for earnings predictability and often punishes companies for earnings shortfalls. This is especially true for utilities, who are seen as stable entities with little variability in earnings. However, revenue and earnings can vary somewhat – even in the utility sector – requiring utility management to look for ways to smooth earnings and “fill the gaps” of periods of projected earnings shortfalls. Since real estate management businesses often allow for some flexibility with respect to earnings recognition, investor owned utilities were able to manage their earnings profile for Wall Street.

Today's investment activities tend to focus more heavily on utility innovation. As utilities are challenged with how to respond to a changing dynamic in the retail electric market sector, it is incumbent upon utilities to develop more progressive strategies for how they will compete in a new, more competitive marketplace. Ensuring that they stay ahead of the curve when it comes to energy innovation is a key step in that process, and involves an investment strategy that is less tactically focused on short-term investment returns and more strategically focused on enhancements to the core business.

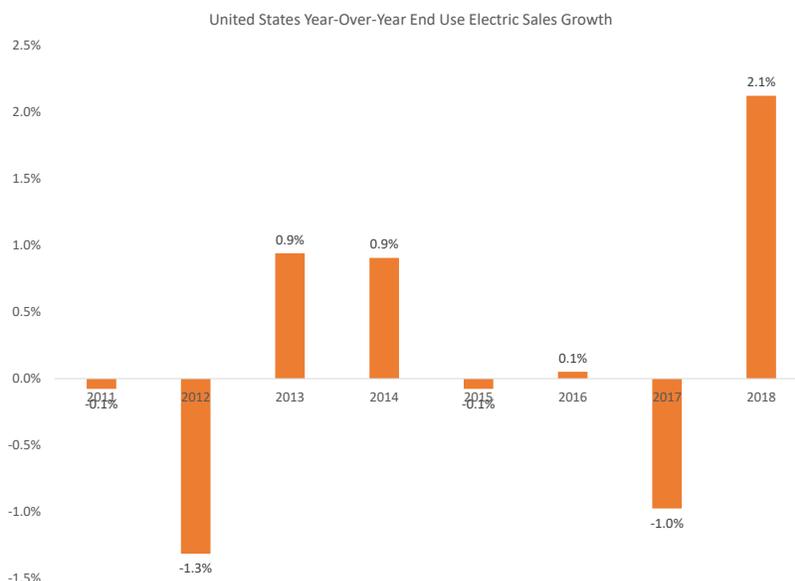
Edison Electric Institute (EEI), the trade association and lobbying group for the electric utility industry, published a whitepaper on the disruptive challenges facing the utility industry². Along with many other industry analysts, it suggested that the historically prevailing model of centralized, fossil-fuel based generation is under threat, and may be replaced in part by on-site, distributed generation as more customers switch to cleaner, and sometimes cheaper, solar power. The challenge is how to maintain revenues – especially at sustainable market prices – when increasing numbers of customers are defecting by producing off-grid electricity.

To an extent, this is a challenge that has been faced by a variety of industries in the past. In business, one of the most difficult problems that companies face is how to adapt a successful business model to technological or social changes that threaten that model. For example, Wang, Unisys, DEC and Amdahl were all big computer companies in the 1970s that clung to an obsolete business model in the face of distributed computing. On the other hand, IBM and HP adapted their business models and thrived in the new market. As the utility industry reshapes, we can expect to see increasing focus by progressive utilities on how to ensure that they stay ahead of the curve.

² Kind, P. "Disruptive Challenges: Financial Implications and Strategic Responses to a Changing Retail Electric Business". Edison Electric Institute.

Recent Trends

One of the leading areas of concern to today’s utilities involves the fear of the so called “utility death spiral”. With rising levels of off-grid distributed generation, there is increased pricing pressure on utilities that must expend resources to accommodate grid support services for intermittent energy sources and allocate that cost across fewer grid-based customers – a potential incentive for even more customers to defect from the grid. As early as 2016, Fitch Ratings issued a note highlighting the risk of solar energy net metering to the creditworthiness of America’s publicly traded electric utilities³. The agency noted that distributed rooftop solar already represented 1% of all energy generated, and the potential to further eat into utility revenues is an issue to be concerned about. In fact, after years of consistent growth, electricity sales have declined in four of the past eight years for which annual electric sales data is available⁴:



The cause of this shift in energy consumption is not only driven by distributed resources. Efficient end use technologies, such as LED lighting and better HVAC systems further cut waste. The emerging universe of cheap and ultimately ubiquitous sensors promises to further reduce consumption by allowing energy consumers to see when, where, and how energy is consumed at the end-use level. This holds the promise to do two things:

- Reduce demand when electricity is more expensive, thereby slashing utility demand charge revenues
- Reduce overall kilowatt-hour consumption by creating the opportunity for use-directed consumption

³ “Net Energy Metering (A Secular Credit Challenge for IOUs)”, Fitch Ratings.

⁴ Statista; The Shpigler Group analysis.

Innovation Targets

There exists a wide variety of technology areas of focus for energy innovation. Some of the leading sectors include:

- Advanced materials (concentrating solar power, hydropower, photovoltaics, and wind power)
- Biomass and biofuels (biomass feedstocks, biofuels processing and conversion, integrated biorefineries, biobased products, and infrastructure)
- Building energy efficiency (appliances, building envelope, indoor air quality, lighting, water heating, and whole building design)
- Electricity transmission
- Energy analysis (resource and material characterization, testing and validation, systems modeling and optimization, products and systems design, life-cycle assessment, and cost optimization)
- Energy storage (batteries, compressed air, flywheels, supercapacitors, and superconducting magnetic energy system)
- Geothermal
- Hydrogen and fuel cell technologies (hydrogen production, hydrogen delivery, and hydrogen storage)
- Hydropower, wave, and tidal technologies
- Industrial technologies
- Solar photovoltaic (PV devices and components, PV systems, and PV manufacturing)
- Solar thermal (linear concentrating, dish/engine, and power tower)
- Vehicles and fuels (hybrid vehicle systems, energy storage, power electronics, advanced combustion engines, and fuels and lubricants)
- Wind energy (large wind, offshore wind, distributed or small wind, and wind turbine manufacturing)

Many of the ventures in these enterprises are being sponsored by industry-specific incubators, including GE Ventures, Greentown Labs, Energy Excelerator, and 1776. Over time, some of these incubators have developed strategic partnerships with utilities either directly or via associations like Edison Electric Institute.

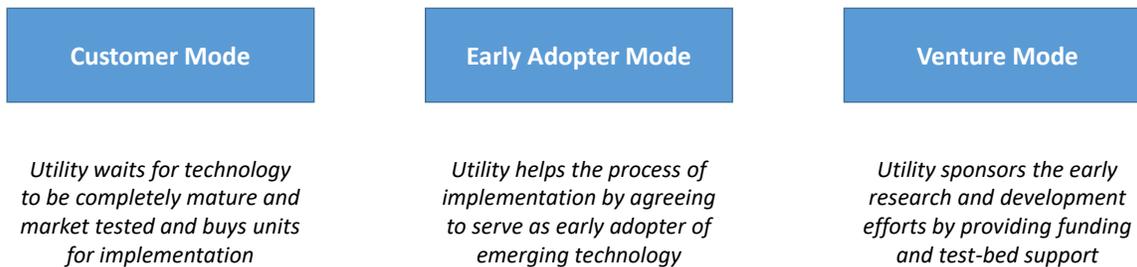
In his address to an energy innovation summit this summer, Anthony Earley, president and CEO of Pacific Gas & Electric and former EEI chairman, said that non-traditional players will be equally important as utilities in modernizing the grid. "Utilities are not going to create this future alone -- even if we wanted to, we probably can't. Our role is going to be about providing

the means to integrate all of this innovation,” said Earley. “We believe the companies that will be successful at that will be the ones that reach out and develop robust partnerships.”⁵

⁵ “Edison Electric Institute: Utilities Are Eager for New Partnerships with Startups”. (May 19, 2015). Greentech Media.

Investment Approaches

The scope of investment types within the field utility innovation investment typically can be characterized within three distinct modes:



We can look at each of these modes of involvement as they have been utilized over time:

- **Customer Mode** – In the past, utilities have historically been conservative with respect to innovation and have been hesitant to be the first to adopt a new technology until it had been proven elsewhere. Since all utilities shared this sentiment, this often served to stifle innovation rather than promote it. Nevertheless, utilities were able to make sure that technology was not placed on their systems until they had been fully vetted in the market, thereby reducing operational and implementation risk.
- **Early Adopter Mode** – As time progressed and utilities recognized that they needed to innovate in order to respond to changing market dynamics, more and more utilities began to open to the idea of serving as a sponsor of technologies that were ready for implementation. In this mode, utilities still largely stayed out of the R&D phase, but opened up the potential of allowing developing technologies to be implemented in pilot deployments.
- **Venture Mode** – Most recently, an increasing number of utilities have become more involved in the front end of the R&D phase, with some providing seed capital in exchange for equity and rights of first refusal for the implementation of new technologies. Some of the support has also extended to providing access to innovation centers for the development of the technologies.

Brian Wolff of Edison Electric Institute offered the perspective that the difficulties in getting a product to market from a new venture, coupled with utility’s increased willingness to invest directly into innovation ventures, offers the potential for increased deal flow within the sector. “Not only do I look at them as partners for the future, but they’re looking at us to be able to acquire them and bring them in, and be able to use and integrate their technologies,” he stated⁶. Several utilities have made direct investments in cleantech startup companies through their deregulated arms. Duke Energy, for instance, acquired a majority stake in the commercial solar developer REC Solar.

⁶ “Edison Electric Institute: Utilities Are Eager for New Partnerships with Startups”. (May 19, 2015). Greentech Media.

Utilities also frequently partner with startups, which has helped companies like Nest, C3 and EnerNOC get to scale. Pacific Gas & Electric, for example, invested \$60 million in SolarCity. Overall, regulated utilities are investing around \$90 billion in new technologies and services each year, most of it aimed at enhancing the distribution and transmission network.

Summary

The world of utility innovation investing is rapidly changing, and much development can be expected in the coming years. As technologies get cheaper, new ones emerge, and business models morph, utilities are caught squarely in the middle of all this change. For utilities, this simple fact presents a major challenge. Utilities' fundamental social responsibility lies in the ability to "keep the lights on". As a result, they do not have the typical profile of an industry with a strong capacity for innovation.

Nevertheless, as market developments continue to shake out, we can expect that not all utilities will behave in the same way. Some will continue to innovate more aggressively and serve as the early adopters for the industry. Meanwhile, others will lag behind and, in some cases, may require regulatory guidance before they proceed. Nevertheless, we can already see signs that the shift is happening and utility innovation investment is becoming more mainstream.