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RAILROADS, UTILITIES AND FREE PARKING: WHAT THE EVOLUTION OF TRANSPORT MONOPOLIES TELLS US ABOUT THE POWER NETWORK OF THE FUTURE

By A. J. Goulding

NOVEMBER 2016

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By A. J. Goulding *

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* The author teaches graduate-level courses in electricity markets and oversees graduate workshops at Columbia University's School of International and Public Affairs. He is also president of London Economics International, a global economic and financial consulting firm to the energy and infrastructure sectors.

COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK

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EXECUTIVE SUMMARY

How electric utilities in the United States adapt to the technological advances that are transforming the industry is a critical question for policy makers and utility stakeholders. In attempting to understand and prepare for the utility of the future, comparisons are often made to the transformation of the telecommunications industry due to wireless technologies. However, the near-death and subsequent rejuvenation of the US rail system also offers significant lessons for the power sector as it faces disruptive change. The rail industry has gone through a series of informative changes over nearly two centuries. Although electric utilities in the United States today are in a far better position than railroads were in the 1970s, when the sector was rocked by bankruptcies and partial government take-over, there is no room for complacency. The competition and changes underway mean that many of the assumptions underpinning both utility strategy and regulator philosophy today are no longer true. This paper argues the following:

- Electric utilities will eventually cease to be natural monopolies and will need to be given vastly greater latitude in how rates are set, while the role of regulators will increasingly shift to matters of safety and access.
- Utilities will need to rethink business and investment planning under the assumption that the sector will eventually become competitive.
- As power customers are offered more choices, they will need to reassess the ways in which they use power and the attributes they value in service.
- Utilities will be less able to rely on steady cash flow from existing customers to finance ongoing operations and will need to adjust dividends accordingly.
- Utilities should reassess their capabilities and focus on what they do best: moving large volumes of electricity over great distances.

As in the case of the rail sector, the factors mounting against the traditional utility model are numerous. Subsidies to disruptive technologies are accelerating change as customers are being encouraged to reduce their usage of the grid. Simultaneously, utilities will likely face increases in both volume risk and credit risk as low-income customers or businesses with limited cash flow will constitute the bulk of classic utility customers, as they cannot afford new technologies. While subsidies for new and renewable energy technologies lack the coherent plan that created the national highway system, the end result will create a similar situation to that faced by the railways after the 1950s: greater independence of customers from a preexisting network.

This has profound implications for the electric utility model. As customers who previously had no options other than to pay set utility rates leave the grid, the cost of distributed generation will become the effective cap on rates for many customers, just as the cost of truck transport became the effective cap on rail shipping rates. Utility executives can reduce rates to retain customers or reinvent their utilities as microgrid operators coordinating distributed resources; however, they may find that some customers shun microgrids if technology becomes sufficiently inexpensive and reliable.

Furthermore, even though distributed generation cannot yet attain the level of grid reliability without significant—and expensive—redundancy, some customers might accept lower levels of reliability, the price point at which distributed generation becomes a viable alternative falls. And as means of delivering energy services become more innovative, new business models will challenge the basic definition of what constitutes a utility, eliminating restrictions on the companies that can participate as well as geographically defined franchises. The combination of all these factors raises the potential for stranded costs for utilities.

As risks to the sector grow, utilities may be justified in seeking higher returns, but increasing rates to customers could make them less competitive against distributed generation. Utilities need to consider which parts of their rate base are most vulnerable to customer flight and determine appropriate competitive and regulatory responses. Increasingly, utilities will need the ability to offer flexible rates flexibility, which may require rethinking the principle of nondiscrimination in rates. Rate design has traditionally focused on costs and not value and must be reconsidered, and utilities must consider how to appropriately price the option of using the grid.

Looking forward, successful utilities will need to master—and profit from—the massive amounts of data that are available to them and focus on what they are good at: transmitting significant volumes of electricity through networks across large geographic areas. Just as consolidation among Class I railroads led to a "big seven" dominating the industry, there is likely to be sustained merger activity as utilities combat shrinking margins and increasing difficulties in achieving allowed returns; however, such combinations, if noncontiguous, will generate limited savings. The continued expansion of entities such as Berkshire Hathaway Energy and Exelon indicate the cycle has already begun.

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Introduction

Policy makers and electric utility stakeholders are increasingly adopting a consensus that the "utility of the future" involves the smooth transition of today's rate-regulated networks, organized around central generating stations, into a "smart" grid that coordinates optimization of clean, distributed generation. However, other outcomes are possible. Electric utilities are not the first network industry to face disruptive change. Lessons from the transport sector—whether we think of canals in the 1840s, railroads in the 1970s or air transport in the 1980s—suggest that evolution will be traumatic for some companies, requiring a complete overhaul of regulatory mind-sets regarding franchises, cost-of-service rates, subsidies and protection of vulnerable customers. Whereas many observers look to the telecommunications industry for clues as to how electric utilities will be transformed, the near-death and subsequent rejuvenation of the US rail system also has significant lessons for all power-sector participants.

Background—disruptive change in the rail industry and applicability to power sector

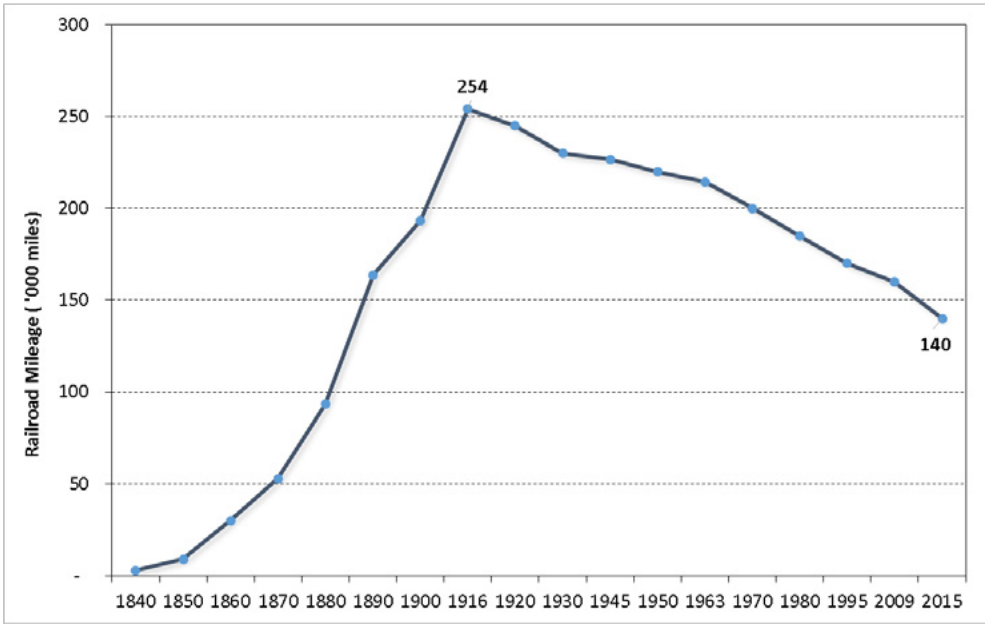
The US rail network was once one of the country's leading industries. According to the Association of American Railroads, starting from around 3,000 miles in 1840, the network grew to its peak of 254,000 miles in 1916. In 2015, the network totalled 140,000 miles. The industry dominated the financial markets as well, with railroads being one of the original indices developed by Dow Jones. In 1913, railroads accounted for 21 percent of the total volume of the New York Stock Exchange. By 2015, this had dropped to 1.23 percent.[1]

Over nearly two centuries of operation—the first railroad was incorporated in 1827, and its successor is still in existence today—the rail industry has gone through a series of changes: entrepreneurship; unfettered growth and competition; cartel-busting and the rise of rate regulation; bankruptcy and partial government control; and most recently, privatization, consolidation and specialization. The number of Class I railroads[2] in the United States fell from over 130 in 1939 to 7 in 2015. Over the same period, freight tonnage fell from 414 billion ton-miles in 1920 to a trough of 375 billion ton-miles before rebounding to a peak of 1.8 trillion ton-miles in 2006.[3] Passenger traffic has followed a somewhat similar trajectory, falling from 21.2 billion passenger-miles in 1960 to a nadir of 8.44 billion in 1975 before largely recovering to 18.2 billion passenger miles in 2014.[4]

In their day, railroads themselves were a disruptive technology, ultimately making obsolete canal boats and stagecoach lines and becoming so powerful that they sparked key changes in views on the role of the state in regulation of commerce. Key antitrust precedents[5] arose from railroad merger efforts, and the Interstate Commerce Commission ("ICC") was developed largely to protect customers from perceived railroad monopolies. However, by the 1950s, the railways faced increasing competition from a number of alternative means of transport. Passengers could choose to drive or fly (albeit at relatively expensive regulated rates), and shippers could deploy fleets of trucks. Just as the rail networks had benefited from generous subsidies in the form of land grants and postal contracts, a concerted federal government effort to build out the road network at little direct cost to drivers made the total cost of road transport appear lower. From the 1930s, airlines also benefited from postal contracts and federal and municipal efforts to build airports.

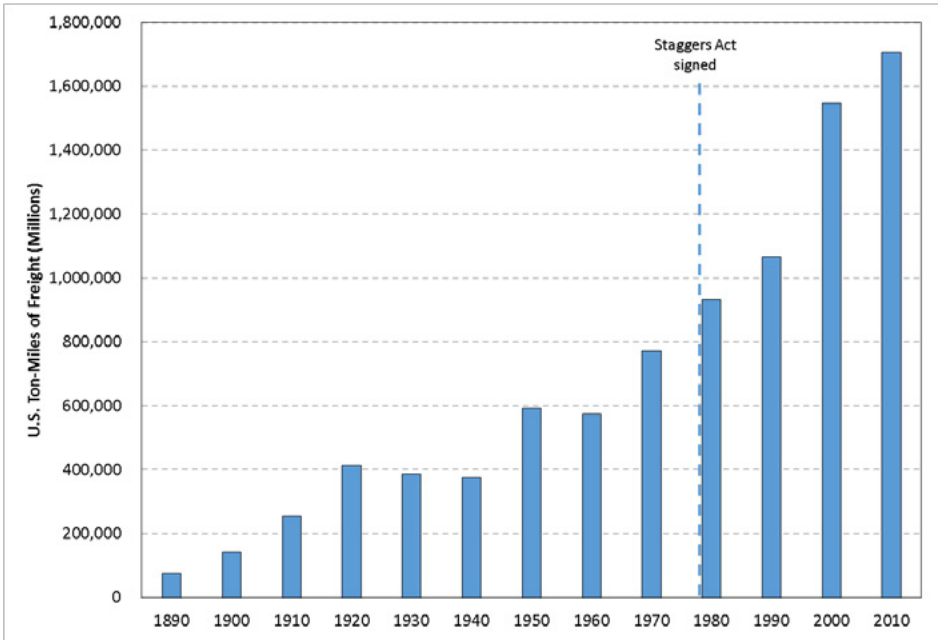
The PennCentral bankruptcy in 1970 came to epitomize the industry's collapse. The creation of Amtrak in 1971 to effectively nationalize passenger rail service and of Conrail in 1976 to allow for government ownership of PennCentral and six other bankrupt northeastern rail lines suggested the industry was dying. The crisis resulted in a complete rethink of how the rail industry was regulated. The Staggers Act of 1980 largely freed railroads from economic regulation, with dramatic results. In a decade that saw the demise of PennCentral and the creation of Conrail, the Staggers Act marked a significant turning point.

Figure 1: Changes in railroad network mileage, 1840–2015



Source: Association of American Railroads (AAR), American-Rails.com.

Figure 2: Ton-miles of freight carried by rail, 1890–2010



Note: The Staggers Act of 1980 was the culmination of nearly a decade of deliberation on deregulating railroads. The principle tenets of the Staggers Act were to allow railroads to price competing routes and services differently, enter into confidential contracts with shippers and streamline the procedure to sell and abandon smaller lines. A summary of the post-Staggers reforms appears later in this paper. Source: Association of American Railroads (AAR).

By the 1970s, ICC regulation had resulted in depressed returns on capital to the rail industry (causing significant capital flight), rail companies became conglomerates and network investment stagnated. Yet ultimately, the rail industry in the United States recovered. Smaller, unprofitable lines were abandoned or sold to short line railroad operators. While passenger rail service remained in government hands, Conrail became profitable and was divested. Railroads engaged in significant consolidation, creating strong regional networks, although a coast-to-coast entity has yet to emerge. Innovations such as unit trains and containerization meant that railroads were unbeatable in their ability to move bulk cargoes long distances and better integrated with erstwhile competitors in the trucking industry to provide door-to-door service. Productivity improved dramatically, with revenue ton miles (RTM) rising 110 percent between 1979 and 2009.[7] Over the same period, railroad employment fell from 518,000 to 150,000.[8]

Although electric utilities in the United States today are in a far better position than railroads were in the 1970s, there is no room for complacency. Many of the assumptions that underpin both utility strategy and regulator philosophy today are false; the utility of the future may not be a utility at all, leaving the utility of today looking more and more like the railroads of yesterday.[9]

Figure 3: Railway regulation in the United States before and after the Staggers Rail Act of 1980

Pre-Reform Regulations	Post-Reform Regulations
• Maximum and minimum rates and service standards published and set by Interstate Commerce Commission (ICC). • Inter- or intra-modal rate competition was generally not possible.	• Confidential rate and service contracts negotiated by customer and rail firm • Rate competition possible • Upper rate limits set for customers served by a single rail firm (so called 'captive customers')
• Innovation was restricted if it was deemed anti-competitive	• Innovation no longer regulated (except for safety measures)
• Ownership of firms in other transportation modes generally not allowed	• Cross-modal ownership permitted
• Route abandonment subject to stakeholder challenges and slow approval process	• Procedures relaxed; route and track abandonment procedures streamlined
• Tough requirements for mergers, divestitures and alliances • Often lengthy hearings and approval processes	• Rules and standards eased particularly for small firms • Procedures for mergers, divestitures and alliances were streamlined
• Rail employee health, disability, retirement and labor relations covered by special federal laws	• No change for the current employees • Labor contract renegotiation was permitted for newly independent small firms formed from spun-off assets
• Track maintenance, operating safety and transport of hazardous materials federally regulated	• No change
• Issuance of stock and other investment securities federally regulated	• No change
• Foreign investment permitted under same rules as US ownership	• No change

Source: B. Cramer, North American freight rail: regulatory evolution, strategic rejuvenation and the revival of an ailing industry (University of Iowa: 2007).

Subsidies to disruptive technologies are accelerating change

While electric utilities with some justification regard net metering as the equivalent of the "free parking" space in Monopoly,[10] net metering is only one of the many ways in which customers are being encouraged to reduce their usage of the grid. Energy efficiency programs continue to receive widespread support, despite their relative value being diminished in a low fuel price environment. Taxpayer subsidies for solar and wind provide additional potential for load migration. The bulk of these programs are regressive in that they are inaccessible to low-income customers or to businesses with limited cash flow. This suggests that over time, utilities will face increases in both volume risk and credit risk, particularly if technological evolution allows their best customers to flee the grid entirely.

US federal and state-sponsored subsidies for new and renewable energy technologies lack the coherent plan of the Eisenhower-inspired national highway system; however, the end result is similar to what happened to the railroads: greater independence of customers from a preexisting network. As customers become more comfortable with the idea of self-generation, they seek more opportunities to engage in it, whether at home or at work. Technological change, wind and solar tax credits and net metering taken together are the equivalent of providing cheap automobiles and the roads on which to operate them. Although the United States appears to have established a glide path toward the elimination of renewable-energy tax credits, and utilities are becoming more successful at convincing regulators to refine net metering to eliminate the more blatant forms of cross subsidies,[11] these developments merely slow, rather than prevent, a world in which electric utilities lose any remaining natural monopoly attributes. As discussed further below, such a world requires rate design to increasingly account for the possibility of network bypass.

Cost of distributed generation represents effective cap on rates

For more than half a century, the game plan to operating a successful electric utility was straightforward. First, develop a smooth working relationship with the regulator. Second, consistently identify new capital projects aligned with regulatory objectives that will allow growth in rate base. Third, implement those projects within a reasonable range of the identified budget. Fourth, adjust rates accordingly to recover costs and approved returns. Fifth, assure a reasonable degree of technical competence, particularly with key constituency groups. While the advent of competitive wholesale generation markets, usually in higher cost jurisdictions, meant that this standard operating procedure became limited to the wires business in such regions, elsewhere integrated utilities continued to thrive by carefully managing regulatory relationships and capital programs.

However, this business model also relied on an assumption of a vertical demand curve—the idea that customers had no alternative to paying the resulting rates.[12] Regulated rate design does not take into account the cost of substitutes, except when determining whether an asset is likely to be used and useful. Once an asset is approved, it is assumed that it will ultimately be paid for. Of course, competitive businesses do not operate this way; in a compet itive business, managers seek to identify the price the market will bear and design product and service offerings (and the associated capital expenditures) accordingly. Investment is undertaken with a clear understanding that it could be lost and with the knowledge that it is the market, not the supplier, that ultimately determines the price paid.[13]

As customers gain a growing understanding that it is technically possible to leave the grid, some will do so simply because they value being pioneers. As technology improves and costs fall, more will do so. Ultimately this means that despite the efforts of utilities and regulators, for many customers, the cost of distributed generation will become the effective cap on rates, just as the cost of truck transport became the effective cap on rail shipping rates. Although simplistic calculations of "grid parity" are much exaggerated (they fail to compare like with like by not assessing the cost to obtain grid-free round-the-clock service of similar reliability, ignore technology and site risk, wish away permitting issues, etc.), the trends are clear: costs of distributed generation are falling, and convenience is increasing. While inertia may for some time allow utilities to charge a premium, there is no guarantee that this premium will equal the rates that are developed using current cost-of-service methodologies.

Utility executives have not lived in a world in which rate increases are impossible and where rates need to be reduced to retain customers. Furthermore, those hoping to reinvent their utilities as microgrid operators coordinating distributed resources should be alert to the possibility that

customers may shun microgrids if technology becomes sufficiently inexpensive and reliable that cooperating with neighboring resources is not valued, even if it is efficient. Utilities have never had to contend with Moore's law in their capital planning budgets, yet if the utility of the future is a technology company, they will have to. Utilities may seek to reinvent themselves as the Uber of electric power but should be reminded that they may instead be perceived as the electric power equivalent of carpooling—an activity that Americans have taken to grudgingly, if at all. Ironically, those utilities that have successfully rid themselves of exposure to competitive generation by becoming purely regulated businesses may find the shield of regulation to be less protective than anticipated if rates need to be reduced to retain customers.

Customers value independence and convenience in addition to reliability

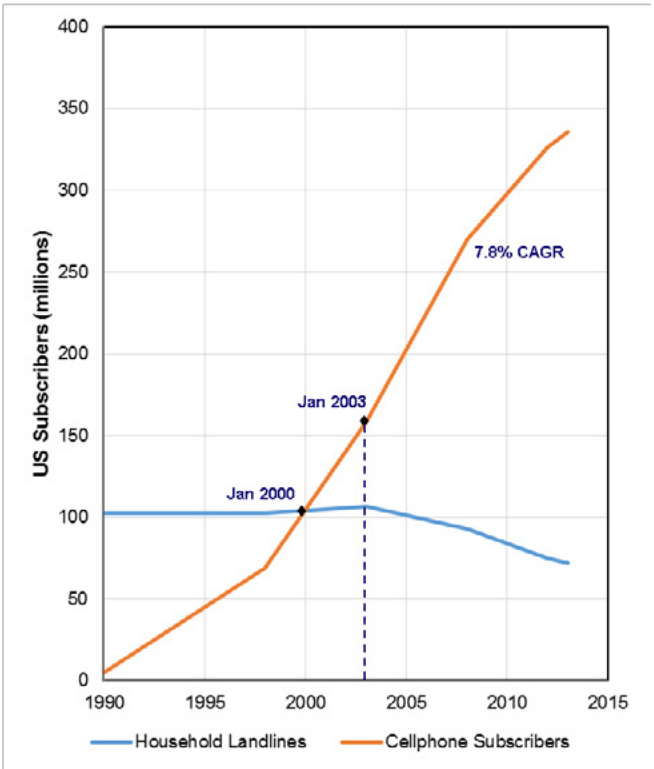
Utilities rightly point out that one of the key selling points of being connected to the grid is reliability. Distributed generation cannot yet attain the level of grid reliability without significant—and expensive—redundancy. Yet for many customers, the targeted level of reliability may be much higher than is actually needed.[14] The typical one-day-in-ten years target[15] may be a level of reliability that few customers desire. After all, if an electronic device has several hours of battery life built in, a short outage is unlikely to interrupt wireless streaming of the next episode of Game of Thrones. If the lights are back on before the last axe has been sharpened, customers may not notice. They will notice, however, if the cell towers all go out of service, suggesting that different types of customers are increasingly going to define for themselves the level of reliability that they are willing to pay for. Consumer preferences are likely to vary regionally and by climate as well. Revising rate structures to allow customers to reveal the number and length of outages they are willing to endure—and at what price—will allow for the development of a differential reliability product that could both reduce costs for consumers and reduce the need for further network investment by targeting those investments to the customers most willing to pay for them.

Gaining an increasingly granular understanding of the true value of lost load has substantial implications for system planning and for the justification for new infrastructure added to rate base. Investments that are justified on the basis of values of lost load in the thousands of dollars per MWh may become uneconomic when the revealed value of lost load is much lower. Furthermore, gaining a perspective on customer-specific values of lost load changes views with regards to cost causation. This in turn may change the type, location and magnitude of the reliability driven investments required. Regulators may need to determine (with some caution) whether utilities under limited circumstances that are otherwise forbidden from owning generation can do so if it increases reliability for critical customers while reducing the need for network reinforcement. However, in the meantime, a large proportion of customers may actually be being overcharged due to the system being designed for levels of reliability they neither need nor want.[16]

If customers are willing to accept lower levels of reliability, the price point at which distributed generation becomes a viable alternative falls. Airline customers who today complain about on-time performance and lack of legroom are nonetheless unwilling to return to train travel, even when it is cheaper. It is worth considering examples from cellular telephony as a further counterpoint. Customers who have cut the cord, eliminating landlines entirely, have made a choice to accept potentially lower levels of reliability in their home in exchange for the portability that cell phones offer.[17] Indeed, in some cases, customers are paying more for their cell phone bill, particularly when the cost of the device is considered, than they would for a landline. Clearly, customers value more than call quality and consistency; independence, flexibility and portability are all also attributes that customers are willing to pay for. Many customers who today have only a cell phone started with a landline; eventually, as those customers became comfortable with the new technology, the landline was supplanted entirely.

This progression suggests a number of potential models in which the current utility framework becomes superfluous. A "Zip car" approach to electric power services, for example, could involve standardized, portable, swappable distributed battery units on a common base, used only when customers require them and maintained or recharged in a central depot. The prospects become yet more intriguing if this concept is married to a fleet of driverless electric vehicles. Indeed, for-profit business models are not the only method of evolution; neighborhood co-ops or informal sharing networks could spring up if franchise rules are eliminated.

Figure 4: Cell phone subscribers versus house landlines (1990–2013)



Source: London Economics International LLC using data from CTIA—The Wireless Association, US Census Bureau; note inflection point in 2003 when landline subscriptions began to fall.

Exclusive franchises are anachronisms

Rail monopolies disappeared long before regulators recognized that trucks were a viable alternative. Economic circumstances inevitably change more rapidly than the set of regulations that underpin the ancien régime. As means of delivering energy services become more innovative, restrictions on the companies that can participate become archaic. Exclusive, geographically defined franchises are going to become obsolete. New business models will challenge the basic definition of what constitutes a utility. New concepts and companies will develop in spite of franchise rules and will not seek permission to come into existence and commence operations.

Just as the rise of Uber has demonstrated that rate regulation for the taxi industry was unnecessary and costly for consumers,[18] new methods of providing energy services will undermine current regulatory frameworks for the electric power sector. Uber argues that it is not providing taxi services but rather facilitating the connection between independent drivers and passengers. New Energy Service Companies ("NESCOs") will argue that they are not "selling" electricity but rather providing the means for customers to generate it themselves. In the "ZipPower" example above, an entity could argue that it is renting batteries, not selling electricity, particularly if clever ownership structures were created for the central charging stations.

While many in the electric power industry have a vision that involves a series of interconnected minigrids coordinated by a utility or a demand-side management company such as EnerNOC, the future may be quite different. The "network" may be a form of the sharing economy in which customers receive power on demand from a series of portable, centrally charged devices and on-site small-scale generation maintained in conjunction with heating, ventilating and cooling ("HVAC") equipment. While all three models (central grid, coordinated microgrid and shared device) may coexist, the implications are that the wires business is no longer a natural monopoly, that

utilities may need to be freed from regulated rates and that exclusive franchises are meaningless. Such franchise agreements may face the fate of taxi medallions, conveying little additional value to the holder.

Stranded costs are inevitable

Once we acknowledge that distributed generation sets an effective cap on rates, that customers have increasing choices and care about more than just reliability and that exclusive franchises are effectively unenforceable, the potential for stranded costs becomes clear. Utilities have relied on the ability to recover reasonable costs from ratepayers. During previous industry transitions, electric utilities have been able to pass through costs of generating stations made uneconomic due to the opening of competitive wholesale markets. Use of such competitive transition charges ("CTCs") allowed the utilities to be financially indifferent to the changes taking place in the industry. However, CTCs work only if customers remain captive. Indeed, great care was taken in the design of CTCs to assure that they were nonbypassable. In the next wave of electric power industry change, stranded cost recovery is going to be much more difficult.[19] CTCs can be recovered only if customers remain on the system. Just as railroads were unable to raise rates to cover existing infrastructure costs as trucks became a viable shipping alternative, utilities may well find themselves in a situation where rate increases are impossible. Unlike railroads, we do not anticipate significant utility bankruptcies. We do, however, expect that utilities will become more cautious about large infrastructure investments and that earnings will become more volatile.

Investors have become complacent regarding the stability of utility finances. Utilities are awarded a cost of capital above the risk free rate precisely because there is some risk. Tribunals are increasingly reminding utilities of this.[20] While utilities may be justified in seeking higher allowed equity returns due to the increased business risk of the sector, if such awards exacerbate cost comparisons against distributed generation, it is likely to be a pyrrhic victory. Utilities need to consider which parts of their rate base are most vulnerable to customer flight and determine appropriate competitive and regulatory responses. Increasingly, utilities will need the ability to offer rate flexibility, which may require rethinking the principle of nondiscrimination in rates.[21] Rates may ultimately become like the rack rates for hotels, published but seldom used, particularly in off-peak seasons.[22]

Rate setting fails to properly price optionality

To adapt to a changing business environment, principles of rate design need to be rethought. To date, rate design has been largely about costs, not value. While more sophisticated regulatory regimes began explicitly incentivizing efficiency in the 1990s and by the twenty-first century were incorporating a range of policy-related performance standards,[23] the starting point for rate setting has remained an assessment of costs. Yet the value that the network provides has not been articulated or captured in pricing. As customers begin experimenting with other forms of service delivery, many may wish to remain connected to the grid. Current rate designs require the grid to be designed to meet the peak needs of even customers that use it infrequently and may not charge customers appropriately for this option. Utilities are already exploring shifting a greater proportion of cost recovery from volumetric to fixed billing determinants. Increasingly, utilities are going to need to think about how to appropriately price the option of using the grid.

Grid access is essentially an elaborate call option on both the transport services of the network and the potentially thousands of generators that feed into it. This benefit is not trivial, and for many customers, the convenience of the grid will outweigh savings from cutting the cord, even when it becomes more economically feasible to do so. However, neither customers nor regulators think in terms of adapting a Black-Scholes model to pricing network access services. Yet theoretically, the value of grid access is equal to the sum of the value of the minute-by-minute options to use the grid; the fixed component of the customer bill becomes the sum of the option premiums for the specified period, and the strike price is the volumetric charge. Thinking about standby charges in this way helps to determine whether standby charges are just and reasonable, particularly if they are ultimately to be disconnected from costs.

Currently, fixed components of bills are set based on peak load over some preset historical period. Customers are increasingly examining the configuration of such calculations to determine whether onsite generation can be used to minimize the peak calculation that determines the fixed component of their bill. This pushes customers to increase investment in onsite generation that may be barely used but that when installed has a negative impact on the utility's ability to recover its costs for the remaining network. Utilities and regulators are going to need to

revisit standby charges to configure them in a way that reduces the incentive for customers to move to onsite generation while continuing to reflect cost causation. This may involve designing a greater variety of standby rates that have varying degrees of firmness. Returning to the concept of differentiated reliability, utilities can use refinements in their fixed or standby charges to further allow customers to reveal preferences, allowing such customers to be incentivized to reduce their peak impact without unintentionally encouraging them to leave the grid.

End of the regulatory compact makes meeting obligation to serve challenging

As more and more customers achieve the means to flee the grid, the definition of the regulatory compact will need to change. Utilities cannot be used as a conduit for funding public policies if the costs of doing so can be avoided by shifting to another form of service delivery. This means that a raft of programs embedded in utility rates today, from low-income assistance to rural rate relief to energy efficiency programs to the regulator itself will need to be funded from sources other than utility bills. The obligation to serve will shift from utilities to society as a whole; the risk is that access to cost-effective electricity service will become similar to access to high-speed Internet today: something that policy makers generally agree has broad public benefits but have failed to find a means to extend effectively to low-income or geographically dispersed communities. It may be necessary to reimagine the role of entities like cooperatives to meet these needs, possibly with funding from a broad-based tax on energy services that would encompass more than current utility customers.[24]

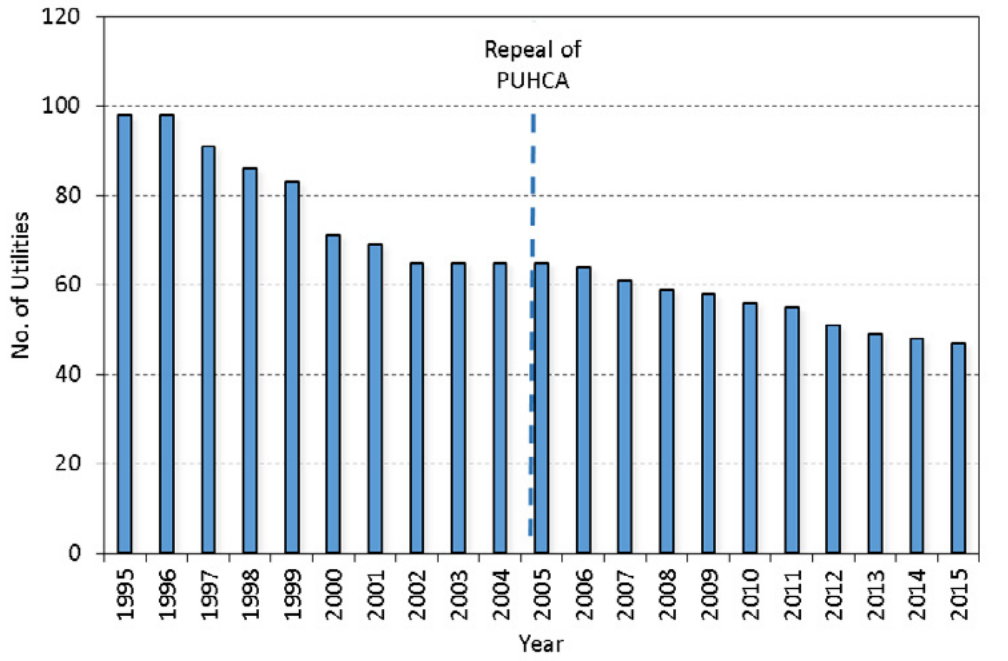
Focus on high-volume network business is likely the future for utilities

Pressure from more customer-centric business models will force utilities to concentrate on their strengths. Utilities have generally done poorly in nonregulated, competitive business lines. The industry has been subject to cycles and fads, with utilities stampeding into and out of oil and gas, buying and abandoning international businesses, creating and spinning off independent power producers ("IPPs"), and entering, exiting and now entering again natural gas distribution and transportation. Regulated entities are not going to evolve into Airbnb. Instead, while many will retain their distribution service operations, successful utilities will increasingly focus on what they are good at: moving large volumes of electricity through networks across large geographic areas. They will also need to master—and profit from—the massive amounts of data that are available to them. Proper application of data-driven asset management tools will enhance utility abilities to capitalize on economies of scale and to better meet the expectations of their customers. Properly managed, utilities will become facilitators for NESCOs, in some ways becoming symbiotic with them rather than competitors for them.

This suggests that there will be sustained merger activity as utilities seek to use larger sizes to combat shrinking margins and increasing difficulties in achieving allowed returns. While such combinations can result in limited savings if they are noncontiguous, the number of stand-alone utilities is likely to continue to shrink. This poses challenges to regulators as the number of comparators diminishes and the concentration of resources used to influence the regulators increases; however, these mergers are likely to be defensive in nature, designed to fortify the companies against a more uncertain operating environment.

Just as consolidation among Class I railroads led to a "big seven" dominating the industry, we are beginning to see the start of such combinations in entities such as Berkshire Hathaway Energy and Exelon. According to the Edison Electric Institute, due to consolidation, the number of utility holding companies declined by over 50 percent between 1995 and 2015. It is likely this pace will accelerate; an additional 50 percent could disappear due to mergers and acquisitions in the next decade. To retain large commercial and industrial customers, these expanded utility platforms will need to be more creative in pricing and service offerings. Utilities will increasingly have to sell the benefits of the network and manage the network in a way that enables its massive economies of scale to be used to compete with distributed generation on price. NESCOs and microgrids may serve the role of Class II and Class III railroads, feeding customers and traffic to the larger entities. As this evolution occurs, we also see greater specialization and pruning of networks. Just as Verizon spun off its rural phone service companies and National Grid sold utilities in smaller, noncore markets, future consolidated utilities will likely hive off those parts of the network that are less susceptible to scale economies. While abandonment—the fate of parts of the rail network—is less likely for these cast-off entities, their cost structure may pose particular challenges to maintaining quality service in the face of potential self-supply by better-off customers.[25]

Figure 5: Decline in utility holding companies since 1995



PUHCA refers to the Public Utility Holding Company Act of 1935, which was repealed in 2005 after having been rolled back in 1992. Among other things, the act limited the activities of holding companies of investor-owned utilities in unregulated industries.

Source: Edison Electric Institute, EEI Financial Review (2015).

Implications for regulators, customers and shareholders

An assessment of the increasingly dynamic environment for electric utilities in the United States leads to several conclusions:

Electric utilities will eventually cease to be natural monopolies. This means that the function of an "economic regulator" becomes unnecessary. The regulator's role will increasingly shift to matters of safety and access.[26] Utilities will need to be given vastly greater latitude in how rates are set and the ability to earn greater returns in response to increased risks. Although jurisdictional issues between state and federal regulators may impede progress, there will need to be a Staggers-like act for the electric power industry. Exclusive franchises will need to be replaced by licensing regimes, which may be extended to NESCOs. Licensing fees may become the basis for funding the regulator and for various aspects of the social safety net, though defining and enforcing the licensing regime may prove to be challenging.

Utility management needs to adapt to a world of falling prices. Utilities are going to need to completely rethink business and investment planning under the assumption that the sector will eventually become competitive. This will manifest itself in a variety of ways. Investments with longer payback periods will become less attractive. Those utilities that have yet to adapt outsourcing will need to reconsider. Defined benefit programs will come under greater strain. Ultimately, management will face the challenge of doing more with less, of becoming more customer responsive while having fewer resources for capital investments.

The world is becoming more complicated for power customers. At one time, the only choice a telecom customer had was the color of his or her Princess phone. This world first gave way to competition in long-distance telecommunications; now customers can choose from a multitude of cellular handsets on a range of voice and data plans. Likewise, the power sector is poised to move to a realm in which the types of devices and service plans

proliferate. Customers will need to reassess the ways in which they use power and think critically about which attributes they value.

Dividends will disappear. The challenges of responding to greater investment needs with less certainty of return mean that payout ratios will need to fall. Utilities will be less able to rely on steady cash flow from existing utility customers to finance ongoing operations and will need to adjust dividends accordingly. If regulatory regimes are adjusted, the potential to earn greater returns may allow for greater revenue growth potential without adding to rate base, but this is unlikely to support robust dividends.

Railroads didn't die, and electric utilities won't either. In many ways, railroad survival relied on them remaining boring. Likewise, for electric utilities, survival will require a reassessment of what their capabilities are. No matter how exciting the idea is of running a fleet of electric vehicles—or exploring large-scale storage or pursuing a host of other technological innovations—utilities are primarily good at just one thing: moving large volumes of electricity over long distances. Focusing on this business—and building on it—is what will assure the long-term viability of existing utilities.

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NOTES

1 Data from Bloomberg and C. Kennedy, *Evolution of Great World Cities: Urban Wealth and Economic Growth* (2011), 101.

2 The Surface Transportation Board (STB) defines a Class I railroad as a long haul freight railroad with 2014 operating revenue of $475.75 million or more. This threshold means that there are 7 Class I railroads currently in operation: Union Pacific (UP), Burlington Northern Santa Fe (BNSF), CSX Transportation, Norfolk Southern, Grand Trunk/Canadian National, Soo Line/Canadian Pacific and Kansas City Southern. The threshold is adjusted annually.

3 Bureau of Transportation Statistics, US Ton-Miles of Freight (BTS Special Tabulation), National Transportation Statistics (2015).

4 Ibid. Table 1-40: US Passenger-Miles, 2015.

5 One example of this was the Northern Securities Company antitrust case of 1904. Northern Securities was a trust company formed in 1901 to control the Chicago, Burlington & Quincy, the Northern Pacific and the Great Northern railroads. Under the Sherman Antitrust Act of 1890, the federal government sued and won Northern Securities Co. v. United States ultimately dismantled the company and set important precedents for future antitrust cases, including forty-four in the following seven years. Ironically, today, all of the subject railroads are part of BNSF.

6 In a report to the Senate, the Federal Railroad Administration detailed the decline of the industry, with an industry return of 4.2 percent in 1955 dropping to 1.7 percent in 1970. According to Stover's *Historical Atlas of the American Railroads* (1999), between 1960 and 1979, the average rate of return for railroads was 2.9 percent, rising to 7.4 percent between 1980 and 1995 following the Staggers Act. The return was as high as 9.4 percent in the four years between 1992 and 1995.

7 An MIT study, *Productivity of the US Freight Rail Industry 1979–2009*, defines productivity in the rail industry via revenue ton-miles (RTM) per units such as operating expense. Productivity of labor grew 430 percent, in part due to the large decline in number of employees (p. 12).

8 Ibid.

9 For the purposes of this paper, the author defines a "utility" as an entity that is subject to price regulation, generally because it is deemed to be a natural monopoly providing an essential service. Using this definition, most distribution and a large proportion of transmission networks are currently considered utilities. An independent power producer, or "IPP," is not a utility. As a participant in the competitive part of the electricity sector value chain, it has neither an "obligation to serve" (other than what is specified in its power purchase agreement, or "PPA"), nor is it entitled to (and limited to) "just and reasonable" rates. As more nontransmission alternatives ("NTAs") arise and incumbent preference is eliminated, transmission is becoming less of a natural monopoly. More slowly, similar trends are eroding the natural monopoly argument for distribution as well.

10 Evaluating the impact of net metering is complex in that much distributed generation may have otherwise unpriced benefits beyond the energy provided; for example, in terms of avoided emissions or deferred distribution investment. Efforts to better align compensation for behind-the-meter resources with their value are ongoing; however, policy makers will still need to consider whether utilities will receive adequate compensation for grid services and the issues of interclass customer equity.

11 Utilities can turn the "free parking" spot to their advantage through concerted lobbying. A common "house rule" in the game of Monopoly is that all fines and payments go into the middle of the board, to be collected by the player who lands on the free parking space. In fighting net metering and repositioning themselves as smart grid coordinators, some utilities are attempting to access such a windfall. Beyond simply preventing cross subsidies, savvy utilities are attempting to use smart grid concepts to again be allowed to own generation in those states that no longer allow generation in rate base. While some circumstances may warrant relaxation of such strictures, regulators need to be vigilant in assuring that net metering rates are fair to utility customers, without creating new rent-seeking opportunities for utilities.

12 The cost-of-service regulatory model had pernicious effects on the entire utility supply chain, as both equipment manufacturers and labor perceived that their utility customers could incorporate significant costs in rates. As the cost-of-service rate model becomes less and less sustainable, utility supplier margins and collective bargaining agreements will also come under pressure.

13 The potential for competition to supplant regulation is seen in the case of *Market Street Railway Co. v. Railroad Commission of the State of California*, upheld by the Supreme Court. In the opinion of the court, "Regulation does not assure that the regulated business make a profit." Further, in this case, the appellant suggested due process had not been followed. The

court was of the opinion that "due process cannot be applied to insure values or to restore values that have been lost by the operation of economic forces" (Supreme Court of the United States, 1945).

14 In Nova Scotia's 2014 Electricity System Review, the Department of Energy found that the primary concern remained low rates. Indeed, while 59 percent of public opinion survey respondents felt that the utility should spend more money to decrease the frequency of power outages, a substantial minority (33 percent) felt it should spend as little as possible in order to keep power rates down (Nova Scotia Department of Energy, 2015). In 2012, Build Energy America's Reliability Demand Survey (RDS) found that less than half (45 percent) of residential customers would be willing to pay a monthly fee of between ten and forty dollars to ensure that they would never experience an outage lasting for more than four hours (K. King, 2012).

15 In its 2004 report prepared by the Resource and Transmission Adequacy Task Force, the North American Electric Reliability Council ("NERC") proposed the now-ubiquitous one-in-ten year's standard. This standard is typically translated to one event every ten years, or 0.1 days/year, or 2.4 loss of load hours per year (NERC, 2004).

16 An analogy in rail networks is the proliferation of high-speed services in countries like France or Japan on routes where traffic will never justify the investment and where air travel or enhanced bus service may be far more cost effective, although in such cases, it is often the taxpayer, directly or indirectly, who bears the unnecessary expense.

17 The IEEE Spectrum describes the trade-off customers make for portability of cell phones as a result of the compression of voice data from the dedicated 64kb/s of landlines to as low as 5–10kb/s. The latter is also performed automatically by cell phones, often at the expense of the user experience.

18 Some state and local regulators have nonetheless required Uber to file rates, though these rates do not require approval.

19 See for example, Binz et al, in *Practicing Risk Aware Electricity Regulation*, who note that "it is unlikely that consumers will bear the full risk of poor utility resource decisions" (p. 7).

20 In its 2015 ruling against FortisAlberta Inc., the Alberta Utilities Commission deemed that the "risk of stranded assets should be borne by utility shareholders rather than be retained in rate base."

21 This principle—that similarly situated customers be offered identical rates—also has its roots in the rail industry, as secret discounts by rail companies were alleged to have helped Standard Oil consolidate its monopoly in the oil business. However, in a competitive market, few customers are exactly alike; tailored, confidential price schedules are standard practice and may be critical to customer retention by utilities.

22 The case of *Orloff v. Verizon* suggests that rate discrimination will become more common as competition is recognized; the Court of Appeal upheld the decision of the US Federal Communications Commission ("FCC") that Verizon was right to offer discriminatory rates to different customers given that "rates are determined by the market, not the Commission, as are the level of profits" and "there is no statutory provision even requiring that the carrier publicly disclose any of its rates, although competition will force it to do so" (US Court of Appeal, 2003).

23 One example of this change in perspective is seen in the UK regulator (Ofgem) rate-setting mechanism that seeks to incentivize quality of service for the consumer. Shortened to RIIO (Revenue = Incentives + Inputs + Outputs), the model incentivizes reliability and customer satisfaction. For electricity distributors, the current regime will run from 2015–2023. New York is moving in a similar direction, with a recently announced regulatory regime that places more emphasis on a variety of utility performance measures.

24 Mass transit has proceeded along a similar path. As aggressive price regulation and implicit subsidies to personal vehicles drove private investment from mass transit, and funding mechanisms evolved that provided contribution from other forms of transportation. Tolls from bridges and tunnels effectively cross subsidize buses and subways in New York City; a portion of proceeds from gasoline taxes in some jurisdictions is used to fund mass transit.

25 An example of declining quality in the wake of a spin-off was seen in the case of Verizon's spin-off of its Northern New England business (1.6 million phone and 200,000 Internet customers) to FairPoint Communications. Fairpoint struggled to maintain service, filing for Chapter 11 Bankruptcy protection in 2009 and, after emerging in 2011, was subject to a yearlong service quality investigation by the Public Service Board of Vermont from 2014 to 2015 (State of Vermont Public Service Board, 2015).

26 An example of how regulators are rethinking access issues in newly competitive markets can be found in Maryland, where the Maryland Public Service Commission has imposed a small surcharge on Uber trips to fund mobility services for riders with disabilities. Regulators may need to evolve similar surcharges on NESCOs to assure funding for programs for low-income customers.


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