Toward A New Regulatory Compact For Electric IOUs

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Contents

Introduction

Stress Tests: Why Are They Important?

The current COVID-19 pandemic crisis has provided a lurid demonstration of what can occur when systems are pushed to the limits of their capabilities. All of their potential weaknesses and shortcomings are suddenly highlighted in a very graphic way, and in an environment which is not conducive to correcting or improving them. Crises such as these are, in essence, "stress tests" that identify the boundaries of effectiveness of existing systems. In the aftermath of these crises, the faults and limitations that were brought out in such bold relief can be addressed and corrected, and ideally an evolution to a superior system will take place.

As a result of the COVID-19 pandemic for example, the following shortcomings and need for improvements were identified[1]:

- The importance of timely non-pharmaceutical interventions (NPIs) by national and local governments to limit the early spread of the disease, including such measures as school and workplace closures, bans on public events and gatherings with more than 10 people, and limitations on human movement.
- The stockpiling of emergency supplies and enhancement and standardization of logistical procedures for making these supplies rapidly available for use when needed.
- Emergency preparedness drills at the community level for pandemics and other disasters.
- A stronger role and increased capabilities for the World Health Organization (WHO) to coordinate and implement various control-measures.
- The elimination or streamlining of arbitrary barriers to emergency supply chain effectiveness, such as state highway tolls and weight inspections, and border issues at the international level.
- Improvements in the general health of the population, as factors such as obesity were observed to increase susceptibility to the disease, the disease's potential to require hospitalization, and its fatality.

And, perhaps most importantly, the recent pandemic has highlighted the need for a conference at the international level to systematically review which strategies were adopted by various countries to control it, and their relative effectiveness.

(It is interesting to observe that the Covid-19 pandemic not only revealed weaknesses in the current health care system, but also highlighted certain strengths and potentialities that perhaps were not apparent before the crisis occurred. For example, private industry – with government support and encouragement - showed incredible speed and alacrity in developing vaccines for the disease. And collaboration in general, between government and industry, between firms

[1] Lessons Learnt From the COVID-19 Pandemic - PMC (nih.gov); also Coronavirus: Lessons of the Pandemic - The Washington Post

within the industry, and at the international level, was generally quite good, as was global supply chain effectiveness – at least in the earlier phases of the pandemic.)

Fortunately, the discovery of limitations in existing systems and consequent envisioning of pathways for improvement do not require the onset of a crisis of the scale that we have seen with the COVID-19 pandemic. Evidences of vulnerabilities can be detected in "stress tests" of a much more limited nature, such as ones that occur in special situations or isolated areas, and in many cases all that is required is simply a sufficiently vivid imagination to envision what *could* occur under certain situations.

Stress-Testing the Electricity Industry

The electricity industry provides fertile ground for the exploration of stress tests – both real and imagined – as a means to address potential limitations and needs for reform or improvement in regulatory, technical, and business systems that have existed virtually unchanged for decades, particularly at the level of the distribution system. Signs of stress have already begun to appear in various electricity systems throughout the country, and trends suggest that these will both expand in scope and increase in intensity in the years ahead. These invite the application of a visionary approach to mapping out needed changes in these systems, and in particular the regulatory paradigm, or compact, that has formed the basis of electricity service for nearly the past century. In states like New York, California, Illinois, and Hawaii, developments are underway which threaten to undermine the traditional regulatory compact, and which call for a fundamental reassessment of the model which this compact supports.

There are essentially three types of stresses that could destabilize an industry:

1. **Incidental Stresses**, generally involving rare and unexpected "black swan" events. The Covid epidemic is an example of this type. These events highlight vulnerabilities that the system had not adequately prepared for, and that need to be addressed so that they can be prevented, or at least effectively handled, in the future. For the electricity industry, such events have included the California wholesale market debacle of 2000-2001, extensive and long-term outages in the northeastern U.S. stemming from Superstorm Sandy in 2012, and the Texas power crisis of 2021.
2. **Disruptive Innovation**, arising from new technologies or practices that undermine or even overturn existing market models. The impact of internet retail services such as Amazon.com on brick-and-mortar stores, streaming services such as Netflix and Hulu on cable television, and ride-sharing services such as Uber and Lyft on taxicabs, are classic examples of this.
3. **Long-term trends** stemming from 1) non-disruptive innovation – or at least innovation that will only be disruptive after reaching some critical threshold of adoption, 2) changes in other external factors, such as the environment and government policy, and 3) demographic trends, involving changing patterns of customer behavior.

While the first of these, incidental stresses, is a highly important source of disruptions to systems, the most important ones affecting the electricity industry have been generally identified and addressed – at least in policy analyses and white papers, if not already directly by the industry itself. The second of these, disruptive innovations, actually – in many if not most cases – represent positive changes for the consumer, and attempts to "address" them by incumbents in the industry have often actually resulted in the prevention or retardation of positive changes. In this paper, therefore, the authors will focus specifically on the third cause of stresses to systems, long-term trends, by identifying them and then exploring how they might best be addressed. The principal feature of the electricity industry most vulnerable to long-term trends is the regulatory compact, and so this, too, will be the primary focus of this paper. Specifically, the authors will assess whether the compact will or should continue to exist and, if so, how it should be modified in a way that continues to serve the best interests of electricity customers.

The Legacy Compact Could Face Increasing Obsolescence

Before addressing individual trends, and how they might present new challenges to the present-day regulatory compact, it is reasonable to address the more fundamental question: is a regulatory compact still needed?

The Regulatory Compact has its origins in the service franchise contracts granted by public utility commissions in the late 19th century.[2] These contracts specified the terms under which utilities agreed to serve the public (e.g., price, duration, quality of service) and evolved into the framework by which investor-owned electric utilities are regulated to this day. Such contracts defined a set of mutual rights, obligations, and benefits; in effect, a contract between the utility and society overseen by the regulator. Utilities accepted the obligation to serve everyone in the service territory, under rates (regulated prices) sufficient to recover their prudently incurred costs, including their cost of capital. Commissions, acting on behalf of customers, agreed to confer an exclusive franchise to the utility. As regulation, evolved the terms of such contracts often were not stated explicitly. Nevertheless, investors relied on this regulatory construct in deciding whether to provide financing to the utility by buying its stocks and/or bonds.

The public purpose rationale for the Compact, as annunciated by the Supreme Court, was based on the premise, first, that electric service is indispensable to the functioning of our modern society; and second, that without regulatory support (i.e., to ensure that it will be able to recover its prudently incurred costs) the utility would not be able to raise the large sums of capital needed to build the infrastructure needed to serve the public. The indispensable nature of electric service was described by Supreme Court Associate Justice Felix Frankfurter in a 1930 article:

> *No task more profoundly tests the capacity of our government … than its share in securing for society those essential services which are furnished by public utilities. Our whole social structure presupposes … dependence upon private economic enterprise. To think of*

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[2] Karl McDermott, *Cost of Service Regulation in the Investor-Owned Electric Utility Industry: A History of Adaptation*, EEI (2012), page 6.

contemporary America without the intricate and pervasive systems which furnish light, heat, power, transportation, and communication is to conjure up another world. The needs thus met are today as truly public services as the traditional governmental functions of police and justice. That both law and opinion differentiate from all other economic enterprise the economic undertakings which furnish these newer services is not the slightest paradox. The legal conception of —public utility|| is merely the law's acknowledgement of —irreducible and stubborn facts.[3]

The need for regulatory support was explained by the Court in The Binghamton Bridge Case in 1865:

The … [capital needed is] beyond the ability of individual enterprise, and can only be accomplished through the aid of associated wealth. This will not be risked unless privileges are given and securities furnished in an act of incorporation. The wants of the public are often so imperative that a duty is imposed on the Government to provide for them; and, as experience has proved that a State should not directly attempt to do this, it is necessary to confer on others the faculty of doing what the sovereign power is unwilling to undertake. The legislature, therefore, says to public-spirited citizens: —If you will embark, with your time, money, and skill, in an enterprise which will accommodate the public necessities, we will grant to you, for a limited time period or in perpetuity, privileges that will justify the expenditure of your money, and the employment of your time and skill.|| Such a grant is a contract, with mutual consideration, and justice and good policy alike require that the protection of the law should be assured to it.[4]

Today's electricity markets have evolved in ways that contradict two of the Compact's critical assumptions. No longer are utilities the exclusive supplier of power in their service territories, and a growing number of consumers are no longer content with "standard" utility service (i.e., generation from utility-scale plants delivered through the transmission system). In thirteen states and the District of Columbia customers can choose from among multiple competing suppliers. These jurisdictions have restructured their markets to allow; indeed, to encourage, retail choice.[5] Even in states that have not restructured, standard service is no longer customers' only supply option. Customers can install their own distributed energy resources (e.g., roof top solar panels, batteries, natural gas turbines, small wind turbines); and they are. According to the Solar Energy Industries Association 514,000 residential photovoltaic (PV) systems were installed in 2021, an increase of 30% over 2020.[6] Fossil fueled backup generators are another consumer option. Sales of such generators declined in 2020 due to the impacts of Covid 19. But according the Fortune Business Insights, given "…remarkable development in the technological advances

[3] Frankfurter, F. (1930). The Public and Its Government, Yale University Press, New Haven, CT.

[4] The Binghamton Bridge Case, 70 U.S. 3 Wall. 51 51, 1865.

[5] National Renewable Energy Laboratory, *An Introduction to Retail Electric Choice*.

[6] SEIA, US Solar Market Insight Executive Summary, March 22:

in generation technologies…" sales are expected to resume growth of over 5% a year through 2028.[7]

And a growing number of customers are interested in more than just standard tariffed service.[8] The increase in extreme weather events, which has been attributed to increasing greenhouse gas emissions[9], is causing many customers to desire levels of sustainability and reliability greater than that offered by standard service. This factor, together with the continuing evolution of distributed energy technologies, is driving market demand for a growing proliferation of custom products and services. Recent examples include the following:

- Utility-Corporate Buyer Collaborative Forum, organized in 2016 to address the desire (demand) by Fortune 500 companies for carbon-free power supply, a product well outside the scope of standard service.[10]

- The combined heat and power (CHP) collaborative hosted by EEI in 2015 and 2016 in an effort to facilitate business partnerships between EEI members and vendors of CHP products. CHP products and services are generally outside the scope of standard service and represent markets incumbent utilities are not allowed to enter.

- The NY Prize program, which supports communities interested in developing microgrids for enhanced reliability and resilience. Microgrids are networks of distributed energy sources that can provide power to multiple customers, including residential and commercial customers as well as crucial public services such as hospitals, first responders, and water treatment facilities. They represent a new technology well outside the scope of standard utility service. Interest in microgrids has been stimulated by severe storm events on the east coast in the last ten years. 83 communities have received funding to evaluate the feasibility of microgrid applications. Interest in microgrids is not limited to New York state.

Continued innovation which results in new, low-cost sources of electricity could greatly diminish or even eliminate the need for a "provider of last resort". If the introduction of these low-cost sources is accompanied by lower barriers to entry, then the new, competitive market could also eliminate any need for pricing oversight by regulators. At the extreme, customers in general might someday find it more economical to self-source most if not all of their electricity needs, through such things as solar panels, microturbines, and energy storage devices. Utilities, if they even continue to exist, would then become, at best, supplemental providers. Regulators might allow them to shift their primary role from that of an energy provider to something more like a stock exchange, overseeing market transactions and/or balancing supply and demand, and this

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7 Fortune Business Insights, Power / US Generator Sales Market: https://www.fortunebusinessinsights.com/u-s-generator-sales-market-106160

8 I was once cautioned by a former chair of the Maryland Public Service Commission not to refer to custom services as "non-standard" because standard service was the gold standard among regulators and anything non-standard would be interpreted as inferior quality.

9 7 c Increased extreme weather events due to climate change | NOAA Climate.gov

10 *Creating Renewable Energy Opportunities*, Utility-Corporate Buyers Collaborative, June 2016.

could entail some form of regulation. But again, the role of "provider of last resort" would be greatly diminished, if it existed at all, and rate cases would be limited to these support services, if not eliminated entirely. The telecommunications industry provides a telling example of how innovation can completely change and diminish the role of regulation. There are no "rate cases" that govern the pricing of cellphone and internet services, and "carrier of last resort" obligations have been greatly reduced and are now limited to the largest telcos, and only in those parts of their territories where they are receiving federal high-cost support. Universal service is now supported, rather than mandated, by an FCC-administered fund which is paid into at a fixed percentage rate by all telecommunications providers.[11]

Extreme scenarios like this one have been alluded to in the grid modernization conversation for years, but they still seem to be very far off into the future. As is implicit in its very definition, innovation is something that is not foreseen, and disruptive innovation – as occurred with internet retail marketing (e.g., Amazon) and ride-hailing services (e.g., Uber, Lyft) – can upend an industry almost overnight. And so while it must be acknowledged that the end of the regulatory compact will always be a possibility, it makes more sense to examine how the regulatory compact should be revised or redefined in the face of changes and trends already occurring. This is particularly true given that electricity is a vital service that should only be left entirely to market forces if there is absolute certainty that there is no risk of exploitation by providers, or critical interruptions of service. The California experience of 2000-2001 – when market manipulation by Enron and others resulted in wholesale electricity prices rising nearly ten-fold, along with large-scale blackouts – provides a telling example of the terrible consequences that could ensue as a result of trusting market forces too quickly, and too completely.

Trends and Challenges

The Challenge of Flat Or Declining Sales

The future of electricity sales has perhaps never been more uncertain than at the present time. On a per capita basis, sales peaked in the U.S. in 2007, and since 2010, total sales growth has only averaged 0.1% per year. The U.S. Energy Information Administration, in its current Annual Energy Outlook[12], is projecting sales growth to average 0.7% per year through 2050, but its projections do not include any future mandated energy efficiency programs, such as for heating and air conditioning systems, and home appliances, which could reduce this rate of growth, or even result in a decline in sales. In any case, such a muted rate of growth compares very unfavorably with the rate of growth of capital expenditures. According to the Edison Electric Institute[13], total capital expenditures for investor-owned utilities grew at an average annual rate

[11] Universal Service Fund | Federal Communications Commission (fcc.gov)

[12] Annual Energy Outlook 2022 - U.S. Energy Information Administration (EIA)

[13] Industry Data | (eei.org)

of 6% per year from 2011 to 2020, and are projected to continue to grow at a rate well above the official sales growth rate indicated in the EIA Annual Energy Outlook. Unless significant efficiencies can be realized in regular utility operations in order to offset these costs, then these capital expenditure requirements will translate into potentially significant price increases for consumers. It is just such an observation that has spurred concerns about a "death spiral", in which rising electricity costs prompt consumers to seek out further reductions in electricity usage or explore other sources of electricity supply, thereby resulting in even further price increases, etc.[14]

It has been argued that electricity sales might actually rebound in future years due to the rise of new applications and uses, principally electric vehicles. The Energy Information Administration, in fact, projects in its Annual Energy Outlook that electricity usage in the transportation sector will grow by 8.7% per year through 2050. But even at this robust rate, total electricity sales in that sector will only amount to 3% of total retail sales in 2050. And even if this projection is conservative, there are other countervailing trends in addition to continuing improvements in energy efficiency. The growth in consumer self-supply of electricity – through solar panels, for example – will translate directly into a loss of retail sales for utilities.

But if electricity sales are flat or declining, will this constitute a threat to the regulatory compact? Regulators in many states already allow special rate designs to exist which enable utilities to actually promote energy efficiency and lower electricity usage and yet still recover sufficient revenue to cover costs and their allowed returns.[15] A simple fixed-variable rate design that is truly reflective of how costs are incurred, which includes, for example, a flat monthly customer charge to cover fixed costs, a demand charge to cover demand-related costs, and a per-kilowatt-hour energy charge to cover incremental costs (e.g., fuel and operating expenses) would ideally shield utilities from the impacts of declining sales. The concept of high fixed and/or demand charges has often met resistance among consumer advocates, but it would really bring electricity rate design more into line with the rate designs of other network services, such as smart phones, the internet, and television streaming services, which generally incorporate most or all of their monthly charges into a fixed access fee.

There is still the risk, of course, that if the overall electricity bill grows at a rate that is unpalatable to many consumers, then there will be even more pronounced declines in usage, which might present a real business risk for utilities, particularly if the declines are accompanied by grid defection, or increased reliance upon self-generation. But electricity utilities faced with such a scenario might adopt a course similar to that faced by telecommunications companies, when customers began to migrate away from landline phones to cellular phones and the internet for communication, and these companies migrated to providing such services themselves. This could be facilitated by regulators enabling utilities to offer distributed energy resources and other services that come into demand as a result of new customer preferences.

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[14] Are Electric Utilities in a Death Spiral? – Alternative Energy HQ

[15] *Alternative Regulation for Energy Utility Challenges: 2015 Update*, Edison Electric Institute.

The balancing act in regulatory policy here would be to allow utilities greater flexibility in providing new services to consumers when it is to the benefit of consumers to do so, while not simply protecting utilities from an obsolescence which might be inevitable.

Climate Policy

According to the 2021 Sixth Assessment report by the UN International Panel on Climate Change[16], even if CO_2 and other greenhouse gas (GHG) emissions are reduced to net zero by 2050, long-term global temperatures will increase by 1.4° C (2.5° F), and if emissions are held to current levels through 2050, the temperature increase will be 2.7° C (4.9° F) . These projections, which have been periodically provided and updated by the IPCC in its assessment reports since 1990, has inculcated an increasing sense of urgency to address the impacts of emissions on climate change. While there has been marked political divisiveness in the United States regarding the seriousness of this issue and how to deal with it, along with much diversity in policy among the fifty state governments, there has nevertheless been a tangible response to the crisis. According to the Energy Information Administration[17], energy-related CO_2 emissions have declined from an all-time peak of 6.0 billion metric tons in 2007 by 19%, down to 4.9 billion metric tons in 2021. More than three-fourths of this reduction came from lowered CO_2 emissions in the electric power sector during that time, mainly in response to state-level renewable portfolio standards and environmental emissions regulations targeted to power plants. (According to the North Carolina State University's Database of State Incentives for Renewables and Efficiency©[18], 30 states and the District of Columbia currently have renewable portfolio standards in place, which establish deadlines for producing targeted percentages of electricity from clean energy sources, such as solar and wind.) And according to the EIA's *Annual Energy Outlook*, the electric power sector will be the only one in which energy-related CO_2 levels will not be flat or increasing from now through 2050.

Clearly, this industry has been expected to do most of the heavy lifting when it comes to reducing U.S. greenhouse gas emissions, and it appears that it will be expected to continue doing so in the decades ahead. With no national policy like a carbon tax, and the apparent minimal effectiveness of reducing emissions through positive incentives, it appears that it will only be through the continued imposition of mandatory requirements on specific industries that further significant emissions reductions will be possible. While it is always possible (but presently unlikely, given the sharp political divide on national-level policies, including environmental) that mandatory reductions could be achieved, for example, in the transportation sector by imposing aggressive vehicle emissions standards, it would seem that only in the electric power sector is this practically possible, and only through impositions on regulated utilities.

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16 AR6 Climate Change 2021: The Physical Science Basis — IPCC

17 Total Energy Monthly Data - U.S. Energy Information Administration (EIA)

18 PowerPoint Presentation (ncsolarcen-prod.s3.amazonaws.com)

The Need For Increased Reliability and Resilience

The increasing frequency and severity of adverse weather events, which are caused by global warming, is driving the need to redesign/harden electricity systems so they are more reliable and more resilient. Utilities need to respond, but cost-of-service regulation, with its strictures against "imprudent" cost incurrence, puts utilities in a quandary. How much spending for increased reliability and resilience is prudent? In an environment where there is little objective guidance, the potential for hindsight-based determination is very real: if the utility upgrades its system and does not experience adverse weather events, it can be challenged for having spent too much; if it experiences adverse events leading to an extended outage it may be challenged for not having spent enough. Reliability is measured via System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI), but there are few explicit standards for required reliability. Where resilience is concerned (i.e., the ability of the system to withstand exigencies without failing), there are not even an agreed-to metrics. Part of the problem is that one size no longer fits all: customer demand for increased reliability and resilience is differentiated. In any case, the need for increased reliability and resilience tends to buttress the need for a regulatory entity to be responsible for providing it, but which is governed by a more enlightened regulatory policy. However, it also leads to the fourth and perhaps potentially most transformational trend: the increased presence of distributed energy resources and the growing demand on the part of consumers for custom products and services.

The Growth of Distributed Energy and Demand for Custom Services

One of the factors stressing the electric system is the growth of distributed energy resources, which are defined as capabilities for actively managing electricity service by customers “behind the meter”, or outside the direct control of the local electric utility. These include onsite sources of electricity, such as power from solar panels, and the ability to store electricity for future use or resale. The growing popularity of these resources can be attributed to increasing customer concerns about reliability, particularly in areas which have seen extended power outages, such as in the northeastern United States after Superstorm Sandy left millions of residents there without power for several days in 2012 . It can also be attributed to the significant cost reductions in solar power and storage technologies, along with aggressive marketing and advocacy efforts by solar power providers. In Hawaii for example, where these developments are particularly pronounced, 14% of electricity comes from distributed energy resources, and nearly 19% of all residential homes possess some form of these resources (generally solar panels). This level of penetration fundamentally undermines the traditional regulatory model, which is premised upon regulated monopoly service by the local utility. As Colton Ching, Senior Vice President of Planning and Technology at Hawaiian Electric observes: “Utility customers are becoming much more active in decisions that determine the operation of the electric grid. Any consideration of de-regulation or re-regulation of the electricity market needs to consider that customers’ desires and expectations are changing. For example, Hawaiian Electric remains a vertically integrated utility, regulated by a state agency. However, in reality, we are no longer a monopoly like we were before. We must compete every single day to serve the customers we have. Other companies, including solar companies and aggregators, are competing for our customers."

To the extent that customers are merely using novel methods to control their electricity usage, without actually sending electricity into the grid, it could be argued – and plausibly so – that this should not impose any additional obligations upon them. To adapt a popular cliché, "What happens behind the meter, stays behind the meter," and if a customer is simply modifying their consumption patterns, then the utility is – and should be – oblivious to whether this is the result of simple energy conservation measures, load shifting, the operation of small electrical appliances with rechargeable batteries, or larger-scale uses of energy resources, such as solar panels. Even here, however, certain large-scale changes in customer behavior could create a source of stress on the system in operational terms, if, for example, demand for electricity suddenly falls or spikes in response to the widespread use of solar power resources, or as a result of the simultaneous charging of a large number of electric vehicle batteries. Sharp reductions in electricity usage to the presence of onsite resources may also hamper the utility's ability to recover its fixed costs of service. However, it could be argued that both of these issues could simply be addressed with more cost-reflective rate designs, rather than for some form of overt control of the customer's consumption behavior. Rates with a suitably-sized customer charge and/or demand charge will help to ensure recovery of fixed costs, and the introduction of energy (i.e., per-kilowatt) charges that are representative of the actual variable cost of electricity will actually create incentives for customers to modify their consumption behavior in a way that stabilizes patterns of demand. But under extreme conditions, would rate design improvements be sufficient to mitigate these issues?

And when behind-the-meter energy resources are introducing electricity into the grid, their owners can no longer contend that their behavior is outside of the bounds of some form of external oversight, whether that be by the utility, or the regulator, or both. Ironically, however, in the early phases of electricity deregulation, measures were taken to *encourage* the production and sale of electricity by non-utility sources, with the idea that this would result in the evolution of a free market for electricity supply, and with corresponding incentives to produce electricity and to sell it at competitive rates. The 1978 Public Utility Regulatory Policy Act, for example, compelled utilities to purchase power from sources (e.g., cogeneration facilities) that could provide it at lower than the utilities' avoided cost, and created a new category of non-utility power providers called "qualifying facilities" that could sell their power to utilities at the utilities' avoided cost. However, the market that eventually evolved in response to this and other measures was a wholesale market, managed at the transmission level. Behind-the-meter electricity resources have introduced complications involving both pricing and system management.

On a small scale, power supplied from resources behind the customer meter have traditionally been tolerated by utilities. When only a handful of customers in a utility's service territory had solar panels, for example, they were allowed to send power back into the grid with no modifications or limitations at all. At times when their solar panels were producing more power than they were using, the rotary electric meters owned by these customers would simply spin backwards, essentially resulting in a negative charge for the electricity produced. Known as "net metering", this phenomenon resulted in the customer getting compensated at a rate much higher than the avoided cost that would have been paid to a qualifying facility under PURPA, as well as the wholesale market price of electricity, because the per-kilowatt-hour rate paid back to the customer included more than simply the avoided or wholesale cost of electricity. It also included a significant portion of the fixed costs incurred by the utility for serving that customer, which had been rolled into the per-kilowatt-hour charge rather than into a flat customer charge (and/or a demand charge). This subsidy could be ignored by utilities when it was on a miniscule scale.

However, on a larger scale, both the cost and operational impacts of such an arrangement cannot be ignored. This constitutes a much more significant "stress test" of the existing system, in which a large number of customers could potentially be putting electricity into the grid. As an extreme, consider a situation in which all customers served by a particular utility had solar panels, and were compensated for net power produced by them under a net metering arrangement. Under conventional rate designs, with a significant share of the utility's fixed costs rolled into the per-kilowatt-hour charge, the utility would incur a huge under-collection of allowed costs to be recovered. And this scenario would be all but impossible to manage physically, as there would potentially be times of the day when all customers were putting electricity into the grid, and no customers were taking it. Clearly, any customer who has the potential to be a net producer of electricity should be subject to some type of oversight, with corresponding limitations. This would probably not be anything close to resembling a "regulatory compact" on the customer's part, with something corresponding to an obligation to serve, or the requirement of pre-regulatory approval for constructing and operating distributed energy resources. Even in the wholesale electricity market, non-utility providers are not bound by any such obligations, and the most that is done in certain ISO regions to make this non-utility supply reliable over a longer-term time horizon is to operate a capacity market, which provides a financial incentive to engage in a commitment for making electricity supply available on demand.

The growth of distributed energy, in the context of climate change, is stressing the electric system in many other ways. In engineering terms, the growth of DER at scale is driving the need to fundamentally redesign distribution systems, from legacy systems designed to support the one-way flow of power (i.e., from utility-scale generators through the transmission system, to distribution system, to end users) to systems that can support the inflex of power from any location on the grid, including the distribution system, by effectively managing their impact on power quality, voltage stability, and frequency control. This is the Modern Integrated Grid, first described by the Electric Power Research Institute.[19] Modern grids differ from traditional grids in that they are developed using a customer-centric strategy, and include components not present

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[19] *The Integrated Grid: Realizing the Full Value of Central and Distributed Energy Resources,* EPRI (2014).

in traditional grids (e.g., advanced sensors, high-speed communications, and distributed control systems).

Modern grids require a new kind of planning. Advanced grid planning, known variously as Integrated Distribution Planning[20] and Integrated Grid Planning[21]represents a significant evolution in traditional utility resource planning methods. Traditional utility planning methods involve “top-down” analyses whose goal is develop an optimal supply strategy that “integrates” supply-side and demand-side resource options. The supply options considered are central station resources, delivered from these resources first through the transmission system, then through the distribution system, to end-use consumers. Advanced Grid Planning methods use “bottoms-up” analyses to evaluate loads at the distribution circuit-level, using new tools to simulate power flows across the distribution grid. They evaluate “hosting capacity” (i.e., the capacity of distribution circuits to integrate new DER without grid upgrades). They evaluate multiple DER growth scenarios to bound and manage this key source of planning uncertainty. They explicitly coordinate supply, transmission, and distribution planning. Most importantly, they evaluate the costs and benefits of new DER applications based on their location on the grid.

In institutional terms, the growth of DER in the context of an evolving climate crisis is challenging both regulators and utilities. Utilities remain responsible for the adequacy of service, pursuant to regulatory oversight, but both utilities and regulators are losing control of power supply. Prosumers generally are not required to inform utilities of their investment plans, which creates a growing source of uncertainty for utility planning. And regulators have no jurisdiction on the customer side of the meter. In addition to planning uncertainty, maintaining "current awareness" of distribution operations is becoming an increasing issue for distribution operators.

Another institutional issue involves the public interest in efficient DER investment. It is in society’s interest that prosumers make good investment decisions (i.e., decisions which reduce their cost and/or increase their welfare). To do this prosumers need to make use of their metering and billing histories to model various investment options. Although not part of traditional utility practice, effective customer engagement can go a long way to ensure cost-effective prosumer investments.

The growing demand for custom services constitutes another, fundamental institutional issue; for customers as well as utilities. Customers need new services to adapt to climate change, and utilities are frequently key to delivering such services (e.g., because of their role in providing delivery). Unfortunately, cost of service regulation is designed for standard service, and is hostile to departures from it. Clearly, regulation needs to allow utilities new flexibility; both to provide custom services, and to partner with third parties to do so. This is in the public interest because partnerships can allow utilities to gain skill and experience with new technologies, while allowing third parties to avoid the cost of building customer care infrastructures – with the

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[20] *Integrated Distribution Planning*, prepared for the Minnesota Public Utilities Commission by ICF International, (August 2016)

[21] *Integrated Grid Planning Workplan* submitted by the Hawaiian Electric Companies, (December 2018)

result that the public is served better and faster, at lower cost. To balance concerns that utility partnerships might close entry to other would be competitors, approval of partnerships might be subject to the following three criteria:

1. The service would not be provided by others if the utility does not participate in a partnership, or
2. The service will be offered more efficiently/economically with utility participation in a partnership
3. Utility participation in a partnership will not create unfair barriers to entry by potential 3rd party competitors. (The utility might satisfy this criterion by providing equal access to relevant data, and non-discriminatory access to the grid.)

Toward a New Compact

A review of the trends above suggests that none of them will explicitly threaten the existence of regulated utilities, and, at most, will require a recasting of the legacy regulatory compact, in order to preserve the best interests of consumers. There is only one plausible scenario where the continued need for regulated utilities might be challenged, and this is one in which there is pronounced growth in the multiplicity of new non-utility supply sources at the distribution level, along with other electricity-related products and services not offered by utilities.

This scenario, in which much if not most of the public obtains electricity without the use of a public electric grid does not obtain today, and probably never will. The vast majority of consumers continue to rely on the grid for power supply. Even those “prosumers” who supply their own power from distributed generators and other distributed resources (energy efficiency, demand response, etc.) make use of the public grid. They use it to sell power to the utility and/or wholesale markets, to back up their own distributed resources, or to minimize their cost by taking system power when it is cheaper than their own. And business users and communities may use the grid to supply multiple facilities configured as microgrids. These various use cases demonstrate that while customer use of the grid is evolving, the grid remains central to electric power supply in our society. Because the grid will remain essential, its maintenance and operation by regulated utilities will ensure that it provides a suitable level of service and support to all customers. Left to themselves, market-based suppliers would not build, maintain, and operate the grid. It follows that a regulatory compact of some kind is still needed, because it is socially useful.

Do utilities still need regulatory support to access private capital? Given the rapidly escalating climate crisis, the need for regulatory support is greater than ever. Public utilities need to finance construction of modern integrated grids, and this at a time when the volumes of utility-supplied power may cease to grown, or even decline. Without continuing regulatory support utilities are unlikely to maintain their sound credit ratings, and access to capital at favorable rates. One further consideration is that utilities may be called upon to finance and build large scale low-carbon generators. The time frame for decarbonizing energy supply is vanishing, a point made recently by United Nation's Secretary-General António Guterres when he observed that “We are sleepwalking to climate catastrophe.”[22] If and when climate policy reaches the crisis level, prompting policymakers to seek a rapid and effective response, regulated utilities will offer the fastest, most direct way to accomplish the transition to low carbon power supply.

General Requirements For A New Compact

A regulatory compact represents a voluntary agreement between regulators and utilities, in which obligations imposed on utilities are accompanied by privileges that will induce them to meet these obligations. As discussed below, this entails that both regulators and utilities voluntarily subscribe to the set of mutual commitments that comprise the compact, including any future modifications to it.

But the ultimate test of a successful regulatory compact is whether it serves the best interests of electricity consumers. In any future form that the compact might take, it will have to meet the following fundamental criteria:

1. **Ensure reliability and resilience:** It is hard to envision any non-regulated entity taking on this important role, which is only growing in importance as threats to these seem to be increasing, and even coming from sources not imaginable just a few decades ago, such as cyber-attacks.
2. **Protect consumers:** All consumers, but particularly conventional ones who simply want to receive electricity service from the grid and pay for it in a monthly bill, should be protected from the impacts of any innovations that might present the risk of exorbitant increases in price, or unexpected and prolonged interruptions in service. In economic terms, such innovations should constitute a “Pareto improvement”: in which at least some customers could benefit from them, but that are not detrimental to conventional customers in general.
3. **Support prosumers:** Regulators and utilities, in recognizing that more and more electricity customers take a more active role in managing their service and even exploring means of self-supply and storage, should endeavor to adapt to and even embrace this trend, and incorporate it into the regulatory compact. The experience of other industries, such as brick and mortar stores, and video rentals, demonstrates that it is never wise to ignore changes in consumer preferences and behaviors, and certainly never wise to resist them.
4. **Encourage economic efficiency:** Architects of the conventional regulatory compact recognized that electric utilities, as natural monopolies with large fixed costs of service, could not set prices at a hypothetical market-efficient marginal cost rate, but instead had to set prices sufficiently high to recover their average costs of service. However, as competition makes continued inroads into electricity service at both the wholesale and retail levels, increasing allowances will have to be made for the pricing of at least certain aspects of that service at market-based, rather than cost-based, rates.

[22] *We Are Sleepwalking to Climate Catastrophe*, Vanity Fair, March 21, 2022.

5. **Encourage (or at least do not hinder) innovation:** Innovation is inevitable and, as with changing customer preferences and behaviors, should never be ignored or resisted. (Again, attempts to do so often lead to disastrous consequences for incumbent providers.) While some types of disruptive innovation may simply overturn current industry models and incumbents, other innovations that are more gradual can and should be adapted to by regulated providers in a manner that recognizes their growing role, and is correspondingly reflected in the regulatory compact.
6. **Maintain commitment to universal service:** Regardless of how much competition enters the electricity industry, and to what extent traditional regulated utilities play a future role in producing and delivering electricity, there will have to remain some provision for ensuring that all customers have access to service. If the role of the electric utility as the dominant provider truly becomes significantly diminished, and it becomes impractical to simply impose upon it the requirement to ensure universal service, other means for ensuring such service must be explored, such as those implemented by the FCC for telecommunications services, as described elsewhere in the paper.

The following sections provide an overview of what new obligations might have to be taken on by utilities to meet these criteria under a modified regulatory compact, and what corresponding privileges could induce them to do so.

New Obligations For Utilities

For utilities the first, most important new obligation involves the need to build and operate modern integrated grids.[23] This is essential to provide reliable, resilient service as distributed energy resources grow and as all customers expect to be insulated from any disruptions, including those stemming from cybersecurity attacks and severe or even extreme weather events. Meeting this obligation will require utilities to implement advanced grid planning methods, which use "bottoms-up" analyses to evaluate loads at the distribution circuit-level, using new tools to simulate power flows across the distribution system.[24] These new methods evaluate "hosting capacity" (i.e., the capacity of distribution circuits to integrate new DER without grid upgrades). They evaluate multiple DER growth scenarios to bound and manage this key source of planning uncertainty. This allows the utility to target new capital additions where they are needed, when they are needed – an important refinement to minimize rate impacts when power throughput may be declining. Most importantly, advanced planning methods estimate the costs and benefits of new DER applications based on their location on the grid. An important, related aspect of the obligation to develop integrated modern grids is the need for new grid control strategies, and new interconnection standards for new generators; particularly, distributed generators.

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[23] *The Integrated Grid: Realizing the Full Value of Central and Distributed Energy Resources,* Electric Power Research Institute *(*2014)

[24] P. De Martini, *Integrated Distribution Planning*, prepared for the Minnesota Public Utilities Commission (2016).

A second new obligation involves engaging and enabling "prosumers" (i.e., those consumers who deploy their own distributed energy resources and thus gain the ability to be *pro*viders of power and related grid services, as well as con*sumers* of them). To fulfill this obligation utilities need to provide easy access to metering and billing data that reflects customers' use (e.g., through on line portals). They need to provide analytic tools which will enable consumers to use such data in the evaluation of various DER investment options. Utilities also need to compensate prosumers for grid support services they may provide. And utilities could potentially provide on-bill financing.

A third new obligation involves protecting consumers from costs incurred to serve prosumers. This involves reforming net metering and other rates so that costs are not shifted from prosumers to consumers. It could also involve new approaches to the design of rates for grid use. For example, considering how different customers are using the grid, the utility might offer three customer options, as follows: (1) a traditional plan for customers who have no interest in deploying their own DER and want to continue to rely on the grid as they always have, (2) a self-supply plan for DER customers who use all of their DER production themselves, and (3) an Export Plan for prosumers who size their DER with the intention of feeding power back into the grid.

New Commitments from Regulators

A regulatory compact is only viable if obligations imposed upon utilities are accompanied by privileges or allowances granted to them in exchange for meeting these obligations. Hence, any additional obligations imposed upon utilities, or modifications to current obligations that provide a potentially greater burden upon them, must come with a corresponding set of privileges or allowances that will induce their continued commitment to and voluntary participation in the compact. At a time when utilities need to make new capital additions to build modern integrated grids, while experiencing flat to declining energy sales, utilities need policies that will ensure timely recovery of prudently incurred costs. Regulators should support new rate designs that are truly reflective of the way that costs are incurred, even if this means that most of those costs would be recovered through fixed customer (access) charges and demand charges, rather than the legacy practice of recovering fixed and demand costs through volumetric (kWh) charges for residential and small business customers. Regulators also should support the use of alternative regulatory mechanisms such as multiyear rate plans, forward looking test years, formula rates, and cost trackers that operate in between rate cases.[25]

As utilities face increasing competition at both the wholesale and retail levels, and the traditional franchise loses its former value to them, regulators should support policies that provide utilities with increased latitude and flexibility to compete in contestable markets. Given the growth in demand for custom services (e.g., related to new distributed energy resources), utilities need policies that allow them to respond. This can be accomplished by establishing

[25] *Alternative Regulation for Energy Utility Challenges: 2015 Update*, Edison Electric Institute.

separate books of account for custom services and conducting periodic audits to ensure that costs incurred to provide custom services are not shifted to cost-of-service revenue requirements. The cost of shared infrastructure and resources will have to be allocated appropriately. Where retail markets are competitive, regulators also should allow the use of market-based pricing for custom services, subject to the conditions that costs are not shifted from custom services to revenue requirements and that the pursuit of profit does not undermine utility credit ratings.

Regulators should explore and consider policies that also give utilities increased flexibility to partner with unregulated suppliers. Partnerships can allow utilities to gain skills and experience with new technologies, while allowing third party suppliers to leverage utility back office capabilities. This can potentially improve the quality, and reduce the cost, of services offered to the public. In approaching the question of partnerships, regulators should follow Alfred Kahn's advice to protect competition, not competitors,[26] and be vigilant in ensuring that these are not creating new barriers to entry for additional competition.

Conclusions

In this paper, the authors examined four actual or potential trends which could create potentially crippling stresses on the electricity system by making the business models of regulated electricity providers unsustainable and/or the underlying regulatory compact that ensures a safe, affordable, and reliable electricity supply to consumers unsustainable. These four trends are:

1. Flattening or declining retail electricity sales
2. The increasing urgency of providing viable policy solutions for reducing greenhouse gas emissions
3. An increase in both the number and intensity of threats to the reliability and resiliency of electricity supply
4. The growth of distributed energy resources, both from new competitors, and from customers taking a more active role in the provision and management of their electricity service

The second and third of these trends support the authors' contention that the regulated utility should continue to exist, while the first and the fourth call for a modified regulatory compact which will enable the regulated utilities to effectively meet the new challenges embodied in them, while still serving the best interests of consumers. For utilities, in order to continue to attract investors' capital, the new compact should provide for:

[26] A. Kahn, Standards for Antitrust Policy, Harvard Law Review, Vol. 67, No. 1, p.33. Nov. 1953.

1. Effective and timely cost recovery mechanisms, including rate designs for standard service that are truly reflective of how costs are incurred, and new, flexible rate designs for services geared to a changing market environment.
2. The ability to provide custom services, and
3. The ability to form business partnerships (subject to suitable strictures and guidelines that ensure fair competition and the prevention of barriers to entry in contestable markets).

As a consequence of one or more of the trends identified above, consumer (and general public) interests might more effectively be served in the future by:

1. The development of a new type of grid that supports a broader range of transactions at both the wholesale and retail level, which is primarily operated and maintained by the regulated utility,
2. Active guidance from the regulated utility to customers and third parties regarding efficient and effective DER investments,
3. Consumer protection from costs incurred to serve prosumers,
4. The development and expansion by regulated utilities of low-carbon generation in a timely manner to meet urgent climate policy needs.

The authors contend that a regulatory compact that meets these objectives will better ensure that customers will receive optimal electricity service in the years and decades ahead, even if one or more of the identified trends actually occurs.

Takeaways

1. The traditional regulatory compact is out of phase with the realities of evolving electricity markets.
2. Regulated utilities are and will continue to be a necessary component of the electricity system. They remain socially useful because they provide services which unregulated (market-based) suppliers cannot; namely, serving customers not served by the market, and building and operating electric grids.
3. A new compact is needed, one which rebalances the interests of consumers and investors.