THE CHALLENGES OF NEW ELECTRICITY CUSTOMER ENGAGEMENT FOR UTILITIES AND STATE REGULATORS

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Synopsis: Growing customer engagement has been a driving force behind transformation of the U.S. electric industry. It has triggered actions by both electric utilities and their regulators. The combination of technology, public policies and economics should stimulate additional customer engagement in the future, although the jury is still out on how fast it will grow in retail electricity markets over the next several years. After all, the overall enthusiasm over electric customer empowerment may be "more noise than sound." To date, the vast majority of residential customers have exhibited much inertia, whether it is participating in retail competition programs or a new pricing scheme like time-varying pricing. Even with the hype over rooftop solar, an extremely small percentage of U.S. households have taken advantage of this technology. In any event, utilities will increasingly operate in an environment with a distinct line between engaged and traditional customers. They will face additional costs and risks. The major challenge for state utility regulators is to protect traditional customers while encouraging utilities to serve engaged customers. Regulators have various tools to achieve these objectives.

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I. CUSTOMER BIFURCATION

This article examines the profound implications for a wide range of utility and state regulatory practices that arise from the growth of "engaged" electric consumers compared to "traditional" consumers. "Engaged" consumers include those who actively seek out opportunities to manage their electric consumption for reasons that may range from simply cutting costs to environmental activism.[1] "Traditional" customers are those more likely to be comfortable with the status quo, and who may have little desire or incentive to seek out alternatives to the existing rate structure or utility provider.

1. One source classifies customers into three broader categories: traditional, active, and prosumers. ONT. ENERGY BD., STAFF DISCUSSION PAPER EB-2015-0043, RATE DESIGN FOR COMMERCIAL AND INDUSTRIAL ELECTRICITY CONSUMERS: ALIGNING THE INTERESTS OF CUSTOMERS AND DISTRIBUTORS 12 (2016). Prosumers benefit from consuming cleaner electricity, reducing their utility bill, receiving satisfaction from producing their own electricity, and receiving payments from their utility for unused power. To avoid confusion with customer activism observed in regulatory proceedings, this article combines and re-labels active customers and prosumers as "engaged" customers.

A. Traditional Customers

Traditional customers essentially pay little attention to their electricity consumption and bill. They receive their bill and then pay for it without much scrutiny. They are satisfied with their utility service (both in terms of price and reliability) and, presumably, find spending much time on managing their usage, or seeking the least-cost option, is not worth the benefits that they expect to receive.

Traditional customers tend to have an "information" deficiency, high switching costs to change providers, or are just simply inert (i.e., once they make a decision, they stick with it and tend not to change their behavior, even when it seems they should). Their relative passivity may reflect the lack of customer participation in new market opportunities because of inertia when new information shows that a customer would benefit. According to this perception, customers are irrational in not modifying their behavior.[2]

Instead, however, inertia may reflect rational behavior where a customer concludes that the benefits from switching to another supplier as highly uncertain or minimal. One noted example of customer inertia is the long distance telephone market, where the penetration of non-AT&T carriers progressed slowly, and several years passed before these carriers collectively were able to increase their market share above AT&T's.[3]

B. Engaged Customers

1. Increased Expectations of Some Utility Customers

A growing number of electricity customers expect more from their electric utility than in the past, just as consumers across a wide spectrum of industries have placed higher demands on other companies.[4] As expressed in one paper, "[e]lectricity is no longer just something the utility delivers to consumers. Consumers want more choice and control over their management of electricity. New unregulated entities are entering the market to meet consumer needs with new products and services."[5]

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2. Behavioral economics predict that real-world decision making is often inconsistent with consumer decisions that neoclassical theoretical models would suggest to be optimal or rational. ROBERT H. FRANK, THE ECONOMIC NATURALIST: IN SEARCH OF EXPLANATION FOR EVERYDAY ENIGMAS (2007); RICHARD H. THALER & CASS R. SUNSTEIN, NUDGE: IMPROVING DECISIONS ABOUT HEALTH, WEALTH, AND HAPPINESS 80 (2008).

3. JAMES ZOLNIEREK ET AL., FED. COMMC'NS COMM'N, LONG DISTANCE MARKET SHARES: SECOND QUARTER 1998 (1998). The analysts used revenues to measure market shares. As a policy matter, whether long distance telephone users would have been better off if AT&T's market share eroded faster over time is not at all clear. One could argue that, in view of the threats of Sprint, MCI, and resellers, AT&T faced enough competition to *not* act like a dominant supplier.

4. Consumers in general feel more empowered, are less tolerant of poor service, less loyal and more informed. For example, Uber has enhanced consumer expectations for the taxi industry by providing quicker service, lower prices at most times, and a more convenient payment method.

5. GRIDWISE ALLIANCE, THE FUTURE OF THE GRID: EVOLVING TO MEET AMERICA'S NEEDS 1 (2014).

The quote implies that utilities must seek ways to provide value to customers other than traditional reliable service at reasonable prices. If they fail, as some analysts have predicted, they could face death-spiral-type consequences.[6]

One fundamental question relates to the source of customer engagement: Has it spawned from the emergence of new technologies and public policies, or has it initiated from the demands of customers wanting more from their utilities? An example of the first is entrepreneurs' desire to provide new distributed-generation technologies, because their costs have dropped to economical levels, even in the absence of consumers previously expressing their desire for them. An example of the second is the desire of customers for clean energy and real-time information, with the market responding by developing new technologies to satisfy these demands. It is probably true that customer engagement originated from both customers themselves and from the development of new, economical technologies.

It also makes sense to expect an interactive relationship between customer engagement and new technologies; namely, the increased penetration of new technologies will likely lead to the growth in customer engagement in controlling electric usage. This in turn can stimulate further technological developments, spiraling yet heightened customer engagement.

2. Engaged Customers Want Different Things

Engaged customers tend to better exploit increased competitive conditions and have access to more information, new technologies and market developments. They place greater demands on utilities to provide (1) a wider array of products and services, and (2) greater opportunities to control their electricity usage and the price they pay for electricity. Engaged customers tend to want one or more of the following:

- Real-time information and pricing so that they can better manage their usage;[7]
- The capability to save on electricity costs via time-varying pricing, demand response, and energy-efficiency initiatives;
- Clean energy as they are willing to pay more for electricity when produced from renewable energy, either by their utility or themselves;

6. Elisabeth Graffy & Steven Kihm, *Does Disruptive Competition Mean a Death Spiral for Electric Utilities?*, 35 ENERGY L.J. 1 (2014).

7. One example is turning "big data" into useful information for customers to make decisions on a real-time basis.

- Exceptional, reliable, and resilient service (e.g., shorter and less frequent outages)[8] and power quality[9] as they assign greater costs to outages and other service disruptions;[10]
- The ability to self-generate (e.g., combined heat and power, microgenerators, rooftop solar) and other distributed energy resources (DER);[11] and
- Opportunities as "prosumers" to sell unused electricity at a "fair" price back to the utility.

Few engaged customers would want all of these things while most others would probably demand varying combinations. One customer may select a green tariff that requires him to pay extra for electricity produced from clean energy sources.[12] Another customer may prefer "fair" rules for self-generation, both in the price he pays for standby utility service and the price he receives for selling unused electricity back to its utility. A third customer may just want real-time information to better control her electricity usage. In satisfying all of these diverse demands, a utility would have to unbundle its services and possibly have to take more drastic actions. Each of these new activities costs money that regulators will have to decide how and from whom the utility will recover them.

Some customers want additional and better services from their utility than previously, just like they do from other companies. As remarked in one paper, "[t]he last best experience anyone has anywhere becomes the minimum expectation for the experience they want everywhere."[13] Customers are increasingly being accustomed to more customer-centric service in other industries. The same paper commented that:

> Today's energy and utility customers are asserting more control by choosing particular providers and offerings, actively managing their consumption and making their voices heard directly through social channels, not just through regulators. In some

8. Grid resilience has become particularly valuable in the East since super storm Sandy.

9. A "digital" world has heightened concern over the serious problems created by momentary disruptions in voltage or frequency. Utilities are unable to maintain perfectly constant voltage at all times, because many power quality problems are beyond their control. Lightning strikes, storms, motor-vehicle accidents, falling tree limbs, and can cause major power disruptions and surges. Customers may best deal with this problem by installing a surge-protection device, especially if they have appliances or equipment that are sensitive, expensive, or contain critical data.

10. One reason is that households use electricity for a wider range of activities, some of which have substantial value that would be lost with power outages or power-quality problems.

11. The spectrum of DER includes solar, wind, CHP, microgrids, storage, efficiency, demand management, and demand response. DER can benefit customers by making generation more flexible, transmission and distribution more controllable and resilient, allowing customers to become producers, and loads more interactive and dynamic. Even though technology will allow customers to become more self-sufficient, say, by installing a rooftop solar system, it is unknown how many of them actually would.

12. Some big U.S. corporations have begun to demand that the electricity they purchase from their local utility comes from clean energy sources.

13. IBM, THE DIGITAL CUSTOMER: ENGAGE CUSTOMERS AS INDIVIDUALS 4 (2016).

> cases, customers are even generating their own power. The utility industry is reaching a point where customers can behave more like partners with their utility, which can lead to new opportunities.[14]

C. The Trend Toward Bifurcated Customers

Regulators and utilities should ask the essential question, what do electricity customers really want? That is, what value do customers receive from electricity? We can safely say that some customers expect less from their utilities than other customers. With confidence, we can also say that more customers will become engaged in the years ahead; we can only speculate, however, on the percentage that will and know exactly what they want.

Sure, almost all customers, when asked, would like to have highly reliable service, clean energy, and low prices.[15] But if asked what trade-offs they would prefer to make, customers would answer differently. Some customers may be willing to pay nothing for cleaner energy, as their preference is for the lowest-priced electricity. Alternatively, other customers would pay, say, 10% more for their electricity if it came from clean-energy sources.

The presumption that all customers are demanding more from their electric utility borders on hyperbole. Electricity customers, like customers of other products and services, are heterogeneous. Many customers want things to remain the same. Others want change, and technological developments have given them the opportunity to take more control with additional options. Bifurcation of utility customers based on their expectation for utility service seems like the right place to start in addressing policy alternatives for the future electric industry.

There are many reasons for why we should expect growing customer engagement over time. The first is economic: with likely cost reductions for self-generation and information-based technologies, more customers will exploit their benefits. A second reason is the availability of new technologies. We have seen the increased penetration of smart meters,[16] information/digital technologies, and Nest thermostats.[17] These have given customers the tools to automatically manage their electricity usage. Demographics also favor more engaged customers in the future. The millennials and other younger generations are technologically astute and have

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14. *Id.* at 2.

15. One problem with consumer research is the discrepancy between what people say they believe and their actions. As a major flaw, a survey respondent may indicate a favorable disposition toward something, but would not be willing to pay anything for it.

16. Smart meters can provide two-way communications capabilities and other functionalities that facilitate the ability of customers to better manage their electricity usage. They can also, although rarely in the United States, allow for time-varying pricing. Less than 4% of the over 50 million households in the United States with smart meters are on time-varying rates. AHMAD FARUQUI, BRATTLE GRP., A GLOBAL PERSPECTIVE ON TIME-VARYING RATES 5 (2015). Time-varying pricing can bolster certain new technologies (e.g., energy storage), both inside and outside the home. The lack of interest in time-varying pricing probably reflects more than anything the preference of customers and regulators for the "stability" aspect of average-cost pricing.

17. Nest thermostats are an example of a technology that has provided customers with a positive experience even though they never expressed a prior demand for it.

a reference point that differs from older customers in their expectations for utility service.[18]

Overall, when customers have more options to manage their electricity costs and make associated choices, it is likely that they will become increasingly engaged and set a higher standard for satisfactory utility service. This development has occurred across a wide spectrum of industries, and the electric industry should expect the same.

D. Caveats

As of today, the vast majority of utility customers are traditional and may continue to be so for the foreseeable future.[19] Because electricity costs are a small percentage of the average customer's income and total spending, it would be unsurprising if many or most customers decide to remain traditional for the foreseeable future.[20]

Another point is that compared to high-tech industries—a prime example is mobile phones—electricity is essentially a commodity with relatively few value-added features.[21] Unlike iPhones and other electronic devices, electricity lacks the special features that make it increasingly valuable to consumers over time.[22] A commodity, by definition, is a product that has little differentiation across markets. That is, it is fungible or interchangeable, no matter who produces it. Electricity seems to fit well within the definition of a commodity, although in the future it may transform into more of a value-added service.

As an opposing thought, one observation from history is that many, if not most, major technologies were not projected to have a disruptive effect (think of

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18. The young generation places high demand on hand-held electronic devices. They also may likely demand real-time information to reduce their energy usage.

19. According to one report:

> The number of electricity customers who use net metering increased exponentially from fewer than 7,000 in 2003 to more than 450,000 in 2013 . . . . Growth has continued in 2014, with more than 75,000 additional net metered customers reported through May 2014. However, despite this growth, in 2013 these customers represented only 0.3% of the more than 145 million electricity consumers in the United States.

JENNY HEETER ET AL., U.S. DEP'T ENERGY, PUB. NO. NREL/TP-6A20-61858, STATUS OF NET METERING: ASSESSING THE POTENTIAL TO REACH PROGRAM CAPS 1 (2014).

20. The average residential customer spends about 2.7% of her before-tax income on electricity. U.S. BUREAU LABOR STAT., CONSUMER EXPENDITURE SURVEY at tbl. 1202 (2012). By reducing her electricity bill by 25%, for example, the average customer's real income would increase by only 0.675%.

21. As one observer has noted:

> The electric utility industry provides a homogeneous product that has more in common with the natural gas and water utility industries than with telecommunications and the internet. The vast majority of electric consumers want reliable, clean, reasonably priced electricity, and little else.

Steve Huntoon, *POPS Is Here to Stay: Reports of Plain Old Power Service's Death Greatly Exaggerated*, PUB. UTIL. FORTNIGHTLY, July 2016 at 82-83.

22. PETER H. KIND, CERES, PATHWAY TO A 21ST CENTURY ELECTRIC UTILITY 15 (2015).

the airplane, the television, the steam engine, the computer, the laser, the mobile phone). These technologies initially were thought to have the ability to attract only a small minority of consumers, rather than a mass audience. But, of course the world has seen otherwise. It is conceivable that, in the years ahead, we will see a radically different electric industry than what we can imagine today. One factor in this transformation could be innovations that turn customers into highly engaged participants. Presently, we can only speculate how the electric industry will evolve in terms of the number of engaged customers.

II. ESSENTIAL ELEMENTS OF CUSTOMER ENGAGEMENT

The possibility that customers could never be worse off if they become more engaged is axiomatic to many. Consumer sovereignty says that each consumer is the sole judge of her own welfare; she does not have to buy from a specific supplier, and if she has choices, she can take her business elsewhere. A number of exceptions exist, however, such as circumstances in which individuals have incomplete or erroneous information or are unable to process rationally the available information. It is easy to imagine some customers processing the information they receive illogically or making decisions based on false, misleading, or incomplete information.[23] Customers might have to live with these decisions either on a temporary or a more permanent basis.[24] Engaged customers consequently need *good information and act rationally* in making decisions that guarantee to benefit them.

A. The Rationality of Customer Behavior

A strategy for engaging customers, or using the popular term—empowering customers—would have three broad components: *the availability of unbundled products and services, adequate information, and enabling technology*. Customer engagement is dependent on several factors, including (1) choice of value added services, (2) pricing options, (3) economical self-generation and demand response, (4) access to alternative electricity sources, and (5) real-time information.[25]

Consumers make decisions in a complex environment in which uncertainty, confusion, and transaction costs often prevail.[26] An apparent rational reason for

23. Many customers fail to fully exploit the available information in making the best choice. Reasons include confusion and bounded rationality.

24. In many markets, customers have incomplete or erroneous information or are unable to process the available information rationally. The relevant question then becomes: Are these problems serious enough to warrant regulatory intervention? The typical societal response, at least in the U.S., is for government to supplement market forces in protecting consumers from inadequacies of their own judgments. We observe consumer protection laws, labeling and warnings, mandatory product standardization, and consumer reports. Two prominent features of poorly performing markets are: (a) companies have substantial market power, and (b) consumers are ill-informed and inactive in changing companies when it would be in their interest.

25. N.Y. STATE DEP'T PUB. SERV., REFORMING THE ENERGY VISION: STAFF REPORT AND PROPOSAL (CASE 14-M-0101) at 6-7, 12 (2014).

26. "Transaction costs" refer to the costs for customers to search out and negotiate with suppliers of different electric services.

why electricity retail consumers should switch from full-requirements to distributed generation (DG) status might clash with factors that make taking no action more sensible. The latter factors would include small expected benefits, uncertainty over actual savings, and high transaction costs.

The economics of customers switching to another provider (which an engaged customer would do) simply says that utility customers will search for a better alternative when they expect the gains to exceed the costs.[27] Gains can arise from lower prices and higher product or service quality; costs include transaction costs plus any perceived costs (e.g., lower service quality[28]) from switching suppliers. When utility customers feel indifferent about switching because of no discernible gains, they would tend to do nothing differently.

The puzzle to some observers is why do customers take no action when it seems that they should. The human tendency is toward "inertia," which some people would call laziness. Since contemplating whether to take new action requires effort and time, the opportunity cost for many customers can surpass their expected benefits. Unless the action offers clear advantages (e.g., large cost savings) in view of time constraints, other costs, and uncertainty over benefits, residential customers might decide to take no action. In other words, traditional customers, although seemingly exhibiting inertia, are acting rationally.[29] A policy goal of artificially stimulating more customer engagement through subsidies may therefore fail a cost-benefit test.

B. Value-Added Products and Service

Unbundling refers to the offering of separate prices to retail customers for individual components of electric service. For retail customers, these components may include energy, capacity, reliability, transmission, distribution, and ancillary services. Examples of more refined value-added services are billing services, enhanced grid management services, emergency operational services, metering services and data, and customer-sited energy storage.[30] Retail competition is a form of service unbundling where the utility sells and prices commodity electricity separately from the other components of electric services.

Customers would typically benefit if offered the choice between bundled services and unbundled services. Some customers, namely engaged customers, may

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27. This condition assumes that customers are risk-neutral. If instead they are risk averse, then even an expected net gain might not necessarily cause them to change their current situation. The reason is that switching providers involves an uncertainty over future electricity-bill savings and service quality.

28. One example is a decline in customer service. Customers of non-utilities might have fewer rights to complain because of poor service, relative to the rights they enjoyed as bundled sales customers of their regulated utility.

29. FRANK, *supra* note 2.

30. ADVANCED ENERGY ECON. INST., TOWARD A 21ST CENTURY ELECTRICITY SYSTEM IN CALIFORNIA: A JOINT UTILITY AND ADVANCED ENERGY INDUSTRY WORKSHOP GROUP POSITION PAPER 23, 25, 30 (2015).

opt for purchasing individual components of electric service—for example, enhanced reliability—if they are less costly than purchasing bundled service.[31] For others, like traditional customers with higher transaction costs, purchasing bundled service could be the preferred action. That is, traditional customers would tend to be content with basic utility service while engaged customers would more likely want enhanced services or value-added services.

Overall, the economic pressures for unbundling of retail services heighten whenever competitive conditions intensify.[32] As long as DG can compete with utility bundled service, those pressures will likely only grow in the future, especially as utility customers become more engaged. One lesson learned from the experiences of other public utility industries is that when existing regulatory and utility practices depart from market realities, reform becomes inevitable. Reform includes the unbundling of retail services and rational pricing.[33] Simply put, competition creates the stimulus for the unbundling of electric services.

C. Adequate Information

One feature of an efficient market is well-informed customers.[34] Such customers know the different products and prices of competing providers. These providers will tend to compete more aggressively, since they expect those customers to switch to those providers offering the best deals. Overall, knowledgeable consumers tend to shop around, demand price cuts, and mitigate the chances of market power. When, instead, customers are ill-informed, providers recognize that they could charge higher prices, not compete as aggressively, and still retain those customers.[35] If a provider knows that its customers are not seeking out the prices

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31. Enhanced reliability on a targeted basis through installation of equipment on a customer's site may be more economical than if the utility treats reliability as a public good by making large investments to increase reliability for all customers. The latter action presumes that all customers value higher reliability at least at the additional costs they have to pay, when in fact some customers do not. Targeted action allows individual customers to decide whether the benefits of increased reliability are worth the costs.

32. The initial stimulus for the unbundling of utility services in the U.S. telecommunications and natural gas industries was the economic pressures from consumers who wanted the opportunity to purchase the lowest-priced products and services. In the natural gas industry, unbundled gas transportation was in large part a response to bypass threats by large retail customers and the associated problems of cost-shifting and stranded investments. From the perspective of local gas distribution companies, unbundling of the commodity and transportation services could prevent a customer from leaving the distribution system (i.e., bypass) and thereby contributing nothing toward the utility's fixed costs. Gas distributors have generally been agreeable to being only transporters for certain customers, since their profits are generally not tied to the amount of purchased gas they procure for their customers. This has not been true for vertically-integrated electric utilities, which would lose profits from generating less electricity because of retail competition.

33. The pricing of value added services might depart from cost of service principles and instead be based on value of service and done through contracting with individual customers.

34. Engaged utility customers might need to understand how, how much, and when they consume electricity. The absence of such information precludes customers from managing effectively their usage.

35. Less-than-perfect information *per se* does not pose a serious problem since rational customers will expend only limited time and resources to acquire information justified by the benefits. In other words, well-

being offered by other providers even though those providers would offer a lower price, the incumbent recognizes that its customers might not know or care if they did.

Often in bifurcated markets, companies will price discriminate in favor of engaged customers, who by nature are more willing to shop around to get the best deal.[36] Because of the inertia exhibited by traditional customers, companies can charge them higher prices while suffering only a minimal loss in sales.[37] Later we will discuss what customer bifurcation means for utilities and regulators in terms of ratemaking, the utility business model, and the role of utilities.

D. Enabling Technologies

Enabling technology allows most of the day-to-day deployment of the offered products to be automatic, lowering transaction costs for customers. One such technology, smart appliances, can automatically respond to price signals without customers taking any action. Limited access to information, high customer acquisition costs, and other transactional hurdles are obstacles to customer engagement. Enabling technologies can help mitigate these factors and transform customers from traditional to engaged.[38]

III. CHALLENGES FOR UTILITIES AND REGULATORS WITH CUSTOMER BIFURCATION

A. Relatively Few Engaged Customers Can Trigger New Utility and Regulatory Practices

The prospect of more customer engagement in the future—even if it only involves the minority of electric customers—has already triggered actions by both electric utilities and their regulators. These actions will intensify in the future as the economics, technological developments, and public policy will move in parallel to place greater customer demands on utilities. As shown by recent events across several states, customer engagement has already driven change in the electric industry or at least sparked vigorous dialogue on various topics calling into question long-held utility and regulatory practices. These actions have occurred notwithstanding the fact that, as of today, only a small minority of retail utility customers are placing greater demands on their utilities.

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informed customers can lack perfect information. George Stigler, *The Economics of Information,* 69 J. POL. ECON. 213, 215-16 (1961).

36. Examples are (a) shoppers who search online often get better deals than shoppers who only make purchases at retail outlets; (b) shoppers who search for coupons pay lower prices at grocery and other stores; and (c) car dealers offer lower discounts to buyers whom they know would purchase cars only from a single manufacturer, like Toyota, BMW or Ford.

37. Different possible reasons exist for passivity, including inertia or lack of market opportunities. What the reason is has policy implications. For example, open access of transportation could mitigate the second problem while better information could address the first.

38. As discussed later, new technologies can be both a blessing and a curse for utilities.

This section focuses on how the unprecedented utility-customer engagement is likely to affect both utility and regulatory practices in a transformed electric industry. Even though, as previously predicted, customer engagement may involve a minority of utility customers, its effect on the industry and its regulation could be profound. We have already observed in several states heated dialogue over net energy metering and rate design, each of which has originated from a small number of customers wanting to self-generate from solar technologies.

Heightened customer expectations come in various forms and derive from different sources. As previously discussed, engaged customers require certain things, like real-time information, unbundled services, and enabling technologies. Traditional customers generally want only reliable service at stable and reasonable prices. [39]

With increased diversity of customer desires and needs, utilities face a greater challenge in serving all customers: They must satisfy disparate customer needs. For regulators, the task is to make sure that utility actions are aligned with the public interest, which according to one definition is the aggregate, long-term collective economic welfare of engaged and traditional customers. The task for regulators is therefore to ensure that utilities serve engaged customers while also protecting traditional customers from cost-shifting and discriminatory practices. This means that they will have to grapple with new ratemaking issues and perhaps even revisit the regulatory compact that they have adhered to over the past several decades. [40] Regulators will also want to assure customers that they have access to new technologies by prohibiting utilities from erecting undue barriers.[41]

Utilities have always had customers with varying characteristics. Two noteworthy ones are the value customers place on reliable utility service and their responsiveness to price. The new engaged electricity customer has distinct demands and characteristics compared with traditional customers. Throughout its history, regulation segmented customers by how much electricity they consume; namely, residential, commercial and industrial classes. Clashes occurred over cost allocation across these classes. In the future, we should expect more discord within the residential class between engaged and traditional customers. Some observers label

39. One perception of traditional customers is they demand only basic service from their utility, while engaged customers demand enhanced or value-added services. This begs the question of what distinguishes the two kinds of services. One might say that basic service reflects electricity as essentially a commodity, while enhanced services transform electricity into more of an overall service. Enhanced services can provide more personalized electricity service by increasing their value to an individual customer.

40. The oft-cited "regulatory compact" connotes an implied agreement between the utility and the regulator: The utility will provide affordable, reliable, universal service in exchange for the exclusive right to serve customers in a specific geographic territory at an authorized "fair" rate of return.

41. This section will later address these topics in more detail.

this as the "digital divide" that could become increasingly challenging for both utilities and regulators in the years ahead.[42]

B. Sticking to First-Order Regulatory Objectives

1. Continued Relevancy of Core Principles

Core regulatory principles applied for decades by state utility regulators include:

- *Maximization of aggregate customer welfare:* maximizing the value of new technologies to all utility customers, engaged and traditional; or maximizing what economists call consumer surplus;[43]
- *No cross-subsidization funded by traditional customers:* no cost shifting as a result of utility non-recovery of fixed costs from engaged (e.g., DG) customers;
- *Rates include only prudent utility costs:* economical investments for serving engaged customers;[44] and
- *Reasonable utility returns from accommodating engaged customers:* aligning utility returns with risk; this may require performance-based regulation (PBR) to encourage utilities to accommodate engaged customers.[45]

2. Dual Objectives for Engaged and Traditional Customers

Future regulatory actions will align with core regulatory objectives, irrespective of how the electric industry evolves. According to many observers, the ultimate objective of regulation is to maximize the long-term welfare of all customers collectively. Violating that objective would therefore jeopardize the public interest. Whereas in the past, regulators emphasized customer protection, in the future the focus will ostensibly shift to assure that (1) engaged customers receive the

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42. "Digital divide" is just a form of market segmentation where the separations of customers into two groups depends on their access to and use of the latest technologies that provide them with real-time information and other valuable services.

43. Consumer surplus measures the value customers received from a product or service minus the monetary and nonmonetary (e.g., search costs) outlays. With new technologies, consumer surplus, conceivably, could increase because of (a) reduced prices, (b) the availability of additional services (e.g., value-added services), (c) lower transaction costs for purchasing those services, and (d) an increase in the quality of service.

44. That is, investments pass a cost-benefit test.

45. A results-based regulatory model shifts the emphasis of regulation from the reasonableness of historically incurred costs to (say) the pursuit of long-term customer value. Regulatory incentive plans allow for shifting the focus from inputs to outputs, which is a fundamental change from traditional rate-of-return regulation. Especially appealing is the notion that a primary criterion for utility revenues is its relationship to the value that customers receive from utility service. Implementing such regulation to produce desirable outcomes poses serious challenges for regulators. KEN COSTELLO, NRRI REPORT 10-09, HOW PERFORMANCE MEASURES CAN IMPROVE REGULATION (2010).

highest possible benefits from new technologies and (2) traditional customers receive protection from undue discriminatory and cost-shifting practices. This involves, among other things, utilities refraining from erecting excessive barriers to third-party providers and shifting costs to traditional customers. It also requires utilities to invest in those technologies that efficiently accommodate the desires of engaged customers.

C. Increased Demands on Utilities

Engaged customers will surely pose greater challenges for utilities. The major ones are:

- More refined unbundling of services and their pricing;
- Investments in upgrading the grid;[46]
- Better communications with customers (e.g., with social media);
- Customer demand for real-time information;
- Investments for greater generation diversity (e.g., clean energy technologies);
- Other investments (e.g., smart meters);
- Higher revenue and profit uncertainty;
- Erosion of monopoly status; and
- Heightened planning uncertainty (e.g., from customers switching from full-requirements to DG status).

The electric utilities' world becomes increasingly complicated when customers have more choices and place additional demands upon utilities. Pressure on inflating utility costs derives from various sources: increased demand for clean energy, replacement of aging infrastructure, grid modernization, transition costs to accommodate more renewable energy, integration of new technologies, cyber security protection, public demands for improved "superstorm" response, customers' demands for higher reliability, and overall quality of service.

As a major challenge for utilities, with more customers adopting DG technologies, operation of the distribution network becomes increasingly complex. The distribution network must keep the system in balance and confine voltage and frequency levels within a tolerable band. It must also respect contingency limits, meaning no violation of a line's physical limit if some other line or generator goes out of service unexpectedly. The network carries out these basic functions by purchasing ancillary services. The operation of an interconnected electric network has to be monitored in real time to assure that: (1) production always matches demand, and (2) power can flow across the network within established reliability

46. Grid modernization can benefit utility customers by mitigating cyber and other threats to the security of the electric grid, expanding new products and services, reducing barriers to new technologies, and improving overall economic efficiency and grid resilience.

and security constraints. By making these tasks more difficult, the integration of DG adds to utility costs.[47]

Regulators might want to consider allowing utilities more flexibility and leeway in their operations and service offerings.[48] The result is that utilities are better able to avoid a death-spiral-type scenario from DG penetration and other developments that challenge utilities' financial health.[49]

D. Broad Concerns

Regulators should ask the following broad questions in a bifurcated-customer world:

- What should we expect from utilities in accommodating new customer demands?
- Who should pay for new required investments, and how?
- What role should third-party[50] (e.g., competitive) providers play in meeting customers' new demands?[51]
- What restrictions and liberties should third-party providers have?

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47. A Massachusetts Institute of Technology study on the future of the electric grid explains that low levels of DG penetration reduce load at the nearby substation, but high DG penetration could create excess load at the substation. The outcome is power flowing from the substation to the transmission grid, creating a reverse power flow that makes grid management more difficult by causing high voltage swings and other stresses on electric equipment. These potential strains on the distribution network will require utilities to undertake further capital investments in system upgrades, which might include distribution automation, system interoperability, data management and analytics, and cybersecurity to address new network dynamics. MIT ENERGY INITIATIVE, THE FUTURE OF THE ELECTRIC GRID: AN INTERDISCIPLINARY MIT STUDY 112 (2011).

48. An example of where companies have been successful in transforming their product line is the cable industry, which expanded its service offerings and competed in other markets, rather than expending substantial resources to compete with the satellite companies in the old product market. Cable companies went from being television-only providers to providers of internet and phone service, sold both individually and in bundles. In other words, customers are able to choose between buying separate services or a combination of services. PETER KIND, EDISON ELEC. INST., DISRUPTIVE CHALLENGES: FINANCIAL IMPLICATIONS AND STRATEGIC RESPONSES TO A CHANGING RETAIL ELECTRIC BUSINESS 14, 16 (2013).

49. A death spiral refers to an existential crisis whereby a utility has limited ability to raise its prices to sustain financial viability in response to adverse events. In a competitive environment by definition, individual companies have no control over the price and will experience financial disaster if they try to raise their price above the market price. In non-competitive industries, companies are able to exercise some control over the price they receive, but even then they can suffer lower profits when they try to price their product or service too high. Kenneth W. Costello & Ross C. Hemphill, *A 'Death Spiral' for Electric Utilities: A Hyperbole or a Reality?*, 27 ELEC. J. 7, 7 (2010).

50. These non-utility providers can directly serve retail customers or utilities. They provide both technologies, products, and services. Non-utility providers play a crucial role in satisfying the demands of engaged customers. How utilities interact with them and what rules regulators establish affect what benefits these providers transmit to retail customers.

51. Experiences in other public-utility industries have shown that in a workably competitive environment, allowing non-utilities to provide services can produce significant benefits to consumers. The telecom industry is a good example where third-party providers played a valuable role in exploiting new technologies for the benefit of consumers.

- How can regulators guarantee an economically level playing field between utilities and third-party providers who serve engaged customers?
- What barriers to consumer engagement exist today, and how can regulators mitigate them most economically?[52]

Proponents of electric utility transformation have emphasized customer welfare as the paramount objective. Throughout its history, utility regulation has given customers top billing. One contemporary complication is that technology and other factors have allowed customers to take more control, placing greater demands on utilities. Another complication is that the interests of residential customers have become diverse, requiring regulators to trade-off the welfare of some customers for the benefit of others. Customers who install rooftop solar and other DG facilities want standby service; on average, they have a lower load factor than other utility customers;[53] and they impose greater demands on the local distribution system (e.g., two-way electricity flow). Utility customers have also responded differently to new technologies, with some exploiting real-time information and others preferring clean-energy generation.

There is a legitimate concern that utilities might favor themselves or an affiliate, which violates the condition of a level playing field. Utilities might also obstruct those innovations that threaten their monopoly status or be indifferent to those innovations that largely have public benefits.[54] Regulators have to be vigilant to make sure that utilities are unable to erect artificial (i.e., undue) barriers to protect their financial interests at the cost of customer or societal welfare. These barriers can reduce the value of the distribution network, thereby obstructing the development of innovative value-added services that stand to benefit engaged customers.

E. Ratemaking

Ratemaking affects the ability of utilities to recover their costs, allocate costs between customer groups, and achieve predetermined regulatory/social objectives. These objectives include the financial health of utilities, the efficient use of elec-

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52. They include limited access to information, high customer acquisition cost, and other transactional obstacles. ADVANCED ENERGY ECON. INST., CREATING A 21ST CENTURY ELECTRICITY SYSTEM FOR NEW YORK STATE: AN ENERGY INDUSTRY WORKING GROUP POSITION PAPER 21-23 (2014).

53. Load factor is the average load divided by the peak load in a specified time period. Assuming other things held constant, the average cost for a utility to serve customers with higher load factors is lower than its average cost to serve other customers.

54. Public benefits are external to a utility and defined by economists as positive externalities. Examples include clean air and national security, which the country values but individual utilities in terms of their profitability do not. Investments in new technologies that reduce greenhouse gas emissions and lower the risk of harmful climate change can benefit society at large. Absent carbon pricing or similar policies (e.g., carbon trading), no direct financial compensation associated with those benefits exists, thus driving a wedge between the private returns that a utility realizes from innovations and the overall social return.

tricity and the accelerated penetration of socially desirable, new and emerging customer-oriented technologies. Customer bifurcation increases the difficulty of ratemaking, especially in balancing the interests of different stakeholders. Especially relevant today, encouraging customers to self-generate may increase rates to full-requirements customers or jeopardize the utility's financial health.

1. Concerns in a Customer Bifurcated World

Analysts, stakeholders, and others have raised concerns about current ratemaking practices, especially as they relate to industry transformation and customer bifurcation. Some of those concerns stem from self-interest while others have more legitimacy from a public-interest perspective. Even in those jurisdictions not anticipating radical industry reform, utilities along with other stakeholders and their regulators are contemplating changes to long-standing ratemaking practices.

Current ratemaking practices have triggered several concerns as bifurcation of utility customers has become more prevalent:

- Financial harm to utilities from lower sales given the typical rate design of recovering most fixed costs through volumetric charges;
- Inappropriate rates and rate design for DG and full-requirements customers;
- Overpricing of surplus power (e.g., the net metering rate) from rooftop solar customers;
- Cost-shifting to full-requirements customers;[55]
- Deficient utility compensation to DG customers for the value they contribute to the utility grid, including standby and other grid services;
- Uniform prices across all time periods; and
- Under-exploitation of smart technologies for more economically rational pricing.

Examples of reformed rates that are under discussion in a number of states are straight fixed-variable-type rates,[56] real-time pricing,[57] revenue decoupling,[58]

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55. Cost shifting could involve the utility allocating DG-related costs to full-requirements customers. As another example, the utility could sell information and computer services to an affiliate installing rooftop solar systems at below-cost. Cost shifting is not necessarily anticompetitive. It always has the effect of raising the prices of regulated services. Yet it might have minimal effect on the unregulated market: It could simply allow the utility to increase its profits by cost manipulation, rather than predation or other strategies giving its affiliate an unfair advantage over competitors.

56. Larry Blank & Doug Gegax, *Residential Winners and Losers Behind the Energy Versus Customer Charge Debate*, 20 ELEC. J. 31, 31 (2014).

57. While studies on real-time pricing generally show that the benefits outweigh the costs, most of the benefits go to a small number of consumers who are relatively price-responsive. Thus, although some customers will likely benefit from such pricing, other customers will see higher bills. The fear of a large number of losers is a political obstacle to widespread adoption of real-time pricing.

58. Under revenue decoupling, the utility adjusts its rates between rate cases for sales deviating from some baseline level. One common structure is to annually adjust rates for a gap between actual sales and test-year

multi-year rate plans (e.g., price caps), surcharges for innovative investments, creation of a separate rate class for DG customers, cost-based standby rates, and performance-based rates for utilities.[59] As DG grows, regulators will ultimately have to reconcile how utilities recover their energy, and capacity/grid costs. Excessive reliance on the volumetric component of utility rates to recover both of these distinct costs will become increasingly contentious and likely unsustainable over time.[60] For those customers who want more control over their electric bill, time-varying pricing and demand rates become critical. The legacy of average-cost pricing will likely continue to unravel as distinctive customers' demands become more prevalent.[61]

2. Recovery of Costs for New Investments Dedicated to Engaged Customers

One topic under robust discussion relates to cost recovery and funding for expensive new investments, some of which are targeted at engaged utility customers. There are five aspects of cost recovery (e.g., rate-basing capital costs): timing of recovery, method of recovery, customers responsible for recovery, criteria for recovery, and the accounting treatment of costs. Each of these aspects affects the willingness of utilities to invest in technologies and services benefitting only engaged customers.

Regulators face two critical questions: Who should pay for new investments benefiting engaged customers, and how should utilities recover their costs? When a new technology benefits only some utility customers (e.g., customers willing to pay a premium for clean energy), the regulator would have to determine the responsibilities of separate customer groups. Should all residential customers bear the risk of a new technology that benefits only engaged customers? As a "fairness"

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sales per customer. If a utility's actual sales per customer over a specific period fall below the level embedded in existing rates, the utility could increase its rates to compensate for the revenue shortfall. This mechanism helps to stabilize a utility's revenues and earnings, causing it to be more indifferent to the level of actual sales and thus removing any financial harm from energy efficiency and distributed generation.

59. In a general sense, performance-based rates would ask: Are customers getting value for their money? Evaluation of utility revenues would consider outputs (e.g., reliability, penetration of DG, energy-efficiency savings) that benefit customers and society as a whole. The question then becomes, given utility outputs, what revenues should regulators allow utilities to earn? Performance-based rates can involve formal incentive mechanisms or simply rate adjustments by regulators based on their judgment of whether a utility performed exceptionally well or poorly. The latter approach is problematic if the regulators' decision takes place after-the-fact in an ad hoc fashion, rather than by applying upfront rules and criteria to the utility.

60. One reason is that utility rates to core (or full-requirements) customers would rise faster as more customers migrate to DG.

61. A hallmark of state utility regulation is the setting of prices based on embedded historical cost. This pricing methodology precludes customers from having to pay fluctuating prices, including higher prices during peak periods and other periods of tight supplies. Regulators have also expressed concern that some consumers would not shift load to lower-priced periods and thereby drive up the average price of electricity they pay and their utility bill.

rule, customer groups who benefit the most should pay more of the costs. In some states, utilities recover the costs of new smart meters through the customers' distribution charges. Complaints have come from some customers who see little benefit from these meters.

F. New Utility Obligations and Functions

A radical regulatory response to changing technological, public policy, and market conditions could involve utilities adopting a new business model (to be discussed later in this article) that defines their new role, objectives and strategies. The utility in a transformed industry would likely have different functions and obligations, including the separate treatment of engaged and traditional customers. Because of engaged customers, the regulatory compact between a utility and its regulators might have to undergo a major revamping. The utility may have less retail monopoly power, disrupting its geographical franchise; and the regulator might allow the utility's rate of return to float within a larger range, based on the utility's performance in serving engaged customers.[62]

Utilities can assume different functions in growing DG. They could provide additional services to DG customers. The services for DG and other engaged customers will include enhanced services that utilities did not provide previously. Regulators have discretion over what products and services utilities can sell. Their decision rests on what functions they envision utilities to perform. Three alternatives are "platform" operator ("traffic cop"),[63] service provider,[64] and "wires" provider.[65]

One alternative is for utilities to invest themselves in DG facilities and electric-vehicle recharging stations and rate-base them to earn a profit.[66] One concern

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62. Instead of utility profits dependent on sales and the dollar value of the rate base, under a transformed industry utilities may have to demonstrate greater customer value from their offerings to receive their authorized rate of return.

63. "Platform" refers to a system that supports interactions among multiple parties, and establishes a set of rules that facilitates transactions among multiple parties. A platform can increase innovation and competition by: (a) reducing transaction costs, (b) increasing transparency, and (c) enabling the enhancement of integration benefits that will grow as additional diverse suppliers and new technologies (e.g., storage, plugged-in electric vehicles) enter the market. Industry observers label this role of utilities as a "smart integrator," "facilitator" or "orchestra leader." *See, e.g.*, ROCKY MOUNTAIN INST., NEW BUSINESS MODELS FOR THE DISTRIBUTION EDGE: THE TRANSITION FROM VALUE CHAIN TO VALUE CONSTELLATION (2013).

64. Some utilities have already invested in solar PV systems to improve their earnings. Others are considering additional services to offer their DG customers.

65. BILL DICKENSON & PHIL SHARP, ASPEN INST., THE FUTURE OF THE U.S. ELECTRICITY SECTOR (2013); BIPARTISAN POL'Y CENTER, CAPITALIZING ON THE EVOLVING POWER SECTOR: POLICIES FOR A MODERN AND RELIABLE U.S. ELECTRIC GRID (2013); Ronald L. Lehr, *New Utility Business Models: Utility and Regulatory Models for the Modern Era*, 26 ELEC. J. 35 (2013); N.Y. STATE DEP'T OF PUB. SERV., *supra* note 25; ROCKY MOUNTAIN INST., *supra* note 63.

66. One socially desirable rationale for utility investments in electric-vehicle recharging stations is market failure; that is, the private sector, for whatever reasons, would under-invest in recharging stations. In a more

with this approach is that all utility customers would pay for the investments even though the benefits would likely go to a relatively small number of customers, namely, engaged customers. Alternatively, utility shareholders could initially fund these investments and recover the costs from DG customers over time. A third option is for utilities to form an affiliate that provides DG services.

G. A New Utility Business Model

1. Rationales

Regulators might want to advance a new utility business model to deal with the bifurcation of customers. A business model focuses on the utility's products and services, their value relative to their cost, and how efficiently and effectively the utility creates, produces, delivers and supports those products and services in their franchised area. A new business model can allow utilities to profit from offering distributed generation services or owning PV solar systems, while maintaining a competitive marketplace that precludes them from having an unfair advantage from shifting costs to traditional customers.

The recent dialogue on the "electric utility of the future" has focused on whether the existing business model is sustainable, given the prospects for the rapid development of solar PV and other DG technologies, and customer engagement in general. A threat to utilities can start with sales losses to DG and, subsequently, an inexorable struggle to recover fixed costs from fewer customers. Price increases aggravate utilities' problem of yet more customers switching to DG.

2. Features of a Business Model Serving Both Traditional and Engaged Customers

The late management guru Peter Drucker commented that a business model should answer the basic questions: Who is your customer, what does the customer value, and how do you deliver value at an appropriate cost and at an acceptable profit?[67] A business model therefore concerns how a company (1) creates value for its customers through its operations, products and services, and (2) generates sustainable operating and financial performance. For a utility, a business model focuses on its products and services, their value relative to their cost, and how efficiently and effectively the utility creates, produces, delivers and supports those products and services in their franchised area.

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facilitative role, a utility could help stimulate electric vehicles by expediting permitting and installation, in addition to offering time-of-use rates for electric-vehicle charging. The market-failure argument would seem to hold less for the DG market, which has attracted a large number of vendors, installers and other market providers.

67. PETER DRUCKER, THE PRACTICE OF MANAGEMENT (1954). Electric utilities, in addition to satisfying their customers and shareholders, must also appease regulators/policymakers who dictate their broader social responsibilities. In the context of this article, the prime question relates to what business model would best maximize the long-term interests of engaged and traditional customers collectively.

The utility business model should have three qualities. First, it should adapt to new technological and market developments. This may require utilities to function as "platform" operators, in accommodating DG that technological advances have made economical to utility customers.

Second, a business model should continue to support core regulatory objectives, including cost-based rates, fairness across different customer groups, highly reliable service, and "just and reasonable rates." Notwithstanding major changes that are likely to evolve in the electric industry, long-held regulatory goals will still hold a high standing.

Third, the business model should satisfy predetermined broad social objectives (e.g., affordable electricity to low-income households, clean energy). Changed conditions might require a different business model in which utilities would have more opportunities to exploit the benefits for themselves and society from the improved economics of DG and other technologies. A utility can then take a more proactive role, rather than a defensive posture where they see new technologies as a threat to their financial viability.

The prime criterion in selecting the appropriate business model is that it should help to steer utility performance toward society's demands reflected through public policies, market conditions, prevailing technologies, and customer behavior and preferences. One desirable outcome would be to enhance efficient competition in the delivery of energy services to engaged customers over a newly formed (i.e., revamped) distribution-grid platform.

H. Exploiting Differences in Customer Preferences

Utilities can exploit customer differentiation of demands through smart technologies by offering individualized value-added services at a profit. They can behave like airlines, in other words, in differentiating their services to earn higher profit margins. Although reflecting discriminatory pricing, such action can enhance the utility's incentive to provide additional services for which engaged customers would benefit and be willing to purchase.

As an illustration, priority service is a form of product differentiation in which the market segments into different groupings. Those customers willing to pay higher prices gain higher priority in receiving the product or service. Priority service is an economical and arguably equitable rationing scheme for curtailing the situation of excess demand.[68] The theory of efficient rationing suggests that allocation should be according to customers' valuations of service.

68. Hung-Po Chao & Robert Wilson, *Priority Service: Pricing, Investment, and Market Organization*, 77 AM. ECON. REV. 899 (1987).

I. Encouraging Innovation[69]

Utilities may have to become more innovative in serving engaged customers. Regulators can help by providing utilities with stronger incentives to adopt new technologies and undertake research and development (R&D).

1. The Benefits of R&D

The main benefit of R&D is to advance the current state of technology. R&D can play a critical role in nurturing new technologies during their initial stages of commercial application so that they become more prominent in the future. When a new technology becomes commercial, it can still benefit from further R&D to hasten its diffusion in the marketplace. Additional R&D and technology improvements will be critical for solar power and other new technologies to become mainstream by mid-century.

In the public utility space, technological change has the additional value of fostering policy objectives. For some industry observers, the absence of breakthroughs in energy technology will preclude major strides toward attacking global warming affordably.[70] R&D can also spawn new technologies that will particularly benefit those customers who want more choices, and control over their electricity usage and the price they pay. There is some concern that electric utilities are underfunding R&D.[71]

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69. This section draws heavily on KEN COSTELLO, NRRI REPORT 16-05, A PRIMER ON R&D IN THE ENERGY UTILITY SECTOR (2016).

70. Varun Sivaram & Teryn Norris, *The Clean Energy Revolution: Fighting Climate Change with Innovation*, 95 FOREIGN AFF. 147 (2016). One view held by many economists is that accelerating R&D instead of increasing subsidies represents a better approach to making clean energy resources economical and acceptable in the long run. Another important action is to hold participants in the energy market accountable for the adverse effect of greenhouse gas emissions. By requiring companies to internalize emissions and their damage to health and the environment, clean energy should become more competitive with fossil fuels, in the process stimulating more R&D spending on clean energy.

71. Electric utilities have spent less on R&D in absolute dollars since the mid-1990s. One reason is that in responding to increased competition, utilities curtailed their internal R&D activities in addition to reducing their support for collaborative research managed by the Electric Power Research Institute. With increased competition, utilities could less easily pass through R&D costs to their customers and appropriability became more of a concern (i.e., new competitors could "free ride" on the benefits of R&D conducted by an individual utility). One study found that electric industry restructuring in the 1990s was responsible for an almost 79% decline in utility R&D expenditures. Paroma Sanyal & Linda R. Cohen, *Powering Progress: Restructuring, Competition, and R&D in the U.S. Electric Utility Industry*, 30 ENERGY J. 41 (2008). The incentives for utility R&D have therefore changed negatively starting in the 1990s. It is not obvious why the movement toward competition would decrease R&D. Utilities might upgrade their R&D activities to improve their operating efficiency and better compete. On the other hand, they may scale down R&D costs as part of their strategy to manage costs.

2. The Effect of Public Utility Regulation

Various features of public utility regulation affect how much and how utilities make R&D/innovation investments. They include the tightness of regulation, regulatory commitment, degree of information symmetry, cost recovery, allocation of the benefits, and risk incidence. Depreciation policy can help ensure recovery of invested funds over the economic life of the physical capital. When depreciation rates are too low, with depreciation stretched out over too many years, a utility may find it uneconomical to replace old equipment with new equipment. The costs could be particularly high in a dynamic environment in which new technologies offer large benefits to utility customers and society in general.

Another regulatory practice is to split the benefits of a new technology between utility customers and shareholders, so as to boost the efforts of utilities to invest in R&D. Otherwise, the benefits to utilities may not justify the risks they would bear. A third practice is the regulatory commitment to R&D, reflected in guidelines, rules, or individual rate-case decisions, that can lower the risk to the utility and make R&D more attractive.

The economics literature has devoted relatively little attention to regulated firms' incentive to engage in R&D, and develop and adopt new technologies.[72] Nevertheless, the standard thinking is that regulation tends to make utilities cautious about innovating and taking risks. The presumption is then that utilities will fall short in their R&D activities and deployment of new technologies.

Utilities tend to underinvest in R&D and new technologies that have public benefits or threaten their monopoly status. Especially for the latter reason, regulators need to be vigilant that utilities do not "squash" those technologies that threaten their financial health but are in the interest of their customers. The consequences can be particularly harmful for engaged customers, who would likely benefit the most from those technologies.

An increasingly important function of public utilities will be to act as a conduit for filtering the benefits of innovations developed by third parties to retail customers. After all, most innovations that benefit utility customers had their beginnings outside the utility space. Utilities' ability and willingness to play the role of "innovation" adopter depend on regulators creating a favorable risk-reward balance.[73] If utilities believe that innovations will threaten their financial condition, they will be less inclined to deploy them for the benefit of their customers. As a cardinal rule, any company will find R&D/innovation financially attractive only when it expects profits to compensate for the risk it bears.[74]

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72. Two publications do offer analysis of this topic: Elizabeth E. Bailey, *Innovation and Regulation*, 3 J. PUB. ECON. 285 (1974); STANFORD V. BERG & JOHN TSCHIRHART, NATURAL MONOPOLY REGULATION: PRINCIPLES AND PRACTICE (1988).

73. As an adopter, utilities do not have to be the creator of a new technology; they can simply acquire and use the technology for the benefit of their customers.

74. The inherent features of R&D pose challenges for a private for-profit company. It is expensive with costs commonly incurred several years before a company can reap profits or other benefits. R&D by nature is

Although the net effect of regulation on R&D/innovation is difficult to assess, the perception among industry observers leans toward the negative. The conditions required for non-regulated firms to innovate seem to be lacking for utilities. Specifically, why should a utility make an extra effort to innovate when most of the benefits will go to customers?

J. Removing Artificial Obstacles

To promote the public good, regulators need to distinguish between "artificial obstacles" and "natural obstacles." A *natural obstacle* is a customer's rational response to risk and customer uncertainty over the future economics of DG. An *artificial obstacle* could include regulatory rules that unduly discourage utilities from accommodating DG, entry barriers to DG providers, or distorted price signals to consumers that make DG less economically attractive. Regulators should always strive to mitigate artificial obstacles, which, by definition, derive from market imperfections or flawed regulatory practices, as long as the benefits exceed the costs of mitigation.

Mitigating natural obstacles, on the other hand, would invariably fail a cost-benefit test. Stakeholders often plead for regulators to eliminate obstacles that allegedly disfavor their preferred technology or source of energy. Frequently, these obstacles are simply normal market conditions whose elimination would involve a cost (e.g., via subsidies) greater than the benefits. One instance is overpaying DG customers for electricity they sell back to their utility. Such a practice would tend to result in overinvestment in DG as well as higher rates to non-DG customers.

IV. THE PATH FORWARD

Some states have aggressively fostered DER and smart grid technologies,[75] while others view them as having little or even negative benefits.[76] It seems reasonable to predict that a few electric utilities will undergo a major facelift over the next few years, while others will see only incremental, if any change.

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risky and success is difficult to predict. Innovations starting with R&D often require long lead times between basic science and commercial deployment. Competitors can also appropriate the benefits. New knowledge is especially appropriable, unless one has acquired patent protection. These features of R&D imply two things. First, companies are unlikely to innovate unless the payoff from successful innovation is substantial. Second, the market may under-allocate resources to R&D, providing a rationale for government funding.

75. The smart grid represents an information- and communications-based technology that gives utility customers the opportunity to better manage their electricity usage and participate in the management and operation of the grid in a more engaged manner. Paul L. Joskow, *Creating a Smarter U.S. Electricity Grid*, 26 J. ECON. PERSPECTIVES 29 (2012).

76. States taking the most engaged positions to date are California, Hawaii, Massachusetts, Minnesota and New York.

The overall question for state utility regulators is what actions they should pursue in view of these prospects for dramatic change in the electric industry.[77] Should they take the lead in proposing changes in utility operations and the business model, and how they regulate? Or should they wait longer to see what transpires in technology development, and regulatory and energy/environmental policies in other states and at the federal level? What are the costs of staying with the current utility business model and regulatory practices if radical changes occur?

At the other extreme, what are the costs of reshaping regulation and the utility business model when actual changes fall short of expectations? A misjudgment or error in selecting a business model is more likely with greater uncertainty of the future.[78] The public policy discourse so far has focused more on not doing enough than on going too far in reshaping the utility business model. Utilities and their regulators should consider the risks associated with both over-reacting and under-reacting to the expected changes for the electric industry.[79] Will an explosion in distributed generation be confined to a few geographical areas, or will it permeate across most states?

A. An Argument for Incremental Action

Each state faces unique economic and political conditions that would rationally lead them to pursue a different path for their electric utilities. Most states to date have favored incremental action in electric-industry transformation. This position reflects (1) hesitancy toward making major changes in a world of high uncertainty, and (2) the willingness to learn (or the preference for learning) from the experiences of so-called leading jurisdictions.

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77. States differ on the authority granted to utility commissions to initiate changes that would transform the electric industry. In several states, commissions see their role as narrow, restricted to enforcing any policy changes or other mandates established by the legislature.

78. Assume that the utility radically changes its business model to accommodate a high continuous growth in DG. If the actual growth fell far short of expectations, the costs of the transformation to the utility could be excessive and fail a cost-benefit test. Disappointing outcomes come from policies that assume a different state of affairs than what actually transpired. Regulatory practices and public policies can therefore fail not only because they move too slowly relative to prevailing technological and market developments, but also because they advance prematurely. The latter condition can occur when unfounded optimism about radical changes leads to investments and other costly actions that ultimately do not benefit either utility shareholders or ratepayers on whose behalf they were undertaken.

79. Type I and II errors are often applied by policymakers to evaluate the risks associated with a particular decision given that their projections of the future and other assumptions turned out to be wrong. A Type I error can result from society expending excessive resources on industry transformation when projections about new technologies turn out over-optimistic. A Type II error can result in society sticking with *status quo* policies when actual future conditions would have called for radical changes. A trade-off exists between a Type I and a Type II error: Reducing one type of error compromises the other. In the context of electric-industry transformation, utility customers can suffer losses from the wrong policy. Policies can encompass the utility business model, ratemaking, rules for fair competition, and financial incentives for clean technologies. For a general discussion of Type I and Type II errors, see WILLIAM MENDENHALL & JAMES E. REINMUTH, STATISTICS FOR MANAGEMENT AND ECONOMICS 323-33 (3d ed. 1978).

Utilities and states do not have to be leaders in supporting new technologies and business innovations, especially those whose future values are in doubt. As "free riders," they can learn from the experiences, both positive and negative, of so-called leading jurisdictions. The followers can view activities in states like California and New York as a public good.[80] This posture seems rational in view of the highly uncertain future of most new technologies and the state of the electric industry.

To say it differently, a sensible approach is for regulators and other policymakers to hedge their decisions to account for uncertainty. A rational decision-maker would tend to respond to future unknowns by delaying major actions. To the extent that waiting reduces uncertainty, utilities may enjoy an "option value" from an investment delay owing to this uncertainty.[81] They might therefore prefer waiting for new information before making major changes. In other words, utilities and states do not have to be leaders in supporting new technologies, especially those whose future is in doubt.

A good case study of diverse state responses is the electric industry restructuring that occurred during the 1990s. Many observers believed that restructuring throughout the country was inevitable. In restructured states, a major obstacle was the divergent visions that interest groups held about the electric industry's future. There was no solidarity of views about the industry's future. For the other states, restructuring was not even a topic of discussion or stakeholders reached a consensus of "no change."

While a few states, such as California and New York, are proceeding boldly, most states have taken a more measured stance. Many questions remain before one can say with certainty that the electric industry will see a transformation over the next five to ten years. After all, many who are projecting change either have ideological (even bordering on a quasi-religious mission), or monetary interests in promoting such a path. Regulators/policymakers should therefore not accept these optimistic or rent-seeking claims for new technologies at face value but act accordingly to a future that may, but not with certainty, turn out much differently than what the consensus is forecasting today.[82]

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80. CAL. PUB. UTILS. COMM'N, ORDER INSTITUTING RULEMAKING REGARDING POLICIES, PROCEDURES AND RULES FOR DEVELOPMENT OF DISTRIBUTION RESOURCES PLANS PURSUANT TO PUBLIC UTILITIES CODE SECTION 769 (Aug. 14, 2014); N.Y. STATE DEP'T PUB. SERV., *supra* note 25.

81. Option theory provides insights for decision-making by saying that when the future is uncertain, it pays to have a broad range of options available and to maintain the flexibility to exercise those options. Risk reduction can result from breaking major decisions into series of smaller decisions; that is, spreading decisions over time allows the regulator to respond to unfolding contingencies. AVINASH K. DIXIT & ROBERT S. PINDYCK, INVESTMENT UNDER UNCERTAINTY (1994); Robert S. Pindyck, *Irreversible Investment, Capacity Choice, and the Value of the Firm*, 78 AM. ECON. REV. 969 (1988).

82. Some analysts contend that the same condition accounts for both the recent push for distributed generation and support for retail competition in the 1990s; namely, that average cost exceeds marginal cost in both periods, meaning that utility customers can benefit from bypassing utility service (priced at average cost) and switching to another source (priced at marginal cost). SEVERIN BORENSTEIN & JAMES BUSHNELL, PUB. NO. EI @ HASS WP 252R, THE U.S. ELECTRICITY INDUSTRY AFTER 20 YEARS OF RESTRUCTURING (2014). Because of

This posture has implications for what course of action regulators should take today and in the immediate future versus waiting to see what transpires over the next few years. There is no denying that the prospect for big changes is a real possibility, if not imminent. Whether these changes will spread throughout the electric industry across most states depends critically on the changed behavior of retail customers from traditional to engaged.

B. Question of Future Customer Engagement

One particularly optimistic scenario is that many residential customers will invest in rooftop solar PV systems. It is plausible that only a small minority of households care enough about lowering their electricity bills to spend a large amount of dollars upfront or even allow a third party to make the investment and install a system on their rooftop. After all, the average residential household spends only about 2.7% of its before-tax income on electricity.[83] Experiences with retail choice have also shown that the vast majority of residential customers would prefer staying with their current utility rather than switching to a third party even at the lost opportunity of lowering their electricity bill.[84]

V. CONCLUSION

Growing customer engagement has been a driving force behind transformation of the U.S. electric industry. The combination of technology, public policies and economics has made this possible, although the jury is still out on how fast customer engagement in retail electricity markets will proliferate in the coming years. To date, most residential customers have exhibited much inertia, ignoring opportunities to participate in retail competition programs or new pricing schemes like time-varying pricing. Even with the hype over rooftop solar, an extremely small percentage of U.S. households to date has taken advantage of this technology.[85] Notwithstanding this fact, this technology as well as others (e.g., smart meters) has triggered robust dialogue, and to a lesser extent actions by both

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this pricing discrepancy, it is difficult to know whether bypass improves net economic welfare (i.e., economic efficiency). The effect is cost-shifting between electricity customers, rather than real cost savings. Lost utility revenues, when exceeding avoided costs, typically pass through to remaining core customers in the form of higher rates. This contention basically says that customers want to avoid utilities' sunk costs by having the right to choose another supplier. The logical, if not politically palatable, remedy is to set utility retail rates based on marginal or incremental cost.

83. U.S. BUREAU LABOR STATISTICS, *supra* note 20.

84. MATHEW J. MOREY & LAURENCE D. KIRSCH, ELEC. MKTS. RES. FOUND., RETAIL CHOICE IN ELECTRICITY: WHAT HAVE WE LEARNED IN 20 YEARS? (2016).

85. At the end of 2014, the percentage of homes in the U.S. with installed rooftop-solar systems was about 0.5%. Half of these installations were in California alone. According to the U.S. Department of Energy, even if the annual growth of residential rooftop solar installations was 25% through 2020, electricity from this source would still be less than 1% of the nation's electricity supply. ENERGY INFO. ADMIN., U.S. DEP'T ENERGY, PUB. NO. DOE/EIA-0035 (2016/8), AUGUST 2016 MONTHLY ENERGY REVIEW (2016); ENERGY INFO. ADMIN., U.S. DEP'T ENERGY, WIND AND SOLAR DATA AND PROJECTIONS FROM THE U.S. ENERGY INFORMATION ADMINISTRATION: PAST PERFORMANCE AND ONGOING ENHANCEMENT (2016).

utilities and state regulators, whether about ratemaking or the utility business model.

The attention given to the new electricity customer seems to overlook the fact that electricity is basically a commodity, and that the average residential customer may be satisfied with her electric service and the price she pays. Radical changes in customer behavior require electricity to be viewed more as a value-added service than a pure commodity. Also, because the amount an average customer spends on electricity is a small portion of her income, devoting additional effort to lowering the electricity bill may fall short of the expected benefits.

New customer engagement has triggered action by both electric utilities and their regulators. Even if a small percentage of electricity customers become engaged in the years ahead, utilities and their regulators will face increased pressure to modify their long-held practices. We have seen this already in net energy metering, where contentious debate has occurred notwithstanding the extremely small percentage of residential customers switching to rooftop solar technologies. Ratemaking is under intense review in several states partially because of the conflicting interests of DG and core customers. Regulators must decide how much they are willing to accommodate DG customers at the expense of other customers. Some states, including Hawaii[86] and Arizona, have already reached a triggering point where their recent actions have swung the pendulum away from rooftop solar to core customers. Other states are likely to follow suit in the future. This position reflects the concern that regulators have toward those customers who continue to purchase their entire electricity needs from the local utility.

The availability of unbundled products and services, and enabling technologies along with more timely information will all bolster customer engagement. Utilities will increasingly operate in an environment where a distinct line exists between engaged and traditional customers. This demarcation means that the dialogue over whether utilities should operate under a centralized *or* distributed business model is off-mark. Both models can coexist and perhaps each can benefit from synergy. Utilities will face additional costs and risks. The major challenge for state utility regulators is to protect traditional customers while eliminating any unreasonable barriers to engaged customers who want to exploit new technologies.

Customer bifurcation poses challenges for determining what role utilities should play, and the appropriate ratemaking and the business models under which they should operate. One big question is whether regulators should place more

86. In 2015, the Hawaii Public Utilities Commission concluded that the retail rate net-metering credit is driving uncontrolled, undirected growth, and raising serious questions about cost shifting to non-solar customers. The Hawaiian Electric programs were capped at existing levels as of the release of the October 12, 2015 decision, and lower buy-back rates were instituted for new rooftop solar systems on each of the state's islands. Systems with existing retail rate net-metering deals will be able to retain them for the life of their contracts. One interpretation of the Commission action is that it reflects its belief that solar has become sufficiently competitive to require no additional assistance. Mark Dyson & Jesse Morris, *Hawaii Just Ended Net Metering for Solar. Now What?*, RMI OUTLET (Oct. 16, 2015), http://blog.rmi.org/blog_2015_10_16_hawaii_just_ended_net_metering_for_solar_now_what.

reliance on regulated utilities to innovate via robust incentives, or on third parties who are more entrepreneurial. After all, throughout their histories, electric utilities have displayed conservatism when creating or using new technologies and other innovations.[87]

Regulators will have to expand their interpretation of the "balancing act" to account for the disparate interests of traditional and engaged customers. They will likely emphasize the protection of traditional customers from cost-shifting and other utility activities benefitting engaged customers.

An opposing scenario is that since engaged customers are more sensitive to price and the quality of utility service, the natural inclination of utilities is to accommodate them by discriminating against traditional customers. This may seem at odds with the current utilities' positions on net energy metering, where they protest giving rooftop solar customers favorable treatment at the expense of other customers. More than anything, the utilities' chief concern is recovering their fixed costs. In the future, if more of their customers desire to switch to a third-party provider, utilities may discourage them through discounted or other forms of discriminatory pricing "funded" by traditional customers. Regulators may frown upon such actions, however, and oppose them as unacceptably discriminatory against those customers who continue to receive their total electricity needs from the local utility.[88]

In enhancing the benefits from customer engagement, regulators and other policymakers should provide utilities with better incentives to innovate and undertake R&D investments that are essential to the creation and dissemination of future new technologies. They should also make sure that utilities are not blocking innovations from reaching retail customers. Many of the new technologies that can benefit customers have their beginnings in the non-utility sector. If utilities erect

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87. The drive to radically change the telecom market came from unregulated companies, rather than the regulated companies.

88. Some electric utilities in the past have offered special rates to discourage industrial customers from self-generating. Industry observers referred to them as "cogeneration deferral rates." As long as the utility is not charging below its incremental cost, according to the conventional economic argument, it is not uneconomical to offer a lower rate. There are three potential problems, however, with discount rates. First, they are definitely discriminatory: The only reason the utility is offering a special rate is that the customer has a "bypass" option [i.e., CHP production]; it is not because it is cheaper for the utility to serve that customer compared with other similarly situated customers. Price discrimination is often defensible, so cogeneration deferral rates are socially desirable under specific conditions. Second, there is a "fairness" issue of who absorbs the "revenue losses." A net-revenue shortfall requires that the CHP-potential customer would have continued to buy its electricity from the utility even in the absence of a rate discount. In this instance, any revenue losses would likely lead to higher rates to other utility customers. Third, discount rates could act as a barrier to CHP, stifling the long-term growth of the CHP sector. In fact, some opponents of discount rates argue that these rates are anticompetitive and in violation of the Public Utility Regulatory Policies Act. Cogeneration Coalition of America, Inc., *Petition for Expedited Investigation under Section 210 of the Public Utility Regulatory Policies Act and Issuance of Declaratory Order*, Docket No. EL87-34 (April 28, 1987).

barriers to their dissemination, customer engagement would likely experience a serious setback.

Finally, the experience to date is one where states have taken varying positions on electric industry transformation, of which customer engagement is a major driver. This diversity exemplifies the adage that states are "laboratories of democracy." Although some observers would disagree, sub-federal regulation has its merits in allowing different jurisdictions to decide what is best for them. Those states that remain hesitant are acting rationally according to option theory, which says that decision-makers should proceed cautiously in an environment of uncertainty. Although the U.S. electric industry is in a transition to something different, the future remains uncertain over the timing, nature, and magnitude of change. One source of doubt is the future spread of customer engagement.