

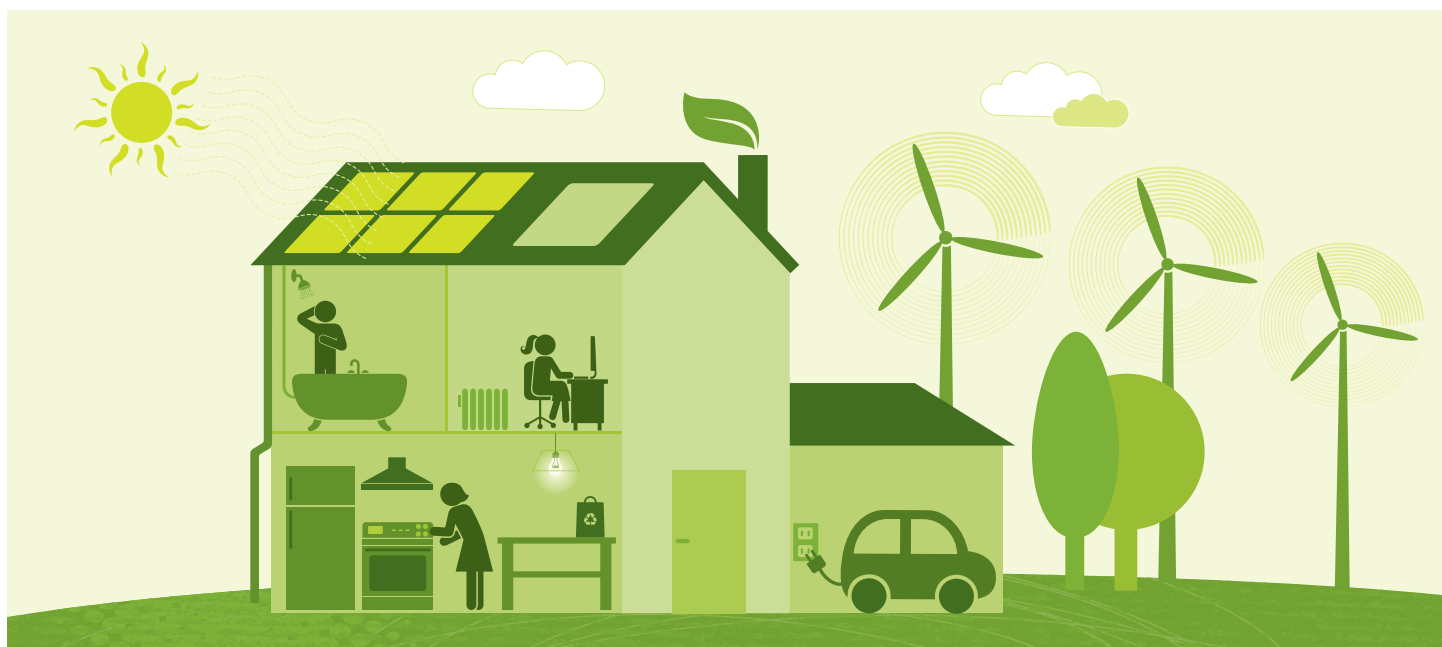
ISSUE BRIEF

# A VISION FOR THE FUTURE OF THE ELECTRIC INDUSTRY

America's private and public electric utilities today are operating in a rapidly changing environment that features an expansion of innovative customer options, shifting public policy goals, and a broader and more diverse electricity service marketplace. This has generated extensive discussion about the "future utility business model" and whether utilities will change their principal focus from primarily selling electrons to considering themselves service providers to residential, commercial, industrial, and agricultural customers.

## NRDC'S VISION

The utility business model, customer incentives, and regulatory structure should encourage and support the cleanest and most efficient, equitable, and affordable electric system possible. It should enable innovation and access to cleaner, more efficient technologies for all customers (including low-income); facilitate access for non-utility providers of services and technologies where appropriate; and ensure appropriate incentives, markets, and planning processes for necessary electric system infrastructure investments. In addition, complementary workforce development policies should focus on evolving worker skills to help with this transition.



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## THINGS ARE CHANGING

- Since 2000, the rate of growth in U.S. electricity sales has lagged well behind population growth, a trend expected to continue, largely because of increased energy efficiency.<sup>1</sup>
- Smarter energy use, large-scale renewable power generation, distributed (onsite) solar production, demand response (compensating customers for curtailing energy use at specific times), advanced metering technology, electric vehicles, and other technologies are changing how the electric grid operates. They make the electric system cleaner and provide customers with a range of options for how their energy is produced and used.
- Non-utility entities entering the marketplace to offer new services and technology are providing customers with more options and further increasing the complexity and unpredictability of today's environment.
- Meanwhile, the U.S. Environmental Protection Agency's Clean Power Plan, which limits the power plant pollution fueling climate change, is expected to accelerate the trend toward cleaner, more efficient electricity service.

As a result of all of these developments, the traditional utility business model and the regulatory system that supports it must evolve to realign utility incentives with our energy and environmental policies, respond to changing customer opportunities, and modernize the electric grid in a way that supports reliability, affordability, innovation, and a clean energy future. Discussion of, and speculation about, the “future utility business model” continues to permeate the industry and challenges us to contemplate how to evolve today's business models such that utilities, customers, and the environment benefit.

## COMPONENTS OF A NEW BUSINESS MODEL

Creating a clean, efficient, modern, reliable electricity grid is essential to the clean energy transition now underway, and utilities remain the most important—although not the only—investors, long-term system planners, and resource integrators. Utilities' approach to grid management must evolve to create a fully integrated, resilient, and flexible system. A significant redesign of the regulatory and utility business models can help motivate these changes.

America's electric system and its public and private utilities encompass a wide variety of market designs and functions (vertically integrated, distribution only, hybrid models, etc.) as well as geographic regions, so there can be no one-size-

fits-all design. However, several universal elements, each with many potential variations, should be common to most.

## THE UTILITY—REGULATORY REFORM

Utilities need revenue certainty to make investments that will modernize the grid, facilitate the transition to a clean energy future, and continue to provide reliable and affordable services. Therefore, it is essential to:

### *Regulate utilities as service providers*

An electric utility should not be viewed or regulated as if it were a commodity business dependent on growth in electricity sales to keep its owners financially whole. This outdated model creates a disincentive for investment in energy efficiency, clean distributed generation, and many other important customer choices that can reduce their consumption and bills. Instead, utilities should be focused on meeting customers' service needs and our energy and greenhouse gas reduction goals. Revenue decoupling makes utilities indifferent to retail energy sales by using modest annual adjustments in rates to ensure the utility recovers its authorized costs for system maintenance and modernization.<sup>2</sup> (The mechanism does not, however, guarantee utility profits or affect utilities' authorized costs of service, which are determined by regulatory authorities in public proceedings.) As of December 2015, 15 states had revenue [decoupling](#) in place for electric utilities and 22 for natural gas utilities; the number of utilities covered stood at 34 and 55, respectively (more than a three-fold increase in the total from five years earlier). The promising new RIIO regulatory model being implemented in the United Kingdom, and being discussed in some U.S. venues, also includes revenue decoupling.

### *Ensure that strong performance is rewarded and new earning opportunities are supported*

Financial incentives (earnings) allowed for utilities in rate cases can be aligned with customer and public interests by tying them directly to performance and not exclusively to the amount a utility invests in its physical assets like poles, wires, and power plants, as often happens today. Performance-based incentives should be tied to such benefits as customer satisfaction, equal access to affordable services for all customers, operational safety, implementing cost-effective initiatives to improve energy efficiency, integration of clean energy generation, promotion of electric

## AN INCENTIVE MODEL TO WATCH

While not all components are appropriately applicable to the U.S. electricity system, an interesting aspect of the RIIO model (Revenue = Incentives + Innovation + Output) in the United Kingdom is that it is both outcome- and performance-based and decouples utility cost recovery from sales volume. RIIO includes explicit utility incentives for quality of service (reliability), safety, environmental performance, conditions for connection, and social obligations (such as low-income access). It also includes specific provisions for innovation, including a Low Carbon Networks Fund (up to 2.5 percent of revenues) to address the general decline of R&D investments. This fund supports projects sponsored by the Distribution Network Operators (Britain's equivalent for a distribution utility) to try out new technology and new commercial and operating arrangements. Although RIIO is still a work in progress and several challenges remain in setting the appropriate metrics and incentives, it is moving in the direction of a more performance-based system and will be a model to watch and learn from.



**THE UTILITIES**  
REFORMING HOW  
THEY'RE REGULATED

- Regulated as service providers
- Allowed earnings reward performance
- Allowed earnings reward innovation/facilitate adoption of clean, efficient technologies
- Flexible regulation



**THE CUSTOMERS**  
OPTIONS AND REFORMING RATE DESIGN

**ALL CUSTOMERS**

- Rates based on the more you use, the more you pay
- Rate design incents clean, efficient choices
- Avoid large fixed charges
- Tools to help everyone respond to new rate designs, take advantage of new technologies, and protect the economically vulnerable

**ROOFTOP SOLAR CUSTOMERS**

- Rates capture full value of solar to owners & the grid
- Rates ensure solar owners pay for grid services used
- Utilities rewarded for facilitating connection/integration
- Access to solar benefits for all

**ELECTRIC VEHICLE CUSTOMERS**

- Utilities help build charging infrastructure
- Utilities ensure availability of smart vehicle charging
- Utilities are rewarded for performance/facilitation
- Everyone has EV access



**THE GRID**  
MODERNIZING THE  
ELECTRICITY SYSTEM

- Comprehensive planning
- Electricity markets support clean energy and treat efficiency as a resource
- More tools to integrate clean energy into grid



**THE REGULATORS**  
REFORMING HOW THE  
REGULATORY SYSTEM  
WORKS

- Information about the changes needed, consequences
- Authority, resources, and tools to make nimble, flexible decisions
- Support from stakeholders

vehicles, innovation, and grid modernization.<sup>3</sup> The design and implementation of the financial and performance-based incentives must be clear and balanced.

As traditional means of generating utility revenues—like increasing sales of electricity and building new infrastructure—diminish or become less dependable, new earnings opportunities should be offered that enable innovation and competition (by the utility or non-utility providers) and that are linked to delivering clean, reliable, equitable, and affordable energy services. These opportunities may include significantly enhancing utility investment in “smart meters” and a “smart grid” that deliver or enable new energy management tools for all customers; facilitating increased energy efficiency and technology such as electric vehicles; reducing the cost of integrating renewable energy generation with variable output into utility resource portfolios; and maximizing value for customers and the grid from distributed resources like rooftop solar.

***Allow more flexibility tied to increased innovation and competition***

More flexible regulation will be important so that utilities can offer tailored rate and service options that respond to unique customer needs and interests, as well as pilot programs or other methods to test, evaluate, and bring to market more quickly new service options, products, and technologies for customers. It is important that this flexibility not discourage innovation and competition or create disincentives for energy efficiency and clean energy investments by customers.

**THE CUSTOMER—OPTIONS AND RATE DESIGN REFORM**

***All residential customers***

Costs for electric services should be allocated equitably to those who use them while remaining affordable, providing appropriate incentives for utilities to invest in energy efficiency and other clean solutions, and allowing customer access to clean and efficient options and technologies.

Utilities deserve assurances that they will fully recover their nonfuel, fixed costs (e.g., installing and maintaining poles and wires), as authorized by regulators, in a timely manner regardless of fluctuations in electricity use. This, however, does not require rate designs (such as declining block rates or large fixed charges) that reduce rewards to customers for investing in energy efficiency and clean energy. The impacts of a rate design on all customers must be considered and protections for low-income customers must be provided.

**Rate designs must support clean, affordable, equitable, reliable choices**

Utilities should primarily collect their costs by billing customers through volumetric pricing (tiered, time-varying, or variable demand charges), which conveys the signal that “the more you use, the more you pay.” Large fixed charges must be avoided as they are not linked to use or demand and provide no useful price signal to customers. These fixed charges also reduce customer incentives to conserve energy and invest in renewable distributed generation, and remove the opportunity for customers to save on their bills<sup>4</sup> However, there are alternative rate design options to

ensure customers are offered clean, affordable, and reliable choices, including:

- **Time-varying rates** set different prices for fixed hours of the day on specified days of the week, with higher prices during peak electricity usage hours and lower prices during intermediate and off-peak hours, generally reflecting the difference in capacity and energy costs during those times. Customers pay for grid service in proportion to how much—and when—they use it. Super high pricing to address the few hours per year when demand is highest, as well as ultra-low pricing to address periods of over-generation (typically of renewables), should also be considered. Time-varying rates, often referred to as Time of Use rates, can provide incentives that lead to utilizing the grid more efficiently. The selection of time periods, the cost differentials, and the criteria for determining whether time-varying rates are default or optional, are crucial decisions for ensuring an appropriate utility bill rate design. Pilot programs can help answer those questions.
- **Minimum bills** guarantee the utility receives at least some payment from all customers for their use of the grid—even if their net use is zero.<sup>5</sup> But the minimum bill disappears and reverts to volumetric charges if the customer exceeds the low monthly consumption threshold, which would be the case for most. Importantly, this approach maintains the maximum reward to customers for using electricity efficiently or producing it themselves when their consumption exceeds the minimum level. This is a superior alternative to fixed charges, which lower the incentive for customers to reduce energy use.
- **Variable demand charges** are based on a customer's maximum demand over a specified period. If well-designed, these rates can provide customers with an incentive to better manage energy use and demand, which could cut their bills as well as reduce overall system costs (because the system is built to meet the highest expected demand); reduce cross subsidies, since customers with high demand are subsidized by customers with low demand; take advantage of digital metering capabilities; and avoid the problems of fixed charges discussed earlier. While demand charges have been included in commercial and industrial rates for decades, they have been rare for residential customers. The design of the demand charge is critical to ensuring it provides adequate incentive to change customers' consumption patterns without creating unintended consequences or harm. Details to consider include: whether demand is defined as coincident with the system peak, the distribution peak, or based on the customer billing demand; whether the charge is continuous or stepped;<sup>6</sup> the time period for measuring demand (e.g., 15, 30, 60 minutes); whether demand charges are based on location on the distribution system; which costs are included; the relationship to other charges; which customers are included; the impact

on energy efficiency incentives; and how to develop good customer education and outreach. Pilot programs can help answer these questions.

No matter which rate design components are adopted, it is essential to provide customers with the necessary tools and information and to protect economically vulnerable customers. Changing the rate structure without giving customers tools and information to respond will just penalize those who consume during expensive times and will not result in desired changes in consumption patterns.

In addition to rate reform, financial incentives and easy access to programs and minimum building energy codes and equipment efficiency standards are important to assist customers in exploiting cost-effective efficiency, management, and technology opportunities.

### ***Rooftop solar customer-generators***

Renewable distributed generation such as generating solar energy with rooftop photovoltaic panels can reduce a grid's needs for fossil generation and other infrastructure, and avoid the pollution associated with generating electricity, which helps meet our clean energy and carbon reduction goals. However, a robust and flexible grid is critical to maximizing the benefits of distributed solar to customers, the grid, and society. Therefore, to continue to speed the deployment of solar generation, rate structures and utility policies should fairly capture rooftop solar's full value to owners and the grid, ensure that customer-generators pay utilities volumetrically for using grid services at times when solar energy is unavailable, and ensure that all customers have access to the benefits of rooftop solar installation. Necessary steps include:

#### **Net energy metering**

Net metering programs, widely used across the United States to credit solar energy system owners for sending their excess electricity to the grid, have helped valuable distributed technologies gain traction and improve performance. Net metering has generally provided a close approximation in terms of capturing the value of solar to the grid and to customers.

#### **Improved access for all customers**

It is important for all regulators to promote access to the benefits of rooftop solar for all classes of customers to enhance equity and reduce pollution. Options to expand access include on-bill financing for solar systems, third-party leasing of systems, and enabling access to community solar systems.

#### **Additional approaches**

As the grid and the electricity marketplace become more sophisticated and the costs and benefits of distributed resources, including solar, on different parts of the grid can be more accurately assessed, owners and operators of onsite/distributed generation should provide reasonable cost-based compensation for the grid services they use,





while also being compensated fairly for the services they provide. Calculating accurate, location-based, and time-of-use/generation values is a complex undertaking. As solar penetration gets large enough, as it has in only a few utility service territories, the benefits of taking this step grow. The rate design changes discussed earlier can be helpful tools in sending useful price signals.

#### **Reward utilities for facilitating access**

Utilities should be financially rewarded for facilitating solar generators' connection to, and integration with, the grid because it generally benefits if the onsite generation systems remain connected to it. The regulatory and rate design options discussed earlier can also serve as tools to enable utilities to adapt to higher solar penetration.

#### ***Electric vehicle customers***

##### **Close the charging infrastructure gap**

Large-scale adoption of plug-in electric vehicles (EVs) is needed to replace gasoline as the dominant transportation fuel and help us meet our clean energy and carbon reduction goals, but the lack of access to charging infrastructure remains an obstacle. Electric utilities are singularly positioned to close that gap in a manner that supports the grid and captures the value of additional grid services.

##### **Well-managed charging can support the grid**

Widespread and well-managed EV charging can benefit all utility customers by avoiding unnecessary investments in grid services. However, time-varying rates are needed to encourage off-peak charging of EVs, which will maximize their value relative to gasoline. Utility involvement is necessary to ensure expansion of the charging network in a manner that supports the grid to the benefit of all customers.

##### **Access for all customers**

Utilities can also target investments in EV-charging infrastructure to increase access to electric vehicles in areas that most need cleaner air and lower fuel bills, such as low-income neighborhoods and communities of color.

#### **Reward utilities for facilitating adoption**

Regulators should consider allowing performance-based earnings opportunities to encourage utilities to accelerate transportation electrification in a manner that benefits customers and society at large. Utility investments can also help grow the market for competitive services (like charging providers). Regulators should also ensure that utilities are not penalized for the increase in electricity use from EVs or other electric technologies that shift from fossil-fueled end uses if it means overall carbon reductions.

#### **THE GRID—MODERNIZING THE ELECTRIC SYSTEM THROUGH PLANNING, MARKETS, AND OPERATIONS**

Technology advances in the electric system will have the greatest economic and environmental benefits if there are robust and flexible transmission and distribution systems. Innovation can make the electric grid stronger and truly integrate the many new supply (renewables) and demand-side (energy efficiency and rooftop solar) resources becoming available. How the grid is used is also evolving, with power flowing in both directions so customers can both buy and sell energy. The grid also provides other services such as balancing, voltage support, and voluntary load management that allow it to be more flexible. This requires an integrated approach to operations planning and investment, and to markets designed to fairly value grid services in pricing and incentives.

#### ***Comprehensive system planning***

Utilities should engage in comprehensive distribution system planning to ensure service reliability and resiliency in the lowest cost and lowest carbon fashion. Planning should address realistic public policy scenarios, determine the ability (capacity) and desirability (value) of demand-side resource integration on various parts of the system, involve the collection of strategic data in a coordinated fashion, be aligned with (ideally, integrated with) wider transmission system planning, and involve meaningful opportunities for stakeholder input. Utilities are uniquely positioned to coordinate the adaptation of the grid to support high penetrations of onsite and large-scale renewables, demand response, energy efficiency, and EVs. Integrating all of these diverse resources from the start will almost certainly be cheaper than adding them individually.

#### ***Markets designed to support a reliable, integrated, low-carbon grid***

Through competitive procurement, direct incentives, or the development of auction-style markets, utilities and independent transmission system operators should ensure the market has the flexibility to support clean energy goals; appropriately values carbon-free and other environmental benefits; provides a level playing field for all types of demand-side resources that technically can provide grid

services to balance supply options; is coordinated with any overlaying wholesale power market structures (organized or otherwise); is transparent; and involves stakeholder participation in developing the rules for how it operates.

### ***Tools needed for integration***

Utilities and other potential distribution system operators will need tools (e.g., real-time operational systems) to increase situational awareness as the complexity of maintaining reliable and stable grid operations increases due to two-way power flow from technologies like rooftop solar and EVs as well as the growing number of participants providing services.

## **THE REGULATORS—REFORMING HOW THE REGULATORY SYSTEM WORKS**

Regulation determines the types of incentives granted to utilities and the operators of the larger transmission grid so it is important that these incentives support the need to quickly adapt to electric industry policy and structural changes in a way that facilitates true system integration, innovation, and competition. This includes publicly owned utilities governed by local boards, investor-owned utilities regulated by the state public utility commission, and independent transmission system operators regulated by a combination of the Federal Energy Regulatory Commission (FERC) and state law. These boards and regulators are responsible for guiding the utilities' portfolio management and long-term investment activities through regulation.<sup>7</sup>

With today's rapidly changing utility environment, regulators must be able to respond much more quickly, flexibly, and in a more integrated manner. However, many utility boards and regulators lack sufficient information about the types of changes needed and their consequences, and lack adequate authority, resources, and tools to



make the type of nimble, flexible decisions required. For example, instituting performance-based regulation could help regulators and result in them spending less time on evaluating individual costs of service, and more on determining compliance with metrics based on performance (assuming that relevant metrics can be established). Support from all stakeholders will be needed for a successful transformation.

## **CONCLUSION**

As the electric utility industry and our clean and affordable options continue to evolve, NRDC's vision of how to achieve the cleanest, most efficient, and most affordable electric system possible also will advance, always informed by the best science and experience. It is time to embrace the changes underway in the electric industry and to find ways to ensure the United States benefits from the cleanest and most efficient, equitable, and affordable electric system possible.

### **ENDNOTES**

- 1 Natural Resources Defense Council (NRDC), *NRDC's Third Annual Energy Report: A Tectonic Shift in America's Energy Landscape*, October 2015. <http://www.nrdc.org/energy/energy-environment-report/files/energy-environment-report-2015.pdf>
- 2 Natural Resources Defense Council (NRDC), *Removing Disincentives to Utility Energy Efficiency Efforts*, fact sheet, May 2012.
- 3 This is an area that still needs much work to develop appropriate designs and metrics. Performance-based energy efficiency incentives have a long track record and can be informative. See NRDC, *Doing More and Using Less: Regulatory Reforms for Electricity and Natural Gas Can Spur Efficiency*, fact sheet, January 2011. Thirty-three states now have performance incentives for energy efficiency, with two more pending. Another potential example is the RIIO model currently being implemented in the United Kingdom. <http://www.nrdc.org/energy/files/doing-more-using-less-FS.pdf>.
- 4 If fixed charges are adopted despite better alternatives, no more than the customer-specific fixed costs should be included (service drop, portion of meter cost, billing). They should also be differentiated based on size; a one-size-fits-all approach is not equitable.
- 5 Any credits (for rooftop solar generation or demand response) are calculated and paid separately from the minimum bill. Therefore, it is possible that these credits could be larger than the minimum bill and result in a zero bill or positive credit.
- 6 By continuous we mean that for each additional kW consumed, the \$/kW charge goes up. By stepped we mean that pricing is based on inclining blocks.
- 7 In states that have restructured their electricity industry and established a competitive retail market, Energy Service Providers also perform the portfolio management function on behalf of customers, while the management of the distribution system remains with the utility.