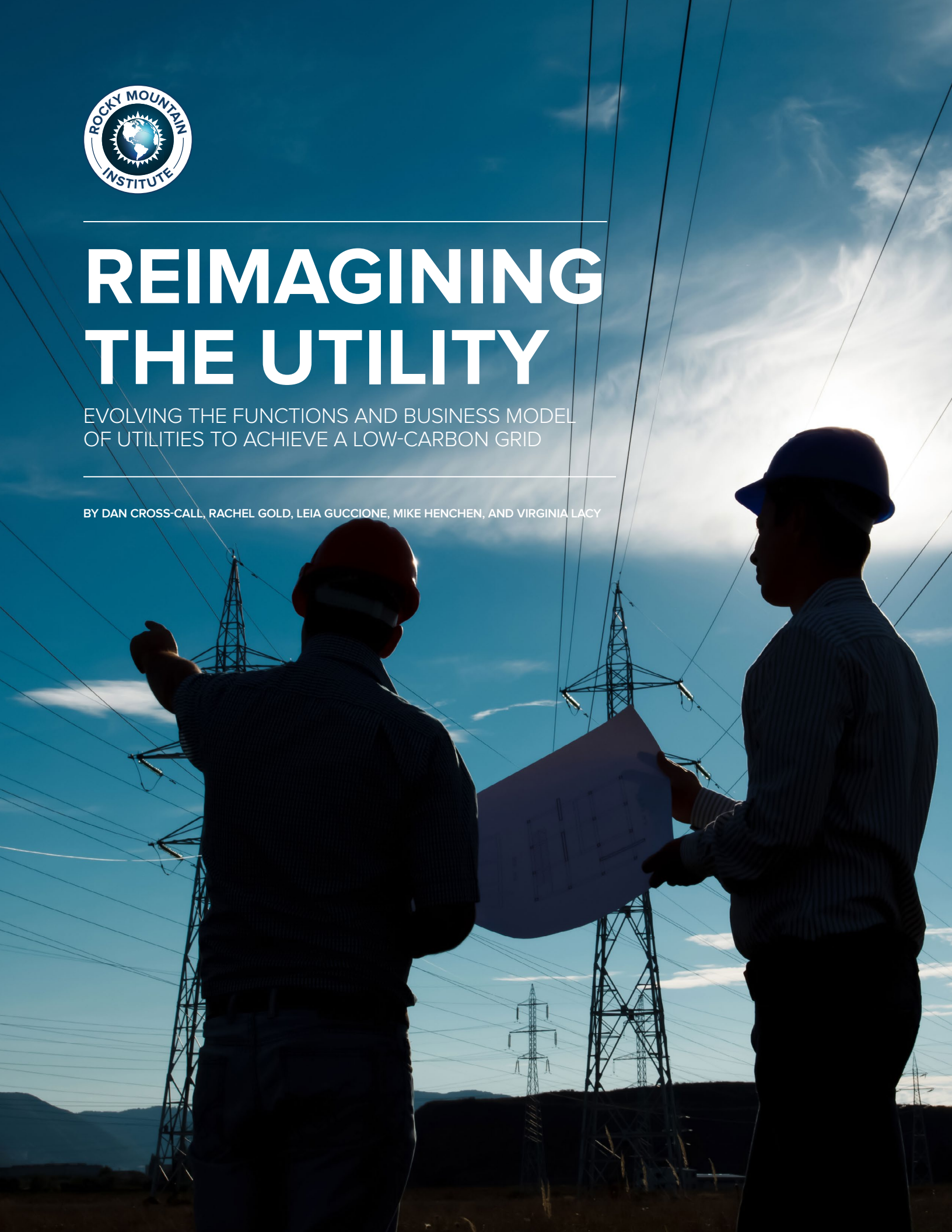

REIMAGINING THE UTILITY

EVOLVING THE FUNCTIONS AND BUSINESS MODEL OF UTILITIES TO ACHIEVE A LOW-CARBON GRID

BY DAN CROSS-CALL, RACHEL GOLD, LEIA GUCCIONE, MIKE HENCHEN, AND VIRGINIA LACY

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ABOUT ROCKY MOUNTAIN INSTITUTE

Rocky Mountain Institute (RMI)—an independent nonprofit founded in 1982—transforms global energy use to create a clean, prosperous, and secure low-carbon future. It engages businesses, communities, institutions, and entrepreneurs to accelerate the adoption of market-based solutions that cost-effectively shift from fossil fuels to efficiency and renewables. RMI has offices in Basalt and Boulder, Colorado; New York City; Washington, D.C.; and Beijing.

INSIGHTS IN BRIEF

1. Electric utilities must modernize to serve new economic and policy objectives, including managing an increasingly distributed and decarbonized power system.

2. A fundamental question for this future system is: What is the appropriate scope for utility functions (and associated earnings opportunities) versus those that should be provided by a competitive marketplace?

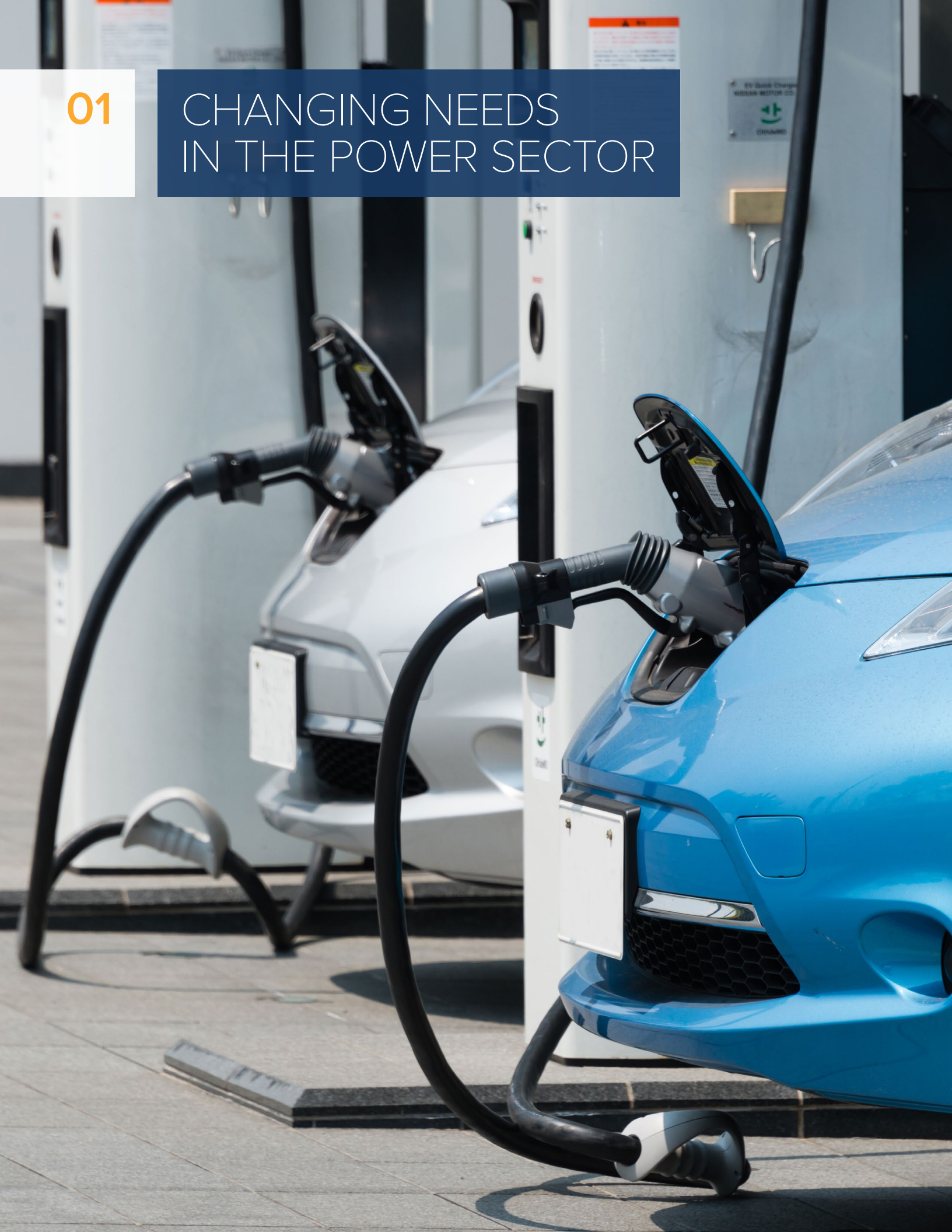
3. Representing two ends of a spectrum, utilities can evolve to be a platform for integrating services from other providers, or they can provide these services themselves through expanded ownership of assets. Both models have merit, and hybrid approaches are available.

4. Third parties will play an essential role in any future system, in some cases as direct partners or contractors with utilities, and in other cases as participants in a competitive marketplace.

5. The utility role may be limited in activities in which its participation would inhibit competition and customer choice, in which a robust market of providers can otherwise exist, or in which the quality, diversity, and pace of third-party offerings is sufficient to achieve public policy goals.

6. The role of regulation remains critical, including in competitive market structures, and is needed to evaluate decisions large and small to ensure they are consistent with objectives to build a clean and customer-oriented business environment.

TABLE OF CONTENTS



01 CHANGING NEEDS IN THE POWER SECTOR

CHANGING NEEDS IN THE POWER SECTOR

The electricity system serves critical societal needs amid shifting economic and technological forces. The electricity sector contributes roughly one-third of U.S. greenhouse gas emissions, and requires deep decarbonization to achieve global climate change mitigation requirements. Meanwhile, electricity is likely to become more central to the economy and to other energy sectors, including for electrification of transport and heating. This evolution is made possible by new technologies for electricity generation and energy management, marked by improving performance capabilities and rapid cost declines. Meanwhile, other markets suggest new possibilities for the power sector, including information technology and service-oriented platform business models that are upending traditional industries.

These changes point to a future electricity system that, by necessity, will likely integrate large amounts of distributed generation (particularly distributed solar photovoltaics [PV]); will need to have significant demand flexibility to balance variable generation sources; will be characterized by a vastly different asset base of physical infrastructure and control systems; and which, consequently, will require innovation and breakthroughs in new service offerings. The challenge for utilities and regulators is to address these needs and harness opportunities on the urgent timeline required to meet greenhouse gas abatement targets, while not abandoning long-standing requirements for affordable, universal energy supply and grid reliability.

This paper is focused on these changes at the distribution level of the grid and on associated options for how to evolve the utility market serving that part of the system. As such, the paper should be relevant to U.S. utilities and their regulators (and many worldwide). However, its application—and the implications for the composition of a given utility's earnings—will differ based on the structure of each utility (for example, vertically integrated utilities that own generation and transmission versus those in restructured markets with only "poles and wires" utilities).

02

FUNDAMENTAL QUESTIONS CONFRONTING THE UTILITY BUSINESS

FUNDAMENTAL QUESTIONS CONFRONTING THE UTILITY BUSINESS

EVOLVING MARKET AND EARNINGS OPPORTUNITIES

Regulatory economics and business literature offer many lenses through which to evaluate electricity market design (see sidebar). Increasingly, the fundamental question confronting the industry is: What functions will utilities perform in the future, and consequently, what is the appropriate utility size and earnings? This question can be thought about both in terms of the figurative "slice" of utility revenues in the market, as well as the size of the total pie. First, for all the functions to be performed in generation and delivery of energy services, what proportion of those should be performed by the monopoly utility versus by a marketplace of competitive service providers? Second, as new roles and services emerge in the electricity sector, the total energy services market is likely to grow. Many roles are well suited to a competitive marketplace, whereas others are appropriate for monopoly utilities to perform. This can provide new activities around which to orient the future utility business, and create new earning opportunities as traditional revenues might decline or be subject to competition.

This is a familiar phenomenon, seen in the years since telecom deregulation in the 1990s and in the emergence of revolutionary technologies over the past 30 years. Where total revenues of telephone companies were about $160 billion in 1992, the telecom market has since grown more than four times to $750 billion as a result of the wireless revolution.[i] While important differences between electricity and telecommunications exist, there remains promising potential for greater value creation and market growth in the provision of electricity services.

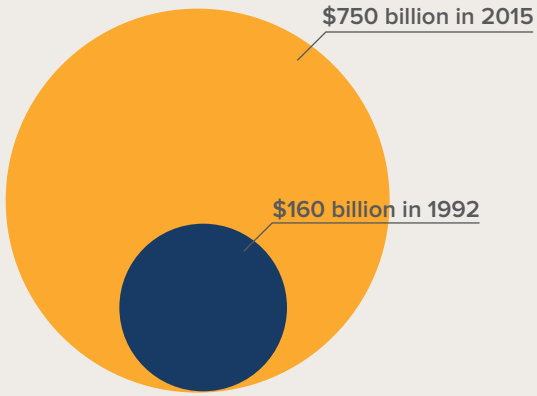
KEY CONCEPTS FOR EVALUATING MARKET DESIGN

As new energy services develop and utility functions evolve, many concepts from economics and business provide lenses through which to understand these opportunities, as well as their trade-offs and limitations.

- Natural monopoly conditions, including economies of scale and scope
- Market power mitigation through appropriate regulation and support for competition
- Platform business models and emerging research on platform economics
- Network effects, including opportunities for networks to create positive externalities
- Price setting, including differences between cost-based versus value-based pricing
- Innovation enablers, including allowance for experimentation and product diversity
- Risk tolerance and allocation between parties, including appropriate protections

FIGURE 1

GROWTH IN TELECOM MARKET SIZE SINCE DEREGULATION AND MARKET REFORM



[i] Based on data and research from the Federal Communications Commission and Radiant Insights, Inc. (Lande, Jim. "Telecommunications Industry Revenue: TRS Fund Worksheet Data." Federal Communications Commission; March 1994. Radiant Insights, Inc. "U.S. Telecom Market Size to Reach $1.3 Trillion by 2020: Radiant Insights, Inc." March 30, 2016. Available at: http://www.marketwired.com/press-release/us-telecom-market-size-to-reach-13-trillion-by-2020-radiant-insights-inc-2110041.html

NEW BOUNDARIES FOR UTILITY FUNCTIONS

Whereas the utility has historically performed a set of agreed-upon roles, expectations for utility functions are shifting. At the dawn of the electricity industry, there was a presumption of natural monopoly conditions at every level of the value chain. Beginning in the 1970s, the natural monopoly presumption began to be dismantled, and it has continued to be revised as new needs, technologies, and service innovations develop. These point to a future in which the majority of business functions and value creation can be subject to more competition and diversity of choices. At the same time, new roles for utilities are emerging that include hosting and curating the market for electricity services, integrating technologies, and managing new forms of transactions.

More than anywhere else on the grid, new functions and capabilities are needed for the distribution system. The previous utility roles of forecast, plan, and build distribution infrastructure need to evolve to a more integrated and robust set of functions for planning, operations, and market facilitation. This requires a deeper reflection on the functions required at the distribution level, based on which further consideration can be given to the role of the utility versus that of other market players. Table 1 highlights some of these distribution-level functions that need to be considered.[ii]

FIGURE 2

SHIFTING OF HISTORICAL UTILITY FUNCTIONS AS NEW BUSINESS AND TECHNOLOGICAL OPPORTUNITIES DEVELOP

[ii] This discussion and identified distribution system functions are derived from a more complete exploration of these issues by Paul De Martini and Lorenzo Kristov. (De Martini and Kristov, 2015. "Distribution Systems in a High Distributed Energy Resources Future." Lawrence Berkeley National Laboratory; Future Electric Utility Regulation series, Report No. 2.)

TABLE 1

FUNCTIONS AND APPLICABLE ASSETS AT THE DISTRIBUTION EDGE

	DISTRIBUTION SYSTEM FUNCTION	APPLICABLE ASSETS (EXAMPLES)
PLANNING	• Network planning based on forecasted needs	• Poles, wires, substations
	• DER-hosting capacity analysis	• Independent DERs such as rooftop PV
	• Identification of network "hot spots" for targeted asset investment	• Integrated DERs (e.g., non-wire alternatives)
CONSTRUCTION AND MAINTENANCE	• Siting, construction, and maintenance of network infrastructure	• Poles, wires, substations
	• Siting, construction, and maintenance of specific DER assets	• DERs, customer meters
OWNERSHIP AND FINANCING	• Platform infrastructure	• Poles, wires, substations; network control center
	• Customer-sited assets	• DERs, customer meters
OPERATIONS	• Switching and outage restoration	• Poles, wires, substations
	• Dispatch of DERs through control signals	• Communications infrastrucutre
MARKET FACILITATION	• Procurement of new assets and services	• EV charging infrastructure; integrated DERs (e.g., non-wire alternatives)
	• Price determination for compensation of customer-sited assets	• Rates/regulatory teams; market settlement software
CUSTOMER RELATIONS AND SALES	• Marketing of programs and service options	• Sales team
	• Billing	• Software and database systems
	• Customer service	• Call center

NEW BOUNDARIES FOR UTILITY AND THIRD-PARTY FUNCTIONS

Figure 3 illustrates some underlying questions that this discussion points to. First, what is the scope of utility functions relative to those provided by third parties and new entrants? Should the utility maintain the majority of functions and associated earnings opportunities, or should most functions be provided by nonutility actors (some in service of the utility, others more directly to customers)? Second, whatever the balance of functions between utilities and third parties, will the total size of the market for electricity and associated services remain the same or could it grow in the future (either in terms of functions or in total revenues), similar to the growth that has been experienced in the telecom market? Under a scenario of growth in total market size, an opportunity may exist for utilities' total business to grow, even if it declines on a relative basis to other market participants.

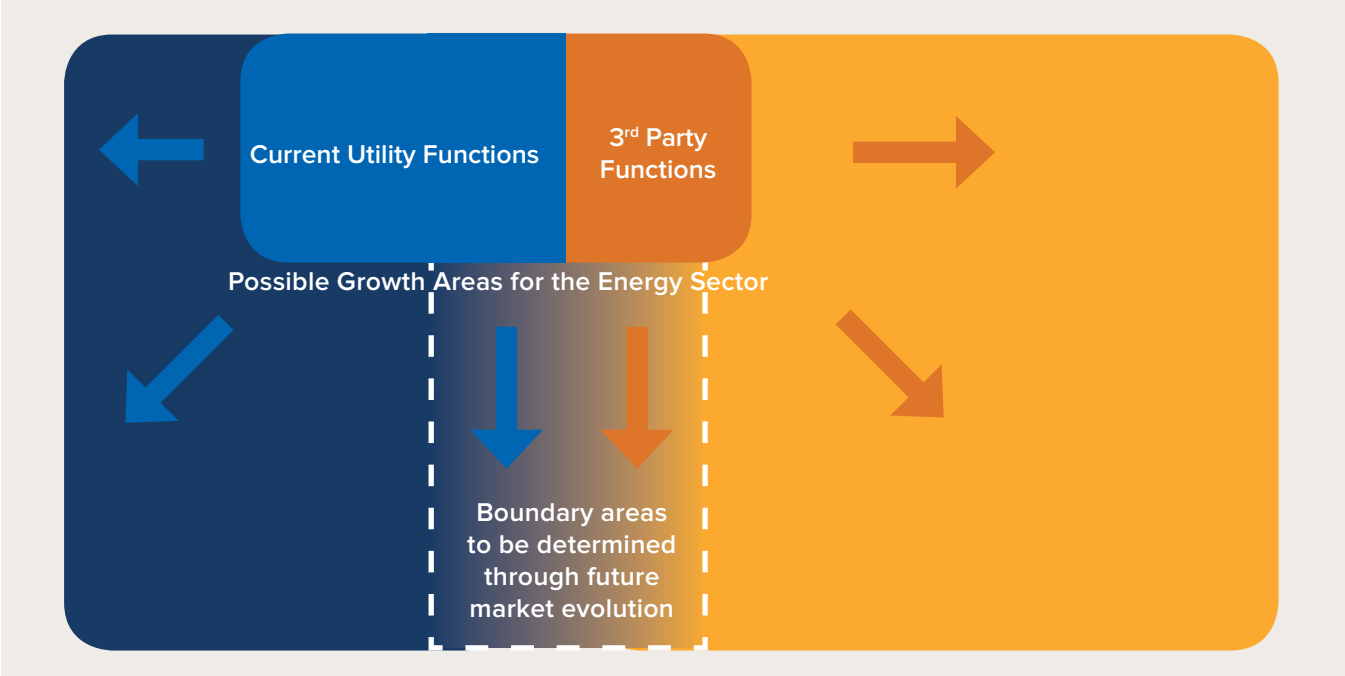
Just as the total market can expand, earnings and profit margins may also change under future structures, for example, through adjustments to regulated rates of return, including possible incentive mechanisms to reward or penalize performance, or from competitive earning opportunities.

This also points to an important question about the appropriate risk profile for utility earnings, including how these risks may be borne by shareholders versus ratepayers, as well as between customers participating in DER programs versus nonparticipants. Changing market dynamics, including regulatory interventions designed to create the "utility of the

FIGURE 3

ILLUSTRATION OF BALANCE BETWEEN UTILITY FUNCTIONS AND COMPETITIVE FUNCTIONS

The scope of utility functions (and associated earnings opportunities), versus those available to third parties, can be either expansive or limited. Meanwhile, the total size of economic activity in the electricity sector may be larger in the future, providing growth opportunities even where proportional market share is less.



future," are introducing new risks and opportunities to the utility business, which suggest a possible need to remake approaches for setting regulated rates of return.[1] The entry of new market participants and greater diversification of customers' service profiles also suggest that the risk profile in the industry should be less monolithic; for the utility, for service providers, and possibly for some customers as well. At the same time, more variability in utility earnings and associated adjustments to utility risk ratings could lead to a higher cost of capital for utility investments—a consequential outcome that should be approached cautiously (though should not necessarily be the litmus test that ends debate on important reforms).

Weighing these and related questions will require a rethinking of the underlying economic assumptions and models that have underpinned the utility sector for decades.

03 OPTIONS FOR THE FUTURE UTILITY

OPTIONS FOR THE FUTURE UTILITY

To frame the discussion of the role of the distribution utility, it is helpful to begin with two extremes on the utility of the future spectrum:[iii]

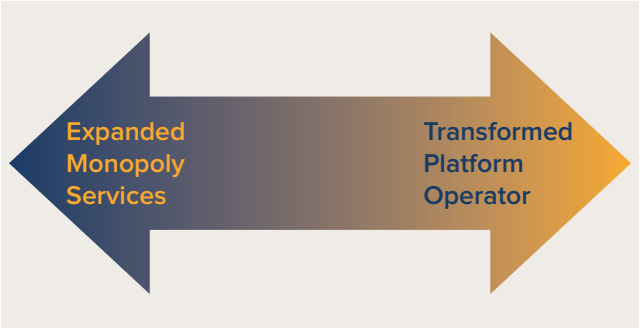
- Expanded monopoly services with utility ownership or financing of all new assets and services (including DERs).
- Transformed platform operator, where the utility serves as a neutral asset integrator and host for market activity.

These models provide strawmen for the structure and identity of utilities, between which numerous hybrid options exist.

FIGURE 4

SPECTRUM OF UTILITY MODELS

The spectrum of utility models, ranging from consolidated monopoly functions that deliver expanded energy needs to a transformed platform operator that integrates competitive distribution services.



EXPANDED MONOPOLY SERVICES

Under this model, the utility would expand its monopoly status across distribution-level functions. While the nature of utility services is changing, including in the diversity of technologies and services available at the customer-facing end of the system, proponents of this approach conclude that economies of scale and scope mean a regulated utility is the best option to deliver these services and achieve new objectives for the power sector. At its extreme, this model suggests complete utility ownership and management for a broadly inclusive definition of the distribution system, including construction and operation of customer-sited assets such as rooftop PV, storage, and demand-response programs. In practice, even under a relatively complete application of this approach, there remain roles for third parties and vendors to provide services to, or on behalf of, the utility.

The utility's advantages that might favor some features of this approach include:

- Its substantial balance sheet and low cost of capital, which can be used to finance, or outright own, customer-sited assets
- Existing customer relationships that it can leverage to deploy new assets and services
- Existing roles for data management and grid operations, which make the utility uniquely familiar with system needs and capable of integrating new assets
- The utility's expertise in not only grid operations, but also in vetting and selecting credible technologies and service providers, so as to protect customers from products that may be low quality or even fraudulent
- That fact that the utility is, indeed, regulated, which helps to ensure public-interest obligations are met

Aspects of this expanded utility-services model are being applied in several places, although nowhere in totality, or in a complete monopoly form. Green Mountain Power (GMP) in Vermont, for example, markets, finances, and facilitates installation of customer-sited batteries, appliances, and efficiency upgrades, while also managing demand-flexibility programs. GMP does not provide these functions

[iii] These conceptual models have been proposed in various forms elsewhere, including by Peter Fox-Penner, who describes a form of the first model as the "energy service utility" and the second as the utility as "smart integrator." (Fox-Penner, Peter. "Smart Power: Climate Change, the Smart Grid, and the Future of Electric Utilities." Island Press; 2014.)

exclusively on its own, however, but rather partners with third parties, while customers maintain the ability to choose other manufacturers or service providers if they like. In Fort Collins, Colorado, the municipal utility is piloting "integrated utility services" in pursuit of the community's accelerated goal for 80% GHG reductions by 2030, demonstrating an interesting application of the expanded utility model outside of the investor-owned-utility framework.[2] Perhaps the most complete endorsement of this approach, meanwhile, comes from a company that does not currently own or operate any assets: Twenty First Century Utilities seeks to purchase a midsize regulated utility then build a highly renewable grid through a "million rate base" model that finances customer-sited clean energy investments from utility-approved vendors.[3]

A variation on this approach—albeit one premised on competitive relationships—is seen where utility holding companies operate competitive affiliates in the same territory as their regulated utility, or in the lesser form of "functional separation" where business divisions remain under the same company.[4] This is common across many U.S. jurisdictions, and provides a compelling pathway for the modernization and financial viability of utilities. It also raises significant concerns regarding the potential for unfair advantages by utility affiliates, and potentially perverse incentives for the holding company to use one business segment or the other to serve broader corporate interests. Southern Company provides a notable example of the use of affiliates for DER services; the company owns a rooftop solar installer that actually sources leads from a web portal hosted by Georgia Power, one of Southern Company's regulated utilities.[5]

TRANSFORMED PLATFORM OPERATOR

At the other end of this spectrum, the transformed utility would be a neutral platform to integrate and coordinate energy services. This approach derives from the recognition that, in light of new distributed-resource and communications capabilities, natural-monopoly and economy-of-scale conditions may no longer exist for many areas of the electricity value chain (or can be eliminated through appropriate reforms). Just as other industries—spanning internet commerce to banking and telecoms—were revolutionized by digital communication opportunities and platform business approaches, similar opportunities exist for electricity.

The appropriate business structure for the distribution system platform, including specific revenue sources and governance, as well as whether the platform is operated by the utility in its historical formulation, is less clear than for the expanded monopoly utility. Options include a for-profit entity that continues to be regulated by a state public utilities commission (PUC), or a distribution system operator in the mold of bulk system independent system operators, which might be more suited to operation as a nonprofit organization or government-chartered entity.

The platform model also faces a substantial challenge in undertaking the business transformation due to the tremendous inertia of the current utility business and the reality that a vast majority of utility earnings derive from rate-based assets. The platform approach could create new revenue opportunities for the utility, for example from network subscriptions and scheduling fees, but it remains to be seen whether these could constitute large enough revenue and profit centers to make them the core financial engine of the business. Even under a platform model, the distribution utility might still own billions of dollars in infrastructure (as evidenced by grid modernization investments across the country), which need to be paid for in some manner.

The utility as a platform has been proposed in many places, although no examples exist that approach anything like a "pure" form. Texas might provide the closest example, where the utilities' role in energy supply was eliminated and utilities now serve only as distribution businesses. However, retail providers in Texas remain largely limited to energy supply, lacking a significant marketplace for advanced DER services. Meanwhile, the "distributed system platforms" (DSPs) proposed under New York's Reforming the Energy Vision

(REV) reforms provide the most visionary example, and highlight some of the challenges of operationalizing this system. (See REV case study on p. 29.)

Elsewhere, utilities in vertically integrated markets are exploring the platform concept, raising interesting possibilities for a utility-hosted DER marketplace that coexists with utilities' broad role in system planning and bulk infrastructure ownership. Hawaii exemplifies this approach, including proposals under consideration for utility procurement of third-party aggregated demand-response products, and Hawaiian Electric Companies' (HECO's) recent Grid Modernization proposals, in which HECO states its objective to "move toward the creation of…grid platforms for new products, new services, and opportunities for adoption of new distributed technologies."[6] Commonwealth Edison (ComEd) in Illinois has also put forward a vision for a platform utility to integrate and coordinate DERs, including a four-layer structure for the system composed of (1) the physical asset base, (2) system operation and planning, (3) transactive commodity exchange, and (4) a services and solutions marketplace.[7] The utility-hosted distribution platform, especially those hosted by vertically integrated utilities in which the utility retains significant financial interests at other levels of the system, as well as a primary role in system planning at all levels, introduces possible conflicts of interest that will require special attention to the pricing structures and procurement processes for the DER marketplace.

HYBRID UTILITY MODELS

In reality, it may not be appropriate for utilities to fully occupy either of these extremes. The expanded utility with a broadly granted monopoly risks crowding out innovation and leading to major inefficiencies. Utilities may also be unwilling to finance customer-sited assets, based on reluctance to effectively take on the business of a bank. At the same time, limiting utilities strictly to playing the role of a platform host for competitive services could result in failures well known to the competitive market, including inequities and reduced service quality to vulnerable populations.

To balance these limitations and adapt the above models to the circumstances of particular regions and to objectives, there are a number of intermediate or hybrid options, including:

- Utility procurement of third-party solutions
- Split roles by product or scope of activity
- Utility competition with third parties
- Utility hosted microplatforms

Utility procurement of third-party solutions

Rather than pure utility control and direct provision of all services, utilities can solicit or partner with third parties to acquire customers and deliver value. This is a familiar structure for businesses across the economy, including in the electricity sector. Outside companies can specialize in a service and are contracted to provide the service, whether through contracted labor, software and other IT solutions, or physical construction or ownership of assets to deliver the service. In the utility sector, this is increasingly seen in choices to outsource Software-as-a-Service (SaaS) and cloud computing for customer relation management, data analytics, and more. This has also raised a significant tension with traditional cost-of-service regulation, which disincentivizes this approach because costs for these systems are commonly treated as pass-through operating expenses, as compared to hardware investments, which are less nimble but are treated as rate-based capital expenses.

The virtual power plant partnership between Southern California Edison and Nest provides another example, where Nest committed to install smart thermostats in 50,000 customer homes and to provide demand-response services by aggregating these devices.[8] In this model, the utility may not collect any new revenue streams and does not own the behind-the-meter assets, but could control the dispatch of distributed devices. There is potential to extend this procurement approach to broader activities, encouraging a competitive marketplace and innovation by doing so. Hawaiian Electric Companies' proposed demand-response programs are an indication of how this might be structured, in which the utility is soliciting third-party aggregators to supply behind-the-meter frequency response and spinning reserve services.[9]

As the examples suggest, this approach will force important questions about how utility procurement is treated in ratemaking and cost recovery. To achieve change on the scale required to transform the grid into a modern distributed system, utilities' profit motives and returns on investment in third-party solutions will need to be aligned to encourage prudent and efficient procurement processes.

Split roles by product or scope of activity

Complete utility ownership or even procurement of all energy services, as suggested by the expanded monopoly model, is also not advisable. There are numerous market segments where natural monopoly conditions are not present and a competitive market of service providers already exists (for example in distributed solar development), or can be expected to thrive if given the opportunity through removal of market barriers.

In other areas, the competitive market may fail to serve an important market segment, in which case it can be appropriate for the regulated utility to serve those needs. Such segments include rural areas with lower customer density, and DER solutions for low-income populations that are less attractive to the competitive market. In the case of EV infrastructure rollout, providers might neglect multiunit dwellings or low-income communities.[10] A hybrid model, in which certain market segments are designated for either the utility or the competitive market, allows the utility to propose entry into underserved markets to provide service where the competitive market does not deliver.

Here, the experience of EV charging infrastructure in California is instructive. Initially, the California Public Utilities Commission (CPUC) prohibited utility ownership of EV infrastructure to prevent the utility from crowding out the private market. The CPUC clarified that if utilities presented evidence of underserved markets or market failures, it would revisit this prohibition. After three years during which charging infrastructure was not widely built, the CPUC determined that the original decision was too restrictive. The commission decided that future utility requests would be considered on a case-by-case basis, with review of existing competitive market entry in the proposed area versus the expected benefits of utility ownership, and with consideration given to possible unfair advantages the utility might have in each case.

Utility competition with third parties

Where the model of split roles defines areas where the utility cannot participate, an alternative is to allow utilities to compete directly with the competitive market. This approach lets customers choose between their incumbent utility and competitive providers, thus challenging the utility to innovate and match the market in providing value to customers. Retail choice is a nascent form of this model; the question remains if and how it can be extended to other services beyond standard energy supply. The approach is increasingly being applied for DER assets; for example, Green Mountain Power customers can acquire a Tesla Powerwall through the utility's Power Sharing program, but retain the option of purchasing behind-the-meter storage from other manufacturers.

Under this model, care is needed to appropriately draw the line between those markets in which the utility can participate and those it cannot. The utility role may need to be restricted in activities or product offerings where it would inhibit competition and customer choice, where a robust market of providers can otherwise exist, and where the quality, diversity, and pace of third-party offerings is sufficient to achieve public goals. Southern Company's entry into Georgia's rooftop solar market provides a cautionary tale for the structural risks that can be introduced if corporate interests are at odds with each other: after one year of availability and about 10,000 inquiries, only five customers had enrolled for Southern's solar service, while third-party solar developers reported their reluctance to enter the market based, in part, on concerns with the utility's role.[11]

Utility-hosted microplatforms

A fourth hybrid model borrows from the microgrid concept, but is defined more by transactive capabilities than by physical architecture, such as being islandable. Under a utility-hosted microplatform, the utility serves at the district level to integrate DER assets and curate a local marketplace. This could include functions for peer-to-peer energy exchange, resource aggregation and coordination, and meeting local balancing needs.

Avista in eastern Washington State has launched an innovative pilot of this form, which is building a platform for peer-to-peer energy transactions in Spokane's University District. The "shared energy economy" will allow commercial buildings to exchange services from DERs such as solar, battery storage, and flexible demand, as well as traditional utility-scale generation, to optimize energy supply and grid services. With Avista providing the platform, the pilot seeks to bring together a diverse set of partners to demonstrate how different technologies can interact.[12]

04 REGULATORY PRIORITIES TO BUILD THE FUTURE MARKET

REGULATORY PRIORITIES TO BUILD THE FUTURE MARKET

Regulation will remain essential in the future system. Given the central role of electricity in the economy and the environmental externalities it creates, as well as important access and affordability concerns, the responsibilities of utility commissions are greater now than ever.

In any future, there are known tools that policymakers and regulators can bring to support desired outcomes from the sector. These include policy choices to determine the boundaries for utility roles, expanded use of performance-based regulation to align financial incentives with policy priorities (see Case Study: Performance-Based Regulation to Guide Utility Reforms on p. 22), guarantees of fair access for third parties to compete, and modernized approaches to market monitoring and oversight to ensure compliance with those priorities. For each, there are different questions for regulators to address depending on which path they pursue on the continuum from expanded utility services to transformed platform provider. The choice of which path to follow, and application of the models, will also vary based on the existing policy context and market structure of each state.

ASSESS JUSTIFICATION FOR CHANGES TO UTILITY ROLE

An expanded utility role for DER services may be appropriate where the utility's participation in customer acquisition, financing, integration, or aggregation results in new economies of scope by improving customers' energy costs, resilience, and power quality, and by operating systems more efficiently and avoiding high-risk capital expenditures.[13] Utilities can realize these synergies where they have a unique capability to promote the public good without impeding the development of competitive markets, for example by:

- Leveraging their grid knowledge to identify sources of value (e.g., targeting areas where DERs may prevent costly substation upgrades)
- Using existing customer relationships to lower acquisition costs
- Providing services more efficiently in lower density, low-income, rural, or otherwise difficult-to-reach areas

However, traditional arguments based on economy of scope may no longer hold, and a utility-centric approach to roles may cement monopoly functions, creating a self-limiting, inefficient approach. Given the risks to competitive markets, direct utility ownership of customer-sited assets may be appropriate only in a limited set of circumstances. New York regulators have taken this view, in which utility ownership of DERs is generally prohibited, except in cases of demonstrated market need where the competitive market fails to deliver, such as for serving low-income customers.[14]

Platform approaches, meanwhile, are appropriate in contexts where the physical system and market characteristics support lower costs through competition. A platform model can also be attractive where market participants prioritize opportunities for innovation and expanded value creation. More dense urban or suburban environments may support the physical infrastructure to enable granular pricing signals, favoring the competitive market in delivering new products and services. A platform model—particularly for an independent platform operator—may also be more suitable to markets that have previously undergone restructuring. True platforms, meanwhile, could require more drastic transformation for vertically integrated utilities, as internal conflicts arise when planning investments that require utilities to trade off DER solutions for their own generation assets. Reforms at HECO and ComEd will be instructive about the viability of establishing a platform market at the distribution level while simultaneously maintaining utility responsibilities and ownership of bulk system assets.

FAIR ACCESS TO PROMOTE COMPETITION

Under any utility business model, third parties should be given opportunities to participate and deliver their services for those distribution functions where natural monopoly conditions no longer hold. The competitive marketplace has inherent advantages for innovation and generating new sources of value that should be allowed space to grow. Even under an expanded

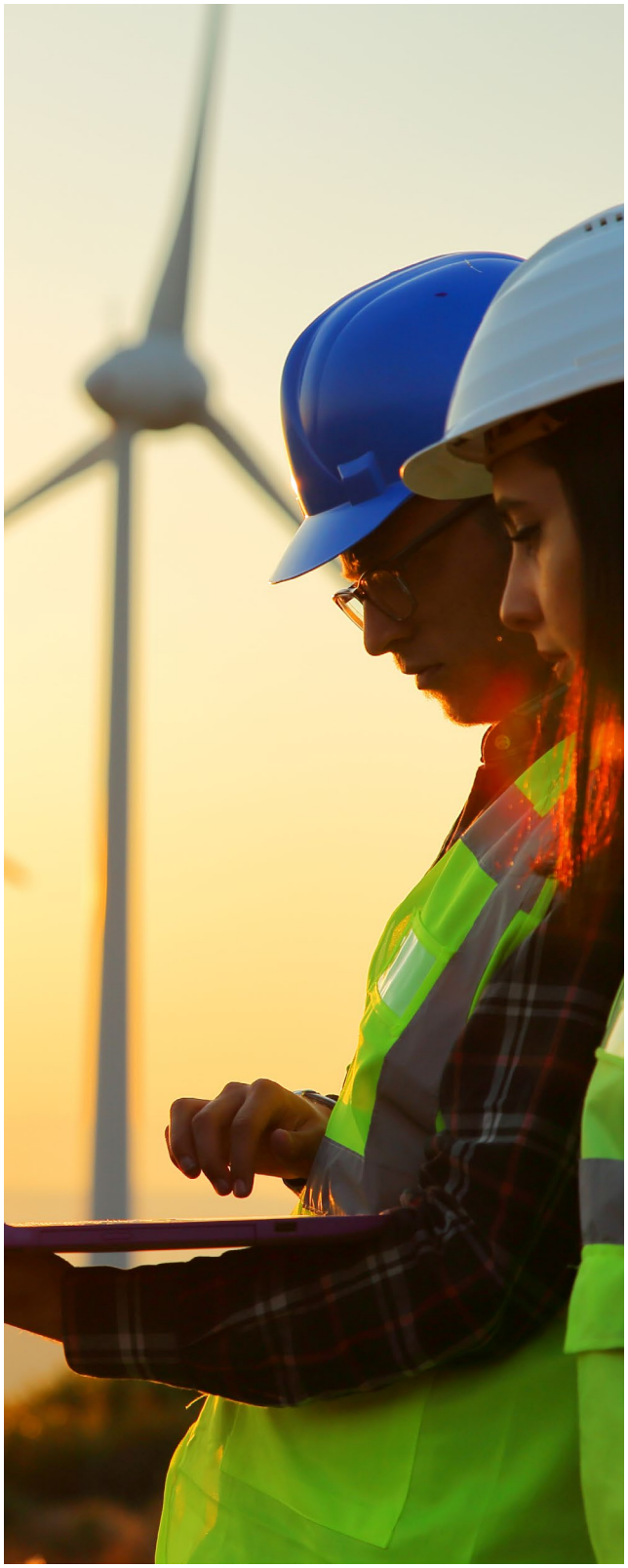
monopoly structure, there are specialized functions or service innovations that utilities need to incorporate to better serve their public interest obligations. This requires new rules to reduce existing information asymmetries and other competitive advantages enjoyed by utilities.

In particular, utilities often have privileged access to customer and system data that aids in acquiring customers and identifying areas of value on the grid. Utilities also have an advantage in being able to directly tie their service offerings to available rates and programs. Where the utility's role in offering and owning customer-sited products may be justified by the market context or the need for immediate and directed investment, the potential for third parties to emerge with competitive offerings still needs support.

Standards for market access can support this levelized competitive playing field, including:

- Price signals: To offer customers compelling value from new products that also benefit the energy system, third parties should have access to price signals that accurately convey grid value. This may include a granular, time-varying rate for which a third party can optimize energy savings for a customer, or other tariff structures that promote advanced services.
- Data access: Utilities can make anonymous customer-demand data available to third parties. This would aid competitors in optimizing customer solutions for a given area and customer class.
- Interconnection standards: As third parties install devices for customers, utilities can meet predetermined standards for interconnecting customer devices. For instance, utilities may face performance incentive mechanisms tied to the speed at which they fulfill customer interconnection requests.

In addition to promoting market access for third parties, codes of conduct between regulated utilities and their affiliates are needed to ensure that utilities and their sister companies do not enjoy unfair advantage over competitors.[15]



MARKET MONITORING AND OVERSIGHT

Regardless of the model pursued, regulators will need to closely monitor outcomes from shifting market structures. The lists below suggest some issues for particular attention at each end of the utility model spectrum, although each of these may need attention under any model, based on circumstance.

Focus areas for regulation of expanded monopoly services

- Information asymmetry that favors the utility, disadvantaging regulators and competitive providers
- Price and rate approval for default and enhanced services, including review to promote system-level benefits and limit burden to nonparticipant customers
- Ensuring prudent investments, and managing the risk of bungled investments that ratepayers are left to pay off
- Reduced business efficiency due to complacency that can come with a monopoly system
- Ensuring that innovation and creativity is not stunted

Focus areas for regulation of a transformed platform provider

- Tacit monopoly advantages that may persist for incumbent utilities and disadvantage competitive providers
- Developing appropriate standards and protections for fair market and platform access, including price signals, data access, and interconnection standards
- Appropriate oversight of new revenue sources such as platform access fees
- Consumer protections, including mitigation of potential price discrimination or other abuses by third parties conducting business on the platform
- Fair assignment and pricing of new financial risks that are introduced

Particularly in light of inherent competitive advantages that incumbent utilities have at the outset, and the potential for changing market conditions or innovation in competitive services that will develop over time, it will be critical to monitor the market conditions between utilities and third parties to assess whether customers continue to be well served by utility-provided functions. If not, regulations may need to be revised to allow third parties to more effectively compete. Further, these assumptions are based on theory, lessons from other industries, and only nascent experience in electricity; new experiments may reveal unanticipated outcomes or market behaviors, based on which further adaptation will be required.

CASE STUDY: PERFORMANCE-BASED REGULATION TO GUIDE UTILITY REFORMS

Whatever the desired utility structure, some amount of performance-based regulation (PBR) is important to create a future utility that achieves societal objectives. PBR is not a business model in and of itself. Rather, it should be deployed to align utility motivations with established objectives. Particularly as utility roles and functions are remade—whether to a platform model, wider asset ownership, or any other model—carefully designed and meaningful PBR approaches will be important to establishing appropriate incentives for utility operations.

PBR describes a set of tools that can be used individually or in combination, at varying levels of ambition and "reach" into the core of utility earnings. The most prominent PBR tools include the following:

Decoupling insulates utility earnings from changes in volumetric sales, which can vary or be in decline due to factors including weather, energy efficiency programs, and increasing DER penetration. This helps to realign utilities' business motivations away from growing total sales, at least for earnings tied directly to recovery of operating costs. Utilities may still have a long-term motivation to grow sales as a driver of investing in more capital infrastructure on which they earn rate-based returns. As of January 2017, 16 U.S. states have adopted decoupling for electricity, with decoupling rules pending in seven more.[16] By some assessments, decoupling may not truly be a performance-based approach, but rather a short-term "mitigation measure" to maintain utility earnings near current levels as the business model transforms from a growth-based industry to modern needs for conservation and other objectives.[17]

Multiyear rate plans (MRPs) let utilities operate without a general rate case for an extended period of time. Based on predetermined revenue allowances, MRPs can create strong cost-containment incentives for utilities, usually with automatically adjusted rates in intermediate years based on updated forecasts or indexed cost trends.[iv]

Performance incentive mechanisms (PIMs) establish specific objectives for the utility to pursue and attach financial rewards or penalties to their achievement. Importantly, PIMs in themselves will not accomplish goals; they can be poorly designed and, in the worst case, result in perverse incentives. Many seemingly minute details are critical to effective PIM design. The best PIMs set incentive amounts large enough to attract executive and shareholder attention; use outcome-oriented metrics rather than narrow program-based measures to allow enterprise-wide creativity; and avoid unprovable counterfactuals in how performance is measured, such as measurement against an assumed but ultimately unknowable business-as-usual case, which can lead to controversy and costly regulatory administration when it comes time to evaluate results.[v]

Benchmarking measures utility performance against a peer group, sometimes adjusting incentives based on relative rank to encourage improvements (or to at least avoid below-average performance).

Earnings sharing mechanisms (ESMs) divide surplus or deficit earnings between utilities and customers to let customers share in savings achieved through operational efficiency or other measures while maintaining utility incentives to pursue cost savings. ESMs can be coupled with PIMs to guard against windfall profits for the utility that could result from chievement of objectives, in some cases due to external factors beyond the utility's control.

[iv] For additional discussion of MRPs and relevant case studies, see Lowry, et al. "State Performance-Based Regulation Using Multiyear Rate Plans for U.S. Electric Utilities." Lawrence Berkeley National Laboratory; 2017.

[v] For a more complete review of these and other design features for PIMs, see work by America's Power Plan, including O'Boyle, 2016, available at http://americaspowerplan.com/wp-content/uploads/2014/10/Peak-Reduction-PIM-whitepaper.pdf; and Orvis, 2016, available at http://americaspow¬¬erplan.com/wp-content/uploads/2016/04/AvoidingCounterfactuals-white-paper.pdf. Also Littell et al., 2017; "Next-Generation Performance-Based Regulation," National Renewable Energy Lab, Technical Report NREL/TP-6A50-68512.

CASE STUDY: PERFORMANCE-BASED REGULATION UNDER RIIO

Great Britain's RIIO is the best known example of PBR in practice. RIIO stands for Revenue=Incentives+ Innovation+Outputs and is composed of a number of PBR mechanisms, including multiyear rate plans (eight-year "price control" periods), benchmarking, earnings sharing mechanisms, and performance incentive mechanisms. The administration of these is interlaced and subject to significant regulatory review and negotiation between the regulator (Ofgem) and the regulated companies.

Under RIIO, each distribution network operator (DNO) submits a business plan for its projected costs and strategies to achieve key outputs. Ofgem then evaluates the plan, and the regulator and DNO agree to a "base revenue" amount, as well as ESM percent-sharing allocations and benchmarking against peer utilities. Following this, the DNO carries out its operations and, if costs are below base revenue, the utility (or its shareholders) reap the savings, with a share returned to customers through rate reductions.

Targeted "outputs" are defined for (1) reliability, (2) environment, (3) interconnection management, (4) customer satisfaction, (5) low-income services, and (6) safety performance. Some (but not all) outputs have associated performance incentives. Most PIMs under RIIO take the form of adjustments to the allowed base revenue, collected two years after measurement or following the full eight-year price control in some cases. The reliability output also includes a component to adjust each DNO's return on equity by plus or minus 2.5%, based on number and length of outages.

The environment output targets both carbon and other pollution, as well as reduction of visual impacts from network infrastructure. In practice, incentives for carbon reduction are limited and specifically target reducing network losses from the distribution system. What's more, there is no performance measure or financial incentive attached to this.

Although widely pointed to as a model for expanded PBR in the U.S., opinions are mixed on how successful RIIO has been, with some finding that it has provided minimal improvement over the "RPI-X" regulatory model, the predecessor to RIIO.[18] Criticisms of RIIO include:

1. Information asymmetry that advantages the DNOs, letting them game the system in various ways (including how base revenue amounts are set and how benchmarking is conducted)
2. Lack of attention to "innovation" beyond conventional measures for improving asset health and reducing outages, including insufficient focus on integrating DERs
3. Insufficient portion of revenues subject to performance-based outcomes
4. Lack of meaningful attention to environmental performance
5. Overly cautious and unresponsive structure, which is not suited to the faster-paced changes required of the power system

There are significant differences between British DNOs and U.S. utilities, as well as the overall power system structure and regulatory history. But the RIIO model points to opportunities for expanded PBR with greater emphasis on performance objectives, while its shortcomings highlight the very real challenges of transforming entrenched regulations in a historically monopolized industry.

05 THE PATH FORWARD

THE PATH FORWARD

Experience shows that the utility business cannot be remade overnight. But this is no excuse to not get started. Delaying action is to accept path dependency on the legacy business and regulatory model, which was built for different infrastructure investments and operating structures than where the grid needs to go today.

ESTABLISH A GUIDING VISION

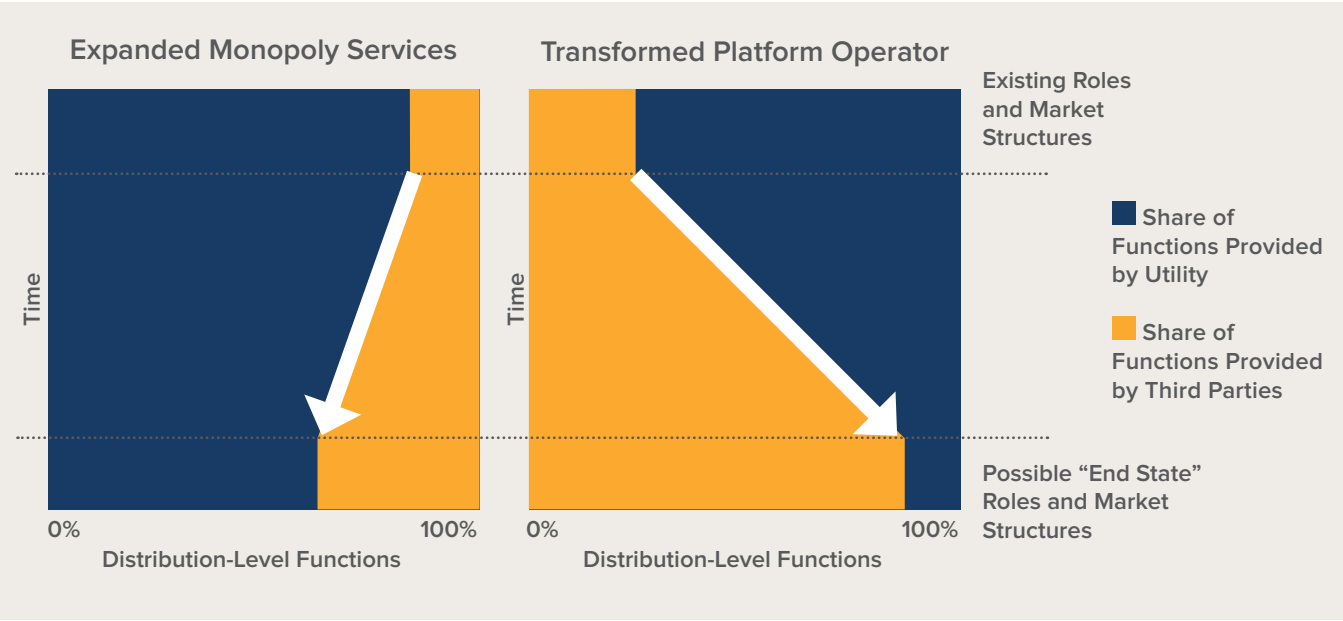
To enable a modernized physical grid system, whatever the business model or regulatory structure, changes are needed to the outdated utility business that persists today. Accepting that the future will be different, utilities and their regulators should proactively consider what utility structure they seek, and then begin to align new programs and revenue sources in a manner that builds operational and business experience with those. Regulators in New York and Hawaii have stepped up to do just this, with early guiding documents in the REV proceeding in New York,[19] and with the 2014 "Inclinations" report in Hawaii.[20]

A conceptual pathway for the evolution of the utility is illustrated in Figure 5. Today, the role of competitive service providers is relatively small. Even in those places that describe themselves as a platform, the utility still enjoys significant monopoly features and is responsible for the majority of value and service delivery. Traveling the path to a larger share of third-party service provision will entail numerous decisions and program changes to progressively incorporate competitive service offerings into the market, while promoting necessary market conditions to guide the market's growth (including design of procurement processes, data sharing, interconnection standards, and more). Even in jurisdictions that pursue expanded monopoly functions for some services, the relative share of third-party functions will need to grow if the market is to deliver desired features for innovation, environmental performance, and customer choice.

FIGURE 5

POSSIBLE EVOLUTIONARY PATHS FOR UTILITIES

Possible evolutionary paths for utilities from the current system in which the utility is responsible for the majority of functions and services to a future in which a larger share of services is provided by third parties.



The paths illustrated do not suggest a single, one-time decision or regulatory proceeding that establishes the end state for the electricity market. Nor do all decisions need to be known in advance, with the exact form and functions of the utility predetermined. Still, regulators and utilities have an important strategic choice to make at the outset: whether to pick off decisions one by one and see over time where they end up, or to set a vision in advance then let decisions follow from that. Clearly, the latter is the better approach.

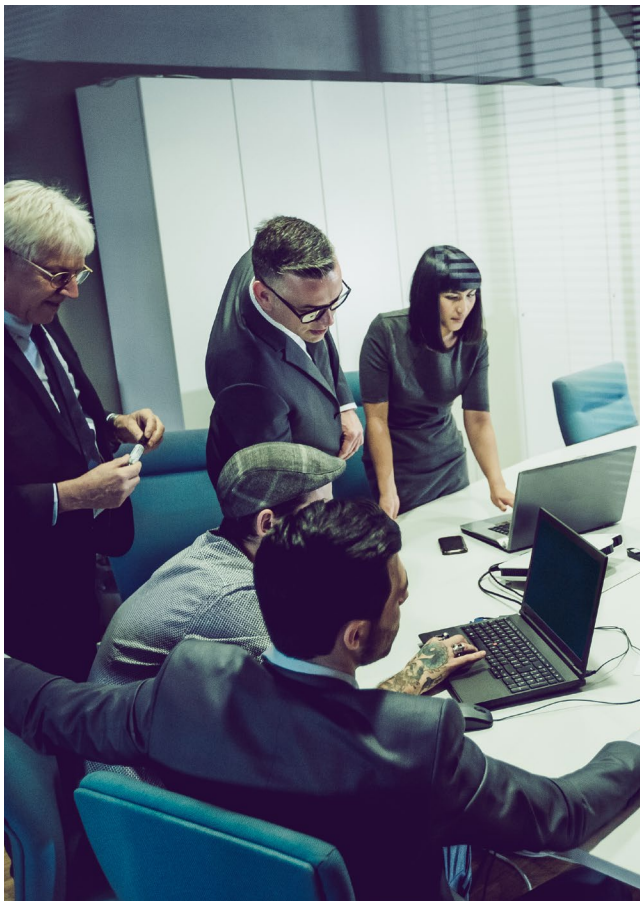
For example, commissions do not need to lay down an all-encompassing decision that the utility will, or will not, be able to own DERs in all cases. Nor do they need to decide that the utility will, henceforth, be subject to unregulated competition in certain service areas. Rather, the general terms should be established at the beginning, and then future decisions can be evaluated against those. This provides a means to guide developments of future proposals and program development, while also holding the commission accountable to an established vision. When the next proposal comes in for utility investment in project X or technology Y, regulators should be held accountable for upholding the same vision for the utility that they have charged utility executives with building. If later decisions deviate from those, utilities and their regulators alike should be able to explain what has changed to suggest this new direction.

Here, the California EV experience is once again informative. Upon revising the restrictions on utility-investment in charging infrastructure, the CPUC has used a set of guiding principles and a balancing test to weigh the benefits of utility ownership against the limitations on competition to decide which scenarios merit utility intervention.

MAKE DECISIONS WITH A CLEAR-EYED ASSESSMENT OF THEIR IMPLICATIONS

After a guiding vision is established, countless individual decisions and compromises will ultimately determine the course of the utility. At every turn, utility program designers and regulators can evaluate proposals against key variables. The following questions can be useful to consider how specific changes will support or inhibit progress toward the future vision:

- Who owns the DER assets being constructed?
- Who manages the primary relationship with customers?
- How will value provided by DERs be signaled to and captured by market actors?
- Does the model leverage opportunities for private sector investment or innovation?
- How do revenues flow between the utility, third parties, and customers?
- What financial or business risk may be associated with the model, and how is risk reflected in approved rates of return or other earning opportunities?



The answers to these questions will not always be black and white; different answers may be appropriate for different circumstances, even within the same jurisdiction progressing toward an agreed-upon vision for the future. For example, while it may not be appropriate for the utility to own or lease customers' rooftop solar, even in a market that leans toward the expanded monopoly structure, there is a case to be considered for utility ratebasing of EV charging infrastructure that has a significant public benefit and positive network effects.

Figure 6 highlights a set of "sliders" on which some prominent issues can be considered. For each utility structure and specific program being considered, program designers should critically ask, where on each range does a proposal lie, and is that consistent with where they want it to be? In some cases, a single program may sit at more than one location for a given variable. For example, some customer-facing programs offered by third-party vendors can include multiple revenue streams, some of which flow to the utility while other payments flow between different actors.

FIGURE 6

KEY DECISION VARIABLES FOR EVALUATING UTILITY PROPOSALS AND MARKET REFORMS

Based on the path being pursued and market conditions for specific programs, the best design can move left or right for each variable

THE NEW UTILITY FUNCTION FOR A CLEAN ENERGY ECONOMY

Finally, in addition to these considerations for utility roles and competition, programs or market designs should always be evaluated for their potential to support clean energy development and reduce environmental damage, particularly greenhouse gas emissions. Just as universal, affordable energy supply was seen in the early 20th century as a social imperative requiring a regulated utility to deliver, that imperative needs to be expanded in the 21st century to recognize the substantial environmental externalities that we now understand are part of the electricity system. Utilities and their regulators should be leaders in reducing the greenhouse gas intensity of our economy, on the rapid timeline required to adhere to global carbon budgets.

This attention to accelerating the speed of the clean energy transition can be made in balance with establishing a profitable market structure and improving customer value. In some cases, the need for rapid, large investment in low-carbon infrastructure may tip decisions toward utility-directed investments. This is not to suggest that the monopoly utility will, left to its own devices, always grow the asset base faster—experience has shown this is not necessarily the case. But with proper regulatory oversight and alignment of utility incentives, there will be important functions for the public service utility to operate in and investments it should make. At the same time, to build the utility of the future, the historical focus on cost-of-service ratemaking for narrowly interpreted “used and useful” investments must evolve to a new focus on balancing the needs and opportunities for a larger role from third-party service providers, with a utility role to support a marketplace that delivers societal and environmental goals.

CASE STUDY: REIMAGINING THE UTILITY IN NEW YORK REV

New York State's Reforming the Energy Vision (REV) initiative has attracted attention from around the world for its broad ambition and transformative vision to modernize the utility sector. REV provides an instructive case study from which to understand many of the concepts and decisions described in this report.

As established by the New York Public Service Commission (NYPSC) and Department of Public Service (DPS) staff at the launch of the proceeding, REV imagines a more competitive distribution market in which new products and service opportunities attract innovation by third parties to create value for customers as well as to drive greater efficiency in grid operation and investments. The following quote from a NYPSC order laying out the vision and policy framework for REV captures the ambition of reform and points to an underlying belief in the virtues of competition and opportunities for third parties (emphasis added).[21]

> REV will establish markets so that customers and third parties can be active participants, to achieve dynamic load management on a system-wide scale, resulting in a more efficient and secure electric system including better utilization of bulk generation and transmission resources. As a result of this market animation, distributed energy resources will become integral tools in the planning, management and operation of the electric system. The system values of distributed resources will be monetized in a market, placing DER on a competitive par with centralized options. Customers, by exercising choices within an improved electricity pricing structure and vibrant market, will create new value opportunities and at the same time drive system efficiencies and help to create a more cost-effective and secure integrated grid.

In the framework of this paper, REV is primarily a platform approach to utility reform, epitomized by the vision of utilities as "distributed system platforms" (DSPs). In practice, many elements of *hybrid* approaches are also evident. For example, Consolidated Edison's Brooklyn-Queens Demand Management (BQDM) project for $1 billion investment deferral is based on utility procurement of third-party solutions. The NYPSC has also expressed its preference that utilities not participate directly in DER services offered to customers, in order not to discourage a competitive third-party marketplace. However, the commission allows utilities to own DERs in cases where it finds the competitive market does not serve key needs (e.g., to serve low-income customers).

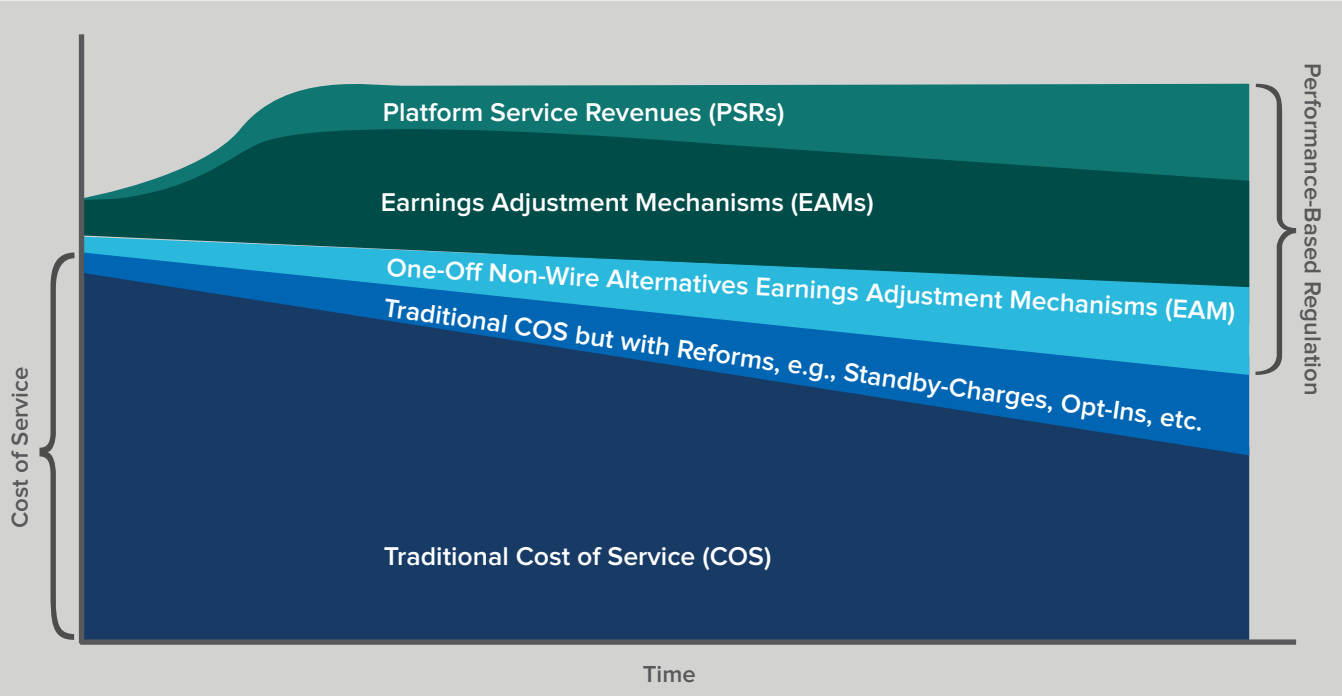
To support the transition to a platform utility, the NYPSC has invited utilities to propose new revenue sources to supplant traditional cost-of-service ratemaking, including "market-based earnings" and "platform service revenues" derived from fees for hosting the distribution system marketplace. Performance-based regulation is also expected to feature prominently in New York utilities' business models, to align traditional and new profit centers with policy objectives. In particular, the commission uses earnings sharing mechanisms to share savings between utilities and ratepayers, and has created earnings adjustment mechanisms as a form of performance incentive mechanism (PIM) and urged utilities to follow best practice for PIM design, including outcome-based metrics. REV imagines that the share of utility earnings from market-based earnings and platform service revenues will, over time, grow in comparison to traditional cost-of-service revenues, forming the basis for the future utility as a platform business model. The following figure illustrates the possible future evolution of earnings under REV.

Critically, the regulatory reforms pursued by REV do not exist in isolation from renewable energy targets. Two years into the proceeding, in August 2016, the NYPSC adopted a clean energy standard for 50% of the state's electricity from clean energy sources. This provides important clarity and enforcement mechanisms to ensure that reforms are in service to

FIGURE 7

POSSIBLE EVOLUTION OF UTILITY REVENUES UNDER REV (ILLUSTRATIVE)

Existing rate-based assets and infrastructure account for the majority of revenue and earnings for the immediate future, while new performance-based and other platform revenue sources develop and grow in size.[vi]



objectives for decarbonization of the sector.

Figure 8 applies the decision variables, previously introduced in this paper, to REV. The position of the sliders for each variable shows approximately where the NYPSC aspires to be for customer-sited DERs (not necessarily for front-of-the-meter grid infrastructure), based on the vision described in commission orders and other statements. As the REV experience has shown, however, not all decisions are black and white, nor can (or should) changes apply uniformly or immediately. For example, financial risk will continue to be shared, in many cases, by a combination of shareholders, third-party developers, and customers participating in new programs, and it will be socialized across all ratepayers for some programs. Revenue streams may also flow differently depending on the services in question; in some cases, a single program may even include financial flows directly between third parties and customers as well as separate payments paid by third parties to the utility. Viewing REV through the lens of this framework highlights the limitations of ascribing a single model or philosophy to utility reform, and also demonstrates the value of having a decision-making framework in place to help consider weighty questions and understand the implications of business and policy decisions.

Laudable for its ambition and progress made, REV has also demonstrated the practical challenges of transforming the utility business. Those include:

- The difficulty of meaningfully changing the cost-of-service revenue model, given that utilities are

[vi] Figure adapted from work by Catherine Mitchell. "Bringing It Together." iGov Team, University of Exeter; July 6, 2017. Available at http://projects.exeter.ac.uk/igov/wp-content/uploads/2017/07/3.-Bringing-it-together-Catherine-1.pdf.

inherently infrastructure-based businesses, in which revenues are substantially derived from rate-based assets that have already been built and that have many years of remaining booklife

- Challenges to defining clear metrics and target levels to track progress and establish performance incentives—for example, how to measure operational efficiency and promote the "right" amount of peak reductions
- Resistance to changes that could introduce greater risk to utilities' rate of return, which, as a result, could increase the cost of capital in debt markets, raising concerns that this would lead to higher costs for customers
- Difficulty of transitioning from siloed incentive programs to integrated markets, after DER providers' businesses have been built on the expectation for continuation of existing programs

These and other challenges have made the transition to DSPs slower than initially envisioned, but REV also shows important progress toward a reimagined electric

FIGURE 8

DIRECTION FOR DER PROGRAMS UNDER REV

In the future, customer-sited DER assets will be available in a competitive marketplace hosted by utility DSPs, reimagining traditional utility roles and relationships.

utility. BQDM is widely regarded as the poster child for non-wire alternative investments; New York utilities are undertaking numerous innovative demonstration projects to experiment with new functions and business models; and work is underway to develop new “value of DER” rate structures to create new pricing mechanisms for distributed solar, and eventually other DERs. More broadly, REV shows the value of establishing a guiding vision, supported by meaningful clean energy targets, against which utilities and other participants can creatively develop the details for new utility roles and third-party activities.

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ENDNOTES

ENDNOTES

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