PERFORMANCE-BASED REGULATION FOR PENNSYLVANIA

An Opportunity for Pennsylvania to Drive Innovation in the Utility Sector

Prepared by Advanced Energy Economy Institute

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ABOUT ADVANCED ENERGY ECONOMY INSTITUTE

The Advanced Energy Economy Institute (AEE Institute) is a 501(c)(3) charitable organization whose mission is to raise awareness of the public benefits and opportunities of advanced energy. AEE Institute provides critical data to drive the policy discussion on key issues through commissioned research and reports, data aggregation and analytic tools. AEE Institute also provides a forum where leaders can address energy challenges and opportunities facing the United States. AEE Institute is affiliated with Advanced Energy Economy (AEE), a 501(c)(6) business association, whose purpose is to advance and promote the common business interests of its members and the advanced energy industry as a whole. Visit *www.aee.net/aeei* for more information.

ABOUT THE 21ST CENTURY ELECTRICITY SYSTEM (21CES) INITIATIVE

Through its 21CES initiative, Advanced Energy Economy is helping to accelerate the transition to a high-performing, customer-focused electricity system that is secure, clean, and affordable. The three primary activities of the initiative are:

1. Convening forums that bring together utility executives, policymakers, and advanced energy companies to develop a vision for reform that is responsive to the needs of each state and drives towards concrete action.
2. Participating in key regulatory proceedings in targeted states to provide leadership and input to policymakers and regulators on electric utility industry changes required to support a viable utility business model that allows a high degree of distributed energy resources and empowers customers to become more engaged in their energy use to the benefit of the whole grid.
3. Facilitating detailed discussions and collaboration among diverse stakeholders who are interested in working together to accelerate reforms that lead to win-win outcomes.

PREFACE

On April 12, 2016, Advanced Energy Economy Institute (AEE Institute) hosted a Pennsylvania 21st Century Energy System (21CES) CEO Forum[1] at the offices of Ballard Spahr in Philadelphia. The Forum brought together CEOs and senior executives from a diverse group of advanced energy companies, the state's electric and natural gas utilities, and key policymakers and regulators. The main objective of the day was to establish a common vision of the 21CES in Pennsylvania that increases consumer control over energy options, increases system reliability, reduces future energy costs relative to business as usual, and transforms the power sector into one that embraces advanced energy technologies. The group also addressed how to advance the ideas and concepts discussed into concrete action.

One recommendation coming out of the CEO Forum was to continue a discussion and develop a whitepaper on Performance-Based Regulation (PBR) for Pennsylvania. To achieve this objective, a Working Group was formed following the CEO Forum with representatives from: BRIDGE Energy Group, CLEAResult, Enbala, EnergySavvy, EnerNOC, Johnson Controls, Intel, Keystone Energy Efficiency Alliance, Navigant, Nexant, Oracle, Philadelphia Gas Works, Philips, Recurrent, Schneider Electric, Siemens, SmartWatt, Smart Wires, Spirae, SunPower, and Sunverge. AEE Institute served as the facilitator for the Working Group. This group worked together over several months to prepare this whitepaper.

In addition to the companies that participated in the Working Group, the following AEE member companies have reviewed and endorsed the paper: EnergyHub, FirstFuel Software, Lime Energy, and Resource Innovations.

[1] For more about the CEO Forums, go to https://www.aee.net/initiatives/21st-century-electricity-system.html.

EXECUTIVE SUMMARY

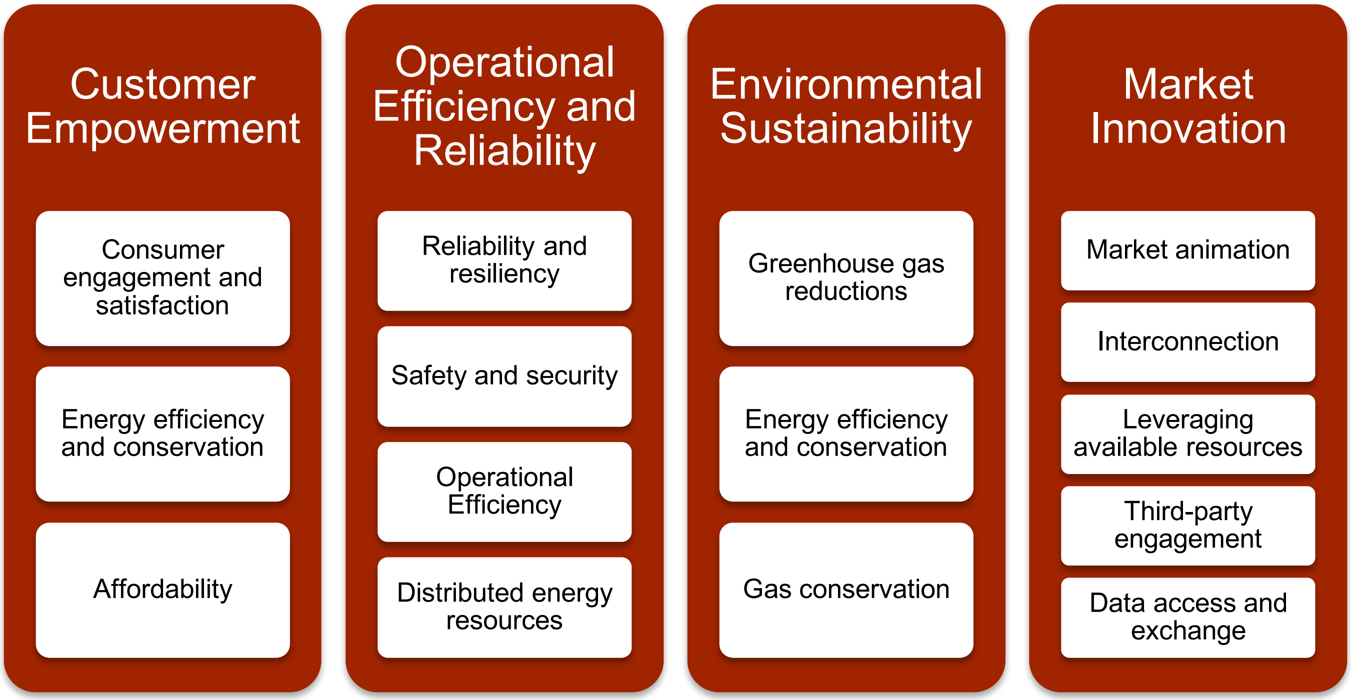
Over the past century, the U.S. utility sector has undergone significant changes in response to developments in technologies, markets, public policies and regulations. The sector is once again entering a period of significant change, driven by new technologies, evolving customer needs, environmental imperatives, and an increased focus on grid resiliency. With these developments come challenges, but also new opportunities to create an energy system that meets the changing requirements of consumers and society for the coming decades. The energy infrastructure of the future will be more complex. It will present technical challenges (such as managing two-way power flows over the electricity distribution system and integrating a much larger number of interconnected devices), involve a greater number and variety of actors, and entail complex market structures. These developments also present business challenges to the long-term viability of the current utility business model, which is primarily built around increasing capital deployment and rising energy sales. Yet if managed successfully, these changes offer opportunities for greater customer choice and engagement, the creation of a more efficient and resilient energy system, and opportunities for utilities to embrace new business concepts that will sustain them in the decades to come.

Performance-based regulation (PBR) is a regulatory framework that attempts to align the behavior and financial interests of regulated utilities with public interest objectives and consumer benefits. It does so by rewarding utilities for achieving well-defined outcomes (performance metrics), as opposed to providing incentives related to capital investment (inputs).

This paper summarizes the collective thinking of an informal Working Group, facilitated by AEE Institute, that met over a several-month period to develop recommendations regarding the potential for PBR in Pennsylvania. This paper is meant to serve as a starting point for further discussions with stakeholders, including regulators, policymakers, utilities, advanced energy companies, and others. Among these stakeholders, there is mutual interest in moving the utility industry in Pennsylvania towards a sustainable regulatory model that meets the diverse needs of the Commonwealth. In the view of the Working Group, Pennsylvania has a unique opportunity to modernize its regulatory framework to facilitate industry evolution and the deployment of advanced technology solutions, creating economic opportunity for the state. The building blocks are in place to put Pennsylvania at the forefront of developing a 21st century energy system.

Performance is the heart of the PBR model and it is managed through established qualitative and quantitative metrics. The focus of the utility thus shifts from static cost minimization to enhancement of value as utilities are incented to improve performance that leads to an increased return on investment. For PBR to be successful, incentives must be large enough to have the desired effect on utility behavior, but capped to protect consumers.

Proposed Performance Categories



To implement PBR, the Commission must first work with stakeholders to define, prioritize, and incentivize utility performance. In defining categories of desired utility performance, the Commission must be consistent with statutory authority and policy mandates. The Working Group identified four specific categories of performance to explore further in the Pennsylvania context: customer empowerment, operational efficiency and reliability, environmental sustainability, and market innovation.

Within these categories, it is possible to define a wide variety of performance metrics. The Working Group prioritized six recommended metrics, using two basic criteria: (i) the metric should be implementable in the near term, and (ii) the metric should be capable of informing performance across multiple categories. This provides the best opportunity for the Commission to take meaningful action to align the behavior and financial interests of the regulated utilities with public interest objectives. The six proposed metrics are as follows:

1. **Data Access**: Consumer access to standardized and actionable energy consumption data; Third-party access to system data
2. **Energy Efficiency**: Quantifiable reductions in usage, including periods of peak demand
3. **System Efficiency**: Combination of peak demand reduction and average system utilization

4. **Third-Party Resource Deployment**: DER deployments by third parties (including on behalf of customers)
5. **Interconnection**: Volume and process speed of filling requests to connect resources to the electricity system.
6. **Reach, Usage, Effectiveness, Feedback**: An Integrated framework for customer empowerment metrics

Of note, all prioritized metrics impact the Customer Empowerment performance category. A common characteristic of many advanced energy technologies is that they facilitate customer interaction and benefits, and the utility has a vital role in enabling the use of those technologies. Under PBR, the value proposition between utilities, third parties, and customers becomes clearer, as utility objectives are more clearly linked to and aligned with the energy needs of Pennsylvania's businesses and residents.

The selected performance metrics must also reflect the ability of utilities to control outcomes related to the metrics – the more control a utility has, the more responsible it should be. This allows the metrics to serve as an effective management tool.

Adopting PBR will also require the consideration of the Commonwealth's unique legal, institutional, and regulatory environment. Over the past decade, Pennsylvania has taken several actions that have laid the foundation for implementing PBR. Using its broad grant of authority from the Public Utility Code, the PUC can support several required elements that would, in turn, support PBR, including data tracking, smart metering infrastructure, energy efficiency, and distributed energy resources. The Pennsylvania Public Utility Code also contains an explicit grant of authority for the PUC to pursue PBR. It states that the PUC has the authority to "use performance based rates as an alternative to existing rate base/rate of return ratemaking…"[2]

Additionally, the Public Utility Code empowers the PUC to consider performance factors, like the metrics outlined in this paper, in the setting of utility rates. Specifically, 66 Pa. C.S. § 523 empowers the PUC to consider utility performance in the setting of rates including any "relevant and material evidence of efficiency, effectiveness and adequacy of service."[3] Thus, the PUC can take action to establish PBR under existing authority.

In terms of next steps, the Working Group believes it would be beneficial to conduct educational webinars or workshops for Commission staff on PBR as a precursor to opening a policy proceeding on PBR.[4] The proceeding would allow a range of stakeholders to contribute to the public record, which could set the stage for formal Commission action. Although the authority exists in statute, the Pennsylvania PUC has not taken a formal position regarding its authority to institute PBR or other forms of alternative ratemaking methodologies. The good news is that the time appears right to do so. As

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[2] Section 66 Pa. C.S. § 2806 (i).
[3] Section 66 Pa. C.S. § 523(b)(7).
[4] On March 2, 2017, the Commission issued an order in Case M-2015-2518883 to gather comments from stakeholders on alternative ratemaking. This could serve as a basis for exploring PBR in more detail.

detailed in this paper, a confluence of circumstances and conditions suggests that the opportunity is attractive and worthy of consideration now. As the utility landscape continues to evolve, commissions throughout the United States have implemented adjustments to the ratemaking process, such as revenue decoupling, forward test years, and capital trackers. With more profound changes anticipated in the coming years, PBR offers the potential for a more comprehensive and flexible approach to meeting the challenges that these individual adjustments were meant to address.

TABLE OF CONTENTS

INTRODUCTION

AN INDUSTRY IN TRANSITION

Over the last century, the U.S. utility sector has undergone significant changes in response to developments in technologies, markets, policies and regulations. The sector is once again entering a period of significant change, driven by new technologies, evolving customer needs, environmental imperatives and an increased focus on grid resiliency (Figure 1). With these developments come challenges, but also new opportunities to create an energy system that meets the changing requirements of consumers and society for the coming decades.

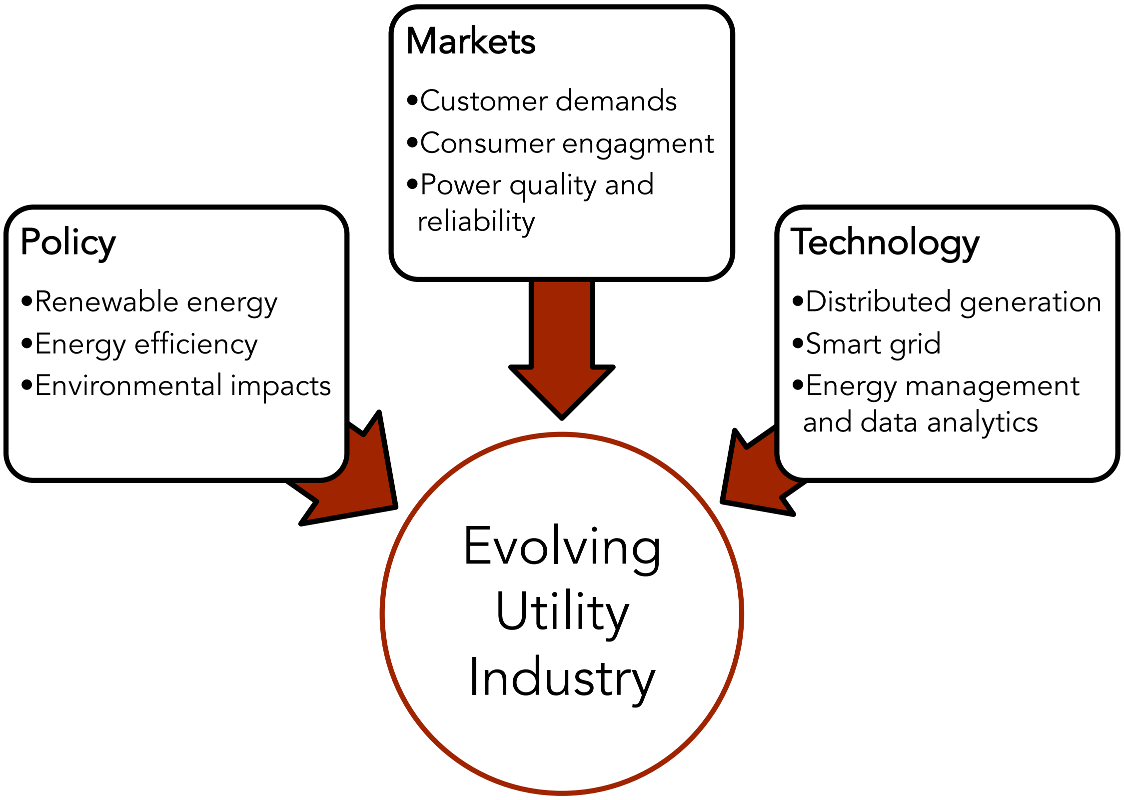
The technological, market, and policy changes that are converging to drive change are affecting how energy is produced, delivered and used. Technology developments include:

- Rising deployment and cost-effectiveness of distributed generation (DG)
- Greater adoption of energy management technologies, including energy efficiency (EE) and demand response (DR)
- Deployment of smart grid technologies, products and services
- Growing adoption of plug-in electric vehicles (PEVs) and battery energy storage
- Deployment of microgrids, which combine some, or all, of the above technologies to meet customer and system needs
- The rise of big data, analytics and connected devices to optimize energy usage and engage customers
- Expanded use of large-scale advanced energy technologies, including renewables

Market and customer developments include:

- Expectations for a more resilient system, including rapid outage restoration and better information and communication about outages, especially during severe weather events
- Consumer demand for environmentally sustainable energy options
- Higher expectations for reliability and power quality driven by the digital economy and proliferation of electronic devices
- A desire for greater visibility and control of energy use and costs, including rising interest in customer-sited options, paving a way for the "empowered customer"
- Growth in energy products and services provided directly to customers by third parties, and the ability of customers and third parties to offer products and services to the utility as an alternative to traditional utility investments
- Heightened awareness of cyber security and threats, on both the utility and customer side of the meter
- The availability of abundant low-cost natural gas

Figure 1: Drivers of Change in the Utility Industry



Reinforcing these technology, market and customer developments are energy policies, at both the state and federal levels, that are driving deployment of energy efficiency, renewable energy, energy storage, electrification of transport, and broad efforts to modernize energy infrastructure to bring it into the digital age. As a result, the energy infrastructure and markets of the future will be more complex, will include a greater number and variety of actors, and will present technical challenges – such as managing two-way power flows over the electricity distribution system and a much larger number of interconnected devices – as well as business challenges – such as the long-term viability of the current utility business model built around increasing capital deployment and rising energy sales. Yet if managed successfully, these changes present opportunities for greater customer choices and engagement, the creation of a more efficient and resilient energy system, and opportunities for utilities to embrace new business concepts that will sustain them in the decades to come.

PERFORMANCE-BASED REGULATION AS A FRAMEWORK FOR INDUSTRY EVOLUTION

Performance based regulation (PBR) is defined as a regulatory framework that attempts to align the behavior and financial interests of regulated companies with public interest objectives and consumer benefits. PBR is best understood as an evolution from the legacy regulatory reward system that primarily aligns revenues with unit (kWh or therms) sales and direct recovery of capital expenditures. This approach, referred to as cost-of-service regulation, primarily values prudent utility spending to create a system that provides safe, reliable, affordable energy. But as technology change occurs and new objectives are defined, utilities and regulators must support a greater set of desired outcomes. PBR represents a regulatory shift toward a wider range of potential values, including customer-oriented outcomes and environmentally sustainable utility service. A system of PBR complements long-held regulatory values, while linking performance objectives to emerging values. PBR provides an exciting opportunity to maintain reasonable costs, meet policy objectives, and craft a market structure to deliver an array of consumer benefits while offering utilities a financial incentive structure that is better aligned with the changing nature of utility service.

ABOUT THIS PAPER

This paper summarizes the collective thinking of an informal working group, facilitated by AEE Institute, that met over a several-month period to develop the recommendations included herein regarding the potential for PBR in Pennsylvania. It is meant to serve as a starting point for further discussions with stakeholders, including regulators, policymakers, utilities, advanced energy companies and others with an interest in moving the utility industry in Pennsylvania towards a sustainable regulatory model that meets the needs diverse needs of the Commonwealth.

THE PENNSYLVANIA CONTEXT

Pennsylvania has a unique opportunity to modernize its regulatory framework, thus facilitating industry evolution and the deployment of advanced technology solutions, while creating economic opportunity in the state. The building blocks are in place to put Pennsylvania at the forefront of 21st century energy system development. For example, Act 129, passed in 2008, is advancing the Commonwealth's goal of ensuring the availability of adequate, reliable, affordable, efficient, and environmentally sustainable electric service at least cost. The legislation also expanded sections of Title 66, including responsibilities of electric distribution companies in the Commonwealth, and the role of the Public Utility Commission (PUC) in meeting those responsibilities.

In addition to Act 129, the availability of low-cost natural gas and the existence of advanced metering infrastructure (AMI) both provide an excellent foundation for accelerating the transition to a 21st century energy system. Regulatory responsibilities increasingly balance the cost recovery for gas and electric distribution company (EDC) investments with monitoring of technological advances and competitive market developments. Indeed, developing Pennsylvania's energy infrastructure must also include engagement of energy consumers and deployment of advanced energy resources that may not be owned by regulated utilities. Expanded responsibilities of EDCs and default service providers include new roles, such as providing energy efficiency services, and development of new customer rates and programs, including time of use and real-time pricing options.

Finally, Section 66 Pa. C.S. § 2806 (i) provides the PUC with the authority to "use performance-based rates as an alternative to existing rate base/rate of return ratemaking…" Ratemaking is one tool in a broader set of regulatory options, all aimed at modernizing utility regulation to focus not just on "used and useful" capital investment, but on a wider array of objectives. The focus of this whitepaper is on how Pennsylvania may evolve regulatory frameworks to evaluate and reward utility performance to achieve these wider objectives.

PBR IN PENNSYLVANIA

When considering an approach to PBR, Pennsylvania stakeholders must consider the Commonwealth's unique issues, including legal, institutional, utility, and financial market considerations. As stated in Title 66:

"The health, safety and prosperity of all citizens of this commonwealth are inherently dependent upon the availability of adequate, reliable, affordable, efficient and environmentally sustainable electric service at the least cost, taking into account any benefits of price stability, over time and the impact on the environment."[5]

The PUC is uniquely positioned, and has legislative authority, to act related to these objectives. The PUC also has authority to define what PBR means for the Commonwealth. This includes a clear ability to act on utility incentives, including the design of alternative ratemaking methodologies for utilities.

Act 129 also recognizes the public interest benefits derived from utility business evolution, including consumer benefits. The Act encourages utilities to pursue efficiency and conservation as means of improving price stability and promoting economic growth. Further, Act 129 encourages the deployment of alternative energy to reduce environmental impacts from utility operations.

Incentives that align utility revenues and cost recovery with effective performance allow utilities to invest in a wide array of programs and technologies. When designed appropriately, PBR may provide stability in rates and costs, while facilitating economic growth in energy services and technologies.

In addition to incentives, PBR frameworks accelerate regulatory processes to react to market dynamics. Traditional regulatory processes can lag behind industry developments. This regulatory lag may unintentionally limit economic growth potential, slow technological advances and deployment, and negatively impact utility financial performance.

[5] Pennsylvania General Assembly (2008) House Act 129, Public Utility Code (66 PA. C.S.) Omnibus Amendments.

PBR: A FLEXIBLE REGULATORY FRAMEWORK FOR A MODERN ENERGY SYSTEM

As noted above, this whitepaper is proposing an update and enhancement to utility ratemaking in Pennsylvania. It describes a performance-based framework composed of an interdependent set of components that address the rationale and value equation for utility investment in line with the policy objectives of the Commonwealth and the interests of customers. The framework is multi-faceted in that it is as much focused on setting rates and financial outcomes for utilities based on achieving goals as it is centered around the regulatory process itself.

As described above, today's utility business is in the midst of considerable change. One of the implications of this is that the regulatory process needs to be more nimble and adaptive while offering an incentive-based framework to foster innovation and value for consumers. PBR is a way to achieve this needed change.

The PBR framework proposed here is envisioned as a dynamic platform where revenues and rates are not arbitrarily fixed, but instead float based on the level of spending year to year, adjusted for quality of performance. Utilities are expected to develop capital spending and asset improvement plans directly linked to stated policy goals, system condition and customer demands. Base rates are projected forward based on the approved capital plan, but are reconciled annually with actual investment.

Performance is the heart of the model and is managed through established qualitative and quantitative metrics. The focus thus shifts from static cost minimization to enhancement of value as utilities are incented to improve performance in return for increased allowed return on investment.[6] Incentives must be large enough to have the desired effect on utility behavior, but capped to protect consumers. The year-to-year review of outcomes ensures that utility earnings remain in line with the value provided and is a means to visualize the progress of innovation. Metrics also greatly enhance transparency and accountability on the part of the utility, which directly addresses regulatory concerns regarding the prudency and value of capital investment.

For the utilities desiring to pursue this paradigm shift and see it succeed in their jurisdiction(s), they will be enabled to move from "defending the spend" to delivering value. Capital investment, be it substations or

[6] This could be in the form of actual basis points adders or set dollar amounts for achieving performance targets. We prefer the latter as this avoids creating the incentive for the utility to increase its rate base just so it can receive a higher incentive payout. An alternative is to also include a revenue cap based on an approved multi-year plan.

IT systems, will be structured to meet defined performance outcomes. Multi-year business and capital investment plans would replace annual rate cases. Thus, less time will be spent in the hearing room, with more time spent enhancing the system and serving customers.

Although there are no examples of other states that have implemented a comprehensive PBR model, the UK has done so with its "RIIO" framework and Massachusetts has created a successful energy efficiency program that includes performance incentives. New York State is also in the process of implementing elements of PBR within the broader regulatory reforms it is pursuing under its *Reforming the Energy Vision* (REV) proceeding. In Massachusetts, an independent Energy Efficiency Advisory Council, made up of a variety of stakeholders, helps set energy efficiency targets and the associated incentive levels. Although the Massachusetts program falls short of a full PBR framework that would apply to all utility activities it provides useful real-world experience with a successful program that is large and that combines PBR principles with other complementary polices, such as revenue decoupling.[7]

PERFORMANCE TARGETS OR METRICS

With PBR, utilities are incentivized to improve performance and service quality given the forward-looking cap on regulated revenues. Generally, the performance targets and metrics would be designed around the most important, forward-looking assumptions that impact the business case of the proposed utility investment. For example, if the investment is dependent upon a certain percentage of customers adopting demand response, distributed generation, or energy storage, so that benefits outweigh costs, then a performance target/metric around that customer adoption rate would be formulated and linked to the increments/decrements around the baseline ROE for superior/poor performance with respect to those metrics. Although metric categories should be the same for all utilities within a jurisdiction, actual targets can vary from utility to utility to reflect differences in the customer base, system condition, or other factors.

OUTPUT VS. INPUT INCENTIVES

PBR is most commonly used to refer to incentives that are provided when a utility achieves certain goals (outputs). Still, these new output incentives need to be considered in the context of the input incentives under which utilities currently operate. Broadly, output incentives are rewards for achieving certain outcomes that are the result of a combination of investments, management, and operational decisions (and potentially the decisions of customers and other actors) while input incentives focus on rewarding utilities based on the capital invested in certain types of assets.

[7] See the Appendix for a description of the UK RIIO model, the Massachusetts energy efficiency program and New York State's performance incentive reforms.

These input incentives are an essential part of utility cost recovery and remain important under a PBR framework – utilities must return value to their investors to be able to raise money to invest in the grid and provide service to customers. However, if the returns to investors (through regulated return on equity) are either higher or lower than what similar investments achieve in the market, the utility will have an incentive to either over invest or under invest in the system. Further, return on equity applies mostly to physical assets, and not to services, which can sometimes replace the need for additional capital expenditures or provide benefits that cannot be provided by traditional assets. With a purely cost-of-service based framework, this means that the utility forgoes profits if it chooses a service over an asset, even if that service-based solution provides greater net benefits to customers.

How to improve these input incentives is an emerging area of focus for the industry that tends to focus on leveling the incentives between services and assets so that the utility can optimize without a hit to its bottom line and allowing the utility to share in the savings if it finds a more cost-effective solution and becomes more capital efficient. Although also worthy of consideration by the Commonwealth, how to improve input incentives is not a focus on this paper. Nevertheless, as described below, PBR can also help address the utility bias towards capital investment over procurement of services.

OTHER ELEMENTS OF THE PBR FRAMEWORK

For performance targets to be effective, other elements of the regulatory framework and ratemaking process need to be addressed. Those are discussed in greater detail below (see the section titled *The Path Forward for PA*), but briefly, these elements are: regulatory oversight, benefit-cost analysis, ratemaking and cost recovery, and rate design (including time-varying rates).

REGULATORY OVERSIGHT

Elements of the capital investment plan filed by a utility would include: a description of the purpose and scope of the plan, an explanation of how the plan is consistent with the values and objectives adopted by the Commission, itemized benefits and costs with supporting documentation, benefit-cost analysis, a cost recovery proposal, class ratepayer impact analysis, and a detailed implementation plan. The plan would be approved by the Commission if found to be cost effective.

To increase transparency and increase stakeholder involvement, each utility would be required to present to stakeholders the critical aspects of its capital investment plan *before* filing the plan with the Commission. Utilities would then be encouraged to modify plans based on stakeholder comments or proposals. The capital investment plan filing by the utility should include a description of the stakeholder input process and the value it provided to the utility. The Commission would then review the capital investment plan as well as the other elements of the utility's filing during a rate proceeding. Standard administrative procedures for a rate case would be followed.

BENEFIT-COST ANALYSIS

Before the start of each plan period, the utility would file a rate case in which it must present a "business case" for major new investments that would include a description of each quantifiable cost and benefit, the associated net present value, and the key assumptions that went into each value, along with a sensitivity analysis. Reliability benefits such as outage prevention can be quantified using methods such as "Value of Service" studies that have been performed by many utilities and the Electric Power Research Institute. Any costs and benefits of the proposed investment that the utility believed should be considered, but which could not be reasonably quantified would also be presented and explained. Generally, the proposed approach would be considered cost-effective when the benefits of the business case exceed the costs, and is consistent with the values and objectives adopted by the Commission.

RATEMAKING AND COST RECOVERY

One goal of the PBR framework is to put operating expenses on a more equal footing with capital investment, particularly when non-capital spending can provide a superior solution. This could be, for example, in procuring load reduction from customers and third parties that deploy distributed energy resources (DER) in lieu of a traditional distribution infrastructure upgrade.[8] Under current ratemaking rules, utilities have little or no incentive to pursue such an option. Another example is cloud computing, where software-as-a-service procured by the utility provides a lower cost and more secure option than installing its own IT hardware.[9] Yet the current regulatory paradigm discourages utilities from taking advantage of this option. Under a PBR framework, utilities would look at a broader array of potential solutions knowing that those based on operating expenses also provide opportunities for earning a return – driven by performance. Within this construct there is also the possibility for shared savings arrangements, whereby utilities could share in some of the benefits (e.g., cost savings to customers) of pursuing nontraditional solutions, beyond the incentives defined in the PBR framework.

Regardless, a capital plan will be required, and presented here is an option for structuring the ratemaking and cost recovery component of a PBR framework. Projected investment costs (depreciation and return on net plant in-service components) would enter base rates beginning in the initial year of the plan and reflect the planned timing of investments over the

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[8] DER is defined broadly to include distributed generation of all types, energy efficiency, demand response, energy storage, electric vehicles, and microgrids.

[9] The National Association of Regulatory Utility Commissioners recently proposed Resolution CI-1 "Encouraging State Utility Commissions to Consider Improving the Regulatory Treatment of Cloud Computing Arrangements" (NARUC Draft Resolutions for Consideration at 2016 Annual Meeting, page 4).

approved plan timeline. Each year an annual review process would be held in which the utility must report and explain to the Commission any variances between planned and actual capital expenditures. The difference in revenue requirements between planned and actual capital expenditures would be reflected in a Capital Reconciliation Mechanism, which would be used to adjust future annual base rates, including carrying costs based on the utility's approved pre-tax weighted average cost of capital, to reflect Commission-approved variances in capital spending. Operational expenditures would be recovered through base rates that are set at the time of approval of the utility's multi-year rate case. This portion of base rates would then be adjusted on an annual basis over the term of the plan based upon a formula that considers the rate of inflation adjusted for productivity gains. Further, base rates would be adjusted annually pursuant to Commission review of utility performance and service quality metrics.

The allowed return on equity (RoE), used to determine the return component of cost recovery, would initially be based on the utility's standard ROE as approved by the Commission in the forward-looking rate plan, but would be adjusted in subsequent years based on demonstrated performance. The standard ROE represents satisfactory or standard performance, akin to the status quo. The ROE can be increased or decreased annually according to performance under the approved metrics. The adjusted ROE would be applied to the utility's entire net plant in-service to determine the base rates for the next year. An illustrative example of how the ROE could be adjusted is given in Table 1.

Table 1: Example Application of PBR to Utility Allowed ROE

Performance Level	Add/Subtract	Allowed RoE*
Poor	(-) 50 basis points (bps)	X – 0.50
Below Standard	(-) 25 bps	X – 0.25
Standard	Neutral	X
Above Standard	+ 25 bps	X + 0.25
Exceptional	+ 50 bps	X + 0.50

** X = Standard Return on Equity*

The actual increments/decrements applied to the utility's standard ROE for superior/poor performance would be determined based on the premise that the increments/decrements must give the utility sufficient financial incentives to achieve success.

Alternatively, the Commission could award incentives as fixed sums at predefined performance levels rather than provide them as changes to a utility's allowed RoE. There are several reasons to explore this option. Primarily, rewarding a utility on the outputs it provides by adjusting RoE (an input incentive) mixes signals to the utility in a way that may not be helpful. The value of good performance on a customer engagement metric does not become any more valuable if a utility spends more to achieve it or if the utility spends more on an unrelated substation upgrade. However, if incentives are tied to the size of the utility's rate base, general increases in capital expenditures will increase the size of the reward for customer engagement, even if no additional funds were spent to improve customer engagement or if no greater performance were achieved. And if the reverse happens, and a utility becomes more capital efficient and decreases its capital expenditures, it would be counterproductive to signal to a utility that its good performance on public policy goals is any less valuable in this scenario by automatically decreasing the rewards that are tied to RoE. As new regulatory structures attempt to maximize benefits and encourage efficiency with inputs, trying to encourage greater performance by setting up incentives as a function of inputs may send a utility a financial signal that runs counter to the goals of PBR.

If incentives are based on fixed dollar amounts, the Commission could use a utility's current RoE as a baseline for the initial award amounts and then in future years, adjust the size of pre-defined payouts as needed based on metrics that are consistent with the utility's size, such as the number of customers served.

RATE DESIGN, INCLUDING TIME VARYING RATES

Achieving certain performance outcomes will depend on greater customer engagement, particularly engagement that makes use of AMI and the granular data it produces. As such, changes to rate design enabled by AMI, such as time-varying rates (TVRs), should be considered for all customer classes. The utility would evaluate the range of rate design options[10] as part of the utility's general rate proceeding, or TVRs could be considered in a separate, targeted rate design proceeding. Recommended option(s) for each customer class could include whether the recommended rates should be opt-in versus opt-out. Low-income customer rates should provide affordability and stability, but also should enable low-income customers to benefit from shifting consumption to lower-cost periods.

[10] Options include peak-time rebates, critical peak pricing, and real-time pricing, among others.

CATEGORIES OF PERFORMANCE

In defining categories of desired utility performance, the Commission will need to act consistent with statutory authority and policy mandates. The Working Group identified four specific categories of performance to explore further in the Pennsylvania context: customer empowerment, operational reliability and efficiency, environmental sustainability, and market innovation. These are summarized in Figure 2 and discussed in more detail below. In defining categories of desired utility performance, the Commission will need to act consistent with statutory authority and policy mandates. The Working Group identified four specific categories of performance to explore further in the Pennsylvania context: customer empowerment, operational reliability and efficiency, environmental sustainability, and market innovation. These are summarized in Figure 2 and discussed in more detail below.

CUSTOMER EMPOWERMENT

An effective PBR model should incentivize utilities to empower customers, resulting in improved customer engagement and satisfaction and increased energy efficiency and conservation, all while maintaining affordability. Ultimately, to be fully empowered, consumers should have access to detailed energy consumption and billing information, pricing and service options, and support for automated response to prices, weather, or other conditions. Customer empowerment is divided into several categories:

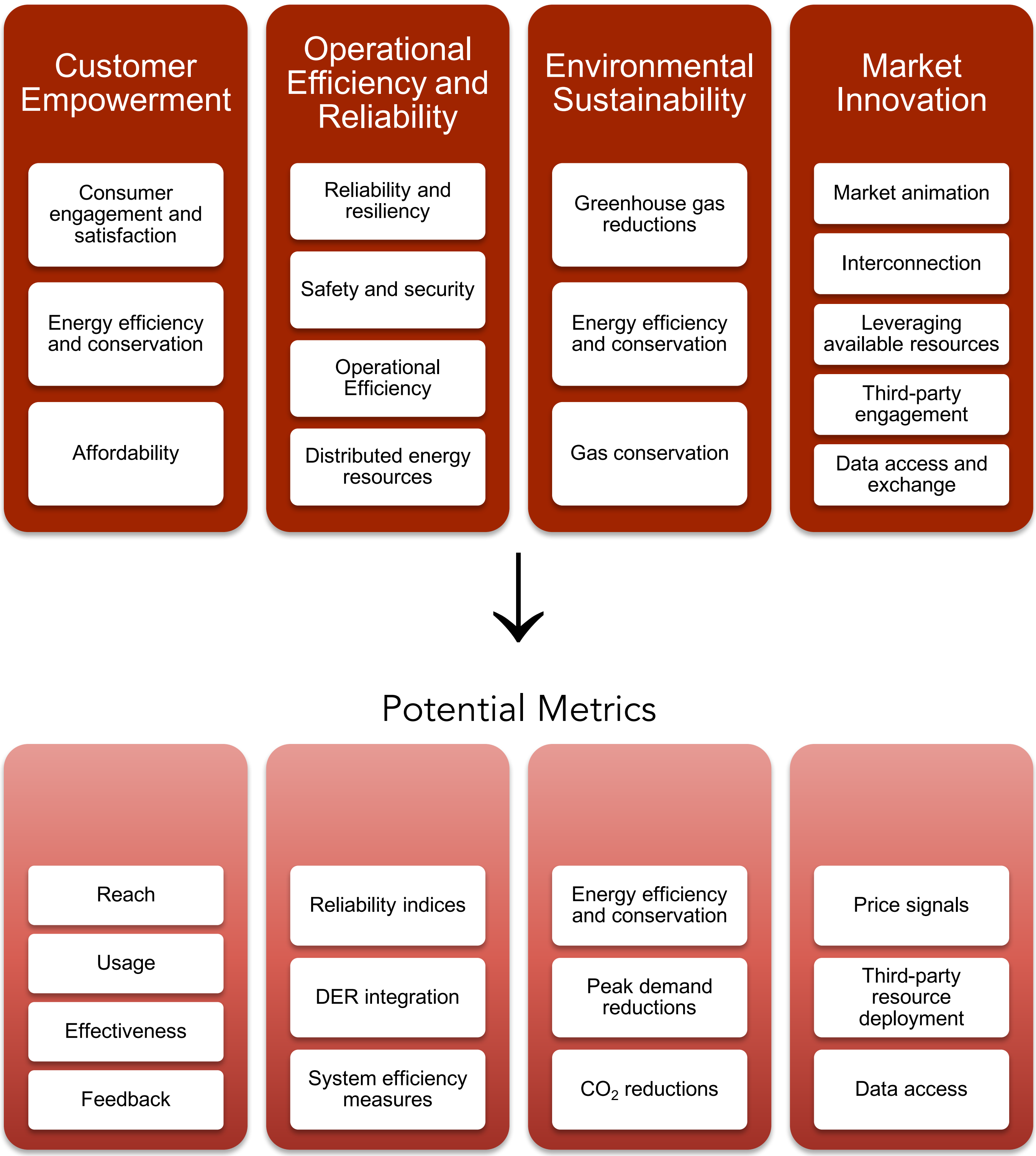
Customer Engagement and Satisfaction

With increased deployment of Advanced Metering Infrastructure (AMI) and similar technologies in the Commonwealth, utilities, customers, and third-party providers have unprecedented access to energy usage data. This unprecedented access to energy data should lead to increased customer benefits, as energy data provides opportunities to engage consumers in new and exciting ways. For example, usage data may lead to a deeper understanding of consumer behavior and can guide effective consumer engagement, program design, appropriate segmentation and tailoring of services, and demand reduction capability.

Consequently, linking utility earnings opportunities to customer engagement and satisfaction is an essential component of PBR. Although utilities use different ways to determine customer satisfaction levels, one commonly used approach is to defer to evaluations from independent third-party evaluators, such as JD Power & Associates.[11]

[11] For illustration only. AEE Institute does not endorse any specific third-party evaluator of product and/or services.

Figure 2: Proposed Performance Categories



Energy Efficiency and Conservation

Energy efficiency has repeatedly proven to be the least-cost resource available to utilities to meet energy demand. Unfortunately, traditional ratemaking models typically treat energy efficiency as a cost to be recovered rather than as a demand-side investment to generate earnings. This treatment often deters investor-owned utilities from promoting energy efficiency. The Commonwealth has sought to counteract this through energy efficiency and demand response programs as outlined in Act 129. While generally considered a success, Act 129 contains only penalties for non-compliance with no upside incentives for meeting or exceeding goals. Coupled with relatively low spending caps, the current regulatory structure dis-incentivizes utilities from choosing low-cost, demand-side resource options to meet consumer energy demands.

PBR would align ratemaking and utility incentives to allow utilities to pick the lowest cost resource while earning revenue. For example, if a new building is built causing neighborhood load to exceed local capacity, through a PBR model, a utility can either choose to upgrade the transformer to accommodate the additional load or they can assist nearby older buildings in upgrading their equipment to reduce demand, thereby staying within capacity constraints and minimizing costs to consumers. Traditional ratemaking models limit such choices. Under current rules, the only tool available to utilities would be to build more assets to accommodate new load. In addition, as data on energy usage becomes more pervasive, consumers, utilities, and third-party energy efficiency providers are likely to find new value propositions that enable deeper energy efficiency savings.

Affordability

While utilities may earn revenue for engaging their customers and improving customer satisfaction through PBR, energy service providers should ensure their customers have access to tools to keep their utility bills affordable. Energy efficiency and demand response programs empower customers to better understand and manage their energy usage. Tools such as high bill alerts – where customers receive a notification if they are on track to receive a high bill, paired with energy saving tips to help them avoid a high bill – time-varying rates, energy efficiency incentives, smart thermostats, and demand response programs all enable customers to manage their energy usage to lower their bills.

Also, as PBR drives improved system operations, this will help drive down costs.

POTENTIAL PBR METRICS FOR CUSTOMER EMPOWERMENT

While there are countless metrics that could be used to measure, track, and evaluate customer empowerment, it is easy for these metrics to operate in silos. Therefore, we suggest establishing a straightforward, comprehensive framework that evaluates customer **Reach, Usage, Effectiveness, and Feedback** (RUEF) to track the progression of utility engagement from the customer's perspective. The RUEF framework can incorporate more narrowly focused data points as well as broader metrics.

Each piece of the RUEF framework should be capable of being measured independently, resulting in a system that accurately captures the customer journey, as described here:

Reach

Reach should measure customer access to information and customer awareness. One measure would be the percentage of the customer base that has access to customer engagement communication (e.g., home energy reports, emails, mailings) or an online Customer Engagement Portal. Basic functionality for the Portal could include a customer's energy usage over a certain period of time (e.g., month), benchmarking against prior weather-adjusted usage and the usage of similar customers, recommendations for more cost-effective energy use (e.g., lighting retrofit or solar installation), the amount that could be saved from implementing the recommendation, basic analytical tools (such as weather impact analysis and rate comparison tools), and links to DER providers.

Usage

After providing universal access to engagement tools, the next step is to ensure that customers are making use of them. A Usage metric could be built around the number of customer interactions (e.g., email open rates, clicks through software, web interactions, logins through customer self-serve portals, call center interactions). Given the expanding set of touchpoints between utilities and their customers, which may include channels such as social media and SMS, it will be important to create metrics that track the percentage of customers reached who have interacted with utility engagement tools. This could include the percentage of customers who have access to a Customer Engagement Portal and are clicking on links to DER providers, or who replied to an email notification that summarized energy efficiency opportunities. These measures would indicate how well utilities motivated customers to leverage their information to understand their service and program options on the way to taking action.

Effectiveness

This metric would track the number of customers who "took action" towards meeting the above Customer Empowerment goals. The metric would measure how well utilities have removed transaction hurdles and motivated customers to manage their energy consumption based on more than just price signals, and could comprise two individual measures of effectiveness:

1. Assessment: actions that lead to customers receiving personalized energy recommendations from an audit, clean energy assessment or email/mail report.
2. Actions: Based on measurement of customer participation in programs, such as a DR program, a behavioral program with verifiable EE savings, or investment in energy efficient products or services, customer sited DER, rooftop solar, etc.

Feedback

The final piece of the RUEF framework tracks customer feedback, both positive and negative. The metric assesses customer reactions to and satisfaction with utilities' engagement tools and program offerings (e.g., based on a 1-5 scale). The Feedback metric measures whether customers are paying attention to the engagement tools, allows utilities to gauge whether they have designed a product that is easy to use and simple to understand, and gives them a basis for improving those tools.

OPERATIONAL EFFICIENCY AND RELIABILITY

Generally speaking, utilities have done well in building and operating energy infrastructure that is safe and reliable. Energy distribution is also generally efficient, but there are opportunities to reduce losses, particularly during times of peak demand, when distribution losses are highest. Moreover, asset utilization on the distribution system remains relatively low especially when considering the capital-intensive nature of energy delivery. Thus, providing utilities with incentives to improve operational reliability and efficiency holds the potential to improve affordability while simultaneously improving the quality of service. Operational efficiency and reliability can be further broken down into several areas.

Reliability and Resiliency

The digitization of our economy is leading to an increased focus on energy system reliability and resiliency. Universities, laboratories, cities, military installations, and data centers, among other users, require reliable, resilient energy for mission critical activities and large loads. Others rely on resilient energy to function at the workplace and at home. Maintaining access to electricity and rapid restoration of outages are paramount, especially when facing natural disasters or threats of terrorism. The problems are compounded when also dealing with aging infrastructure.

For these reasons, utilities are typically measured on the reliability and resiliency of their delivered electricity service, and in some cases there are financial penalties for poor performance. Yet there may also be ways to encourage improved performance. Broadly speaking, utilities should take measures to prevent outages, and when outages occur, utilities should also be incented to shorten recovery periods.

Disruptions can be less frequent and shorter in duration if the energy system is robust and designed with recovery in mind. Today, 500,000 people a day experience outages and the cost is remarkable: $119 billion/year in productivity losses due to power disruptions and $25-70 billion/year for weather-related outages.[12] Protecting and improving the resiliency of Pennsylvania's grid in the face of natural disasters and manmade threats is an ongoing effort that requires continued vigilance to create an impact-resistant system.

There are numerous ways to improve reliability and resiliency. Fuel and resource diversity lessens the impact of any individual fuel shortage. Upgrading aging equipment will lessen mechanical failures and allow new IT technologies to offer additional services. Moreover, some of the same technologies that

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12 http://www.cnn.com/2010/TECH/innovation/08/09/smart.grid/. For weather-related outages: Congressional Research Service study (Campbell 2012).

enhance reliability and resiliency can also provide other benefits to system efficiency and flexibility.

Safety and Security

Outages are not only an inconvenience; they can be a safety and security risk. The loss of lights and traffic signals in a city causes chaotic disruptions, while the loss of heat or cooling can be a life or death situation for the elderly or vulnerable members of society. A poorly protected electric system is also a safety and security risk. Open access to critical systems can lead to intrusions from hackers and people who are unauthorized to control grid operations. It also may expose private data and security vulnerabilities.

As part the shift to "Big Data" and connected devices, utilities are transitioning from an antiquated IT system to a more secure and efficient modern IT system. Incorporating sophisticated IT hardware and software allows for threat detection and mitigation against weather emergencies and security threats. Emerging industry standards ensure advanced energy technology is protected through encryption, authentication, and "hardened" against accidents or malicious attacks. New technologies will be required to meet more rigorous levels of security standards. Newer technologies are also more adaptable through updates or patches, as needed.

Thus, cyber security has emerged as a key aspect of safety and security. With the right skill, someone can hack a utility and damage systems that control the grid and affect the economy and security of a country or region. Access control and data protection are crucial to prevent hackers from penetrating control system vulnerabilities like network architecture loopholes, unsecured and outdated hardware, and software. System integrity is also crucial because proprietary devices once considered for specialized applications are now vulnerable.

Weather/emergency preparedness is another key component of safety and security. One of the ways for utilities to enhance safety is through more accurate weather forecasting and tracking services, for example, by combining more granular forecasted storm parameters, such as high winds and lightning, with utility asset data to identify areas with the greatest potential for damage from an approaching storm. This information can be used to communicate with customers and preposition crews and equipment to speed up restoration efforts.

Operational Efficiency

Grid technologies that improve operational efficiencies have grown and improved over the past decade, including technologies that provide greater situational awareness and finer control over grid operational parameters such as voltage and power factor. A smarter system architecture can present an integrated flow of information so that operations and analysis of the distribution grid are simplified and high-quality decisions are enabled. Utilities should leverage advanced technologies to improve how they deliver electricity from generation to load efficiently and with reduced losses. In short, utilities should be measured on the efficiency of their operations.

System awareness is the first step to identifying and improving operational efficiency.

Integration of field sensors (smart meters, other sensors) into grid operational systems enables situational intelligence and aids in the transition of the digitization of field asset information. Updated hardware and software applications allow remote monitoring and measuring of equipment performance out in the field. Predictive models identify weak assets and proactively suggest replacement. Systems awareness can also identify the source of an outage, visualize any reported hazards, obtain a count of how many customers are out, and determine where the crews are that can be dispatched to help.

Automation also enhances operational efficiency. The size and complexity of the distribution network model presents a management challenge. The utility must be able to handle the large quantity of information and must also quickly sort through and identify the monitored data points with operational relevance. The challenge is to avoid flooding the operators with a deluge of information. By automating easy decisions, this frees up time for operators to focus on the more complex ones.

Operational efficiency also relates to the ability to improve overall asset utilization. With the grid sized to meet the single highest peak hour of the year, much of the capacity of the system goes underutilized. Given the capital-intensive nature of energy delivery infrastructure, this results in relatively poor capital asset utilization. Thus, the ability to reduce peak demand and shift load can avoid or defer additional capital expenditure and increase the average utilization factor for sunk investments, to say nothing of the benefits of reduced wholesale prices when peaks are reduced. This, in turn, can lower the cost of service, reduce distribution losses, and reduce the likelihood of outages or poor power quality resulting from stress and strain on the system, particularly during periods of high demand.

Distributed Energy Resources (DER)

Traditionally, utilities have simply invested in new T&D infrastructure and generation resources to meet rising demand or other system needs. Across the country, utilities are increasingly being directed to consider non-wires alternatives (NWAs) that can meet these needs as well as offer additional benefits. In addition, a growing priority for utilities is the integration of higher levels of variable renewable energy sources without compromising network reliability.

At a minimum, DER that is interconnected to the system must not negatively interfere with grid operations, expose the grid to cyber security risks, or create safety hazards for line workers. Beyond that, rather than simply interconnecting DERs, utilities should *integrate* DERs in such a way as to meet new demand and avoid investing in traditional capital-expensive solutions. Utilities could then be measured on how well they leverage these DERs. Some examples of DERs are described below.

Demand response (DR) programs encourage customers to adjust their consumption in response to pricing signals or curtailment requests, thus providing benefits to these customers in the forms of lower costs, but also benefitting the whole system. Customers that have or develop this flexibility, whether by curtailing loads or using on-site generation, can become important resources to help balance and manage the grid.

Solar and wind technologies rely on abundant natural resources and offer stable and predictable long-term energy costs for utility customers. Smart inverters within solar power systems can also provide grid support functions such as frequency regulation and power smoothing. Energy storage can be utilized as an effective resource to provide load shifting, peak reduction, and to add stability, control and reliability to the electric grid.

Microgrids optimize the use of different types of DERs and can function either autonomously (islanded) or in coordination (synchronized) with the main grid. They are robust, always-on assets that provide primary energy services to either a single facility or campus, or a collection of residential, commercial, and industrial customers. A microgrid can provide backup generation, but generally offers a wide range of services and benefits.

POTENTIAL PBR METRICS FOR OPERATIONAL EFFICIENCY AND RELIABILITY

Utilities are already measured on the reliability and resiliency of their delivered electricity service using established metrics such as SAIDI and SAIFI. Simply measuring the number of outages does not accurately capture other important characteristics, such as the severity of the outage (in terms of type, quality, time, and geography). Customer average interruption duration or the number of customers experiencing multiple interruptions could prove to be better metrics. Another good metric would be to measure the speed of the restoration following an outage: How quickly did the utility detect the cause and location of the outage and dispatch services to restore service?

Utilities could also be measured on the security of their system, although arguably the security of a utility system could be considered a threshold requirement. Confirming that utilities are up-to-date on their standard certifications and protocols would be a strong indication of their security. Requiring utilities to incorporate weather forecasting could also provide benefits.

Utilities could be measured on the efficiency of their operations. Electric usage intensity could measure this, but could also be affected by outside factors. Transmission and/or distribution losses would be a key metric. Power quality metrics could be developed to measure how efficient the grid is operating (e.g., peak to peak voltage, phase imbalance). Specific targets for peak load reduction or load factor improvement could also be developed.

Utilities could also be measured on how well they interconnect, integrate and leverage DERs. For example, the inclusion of DERs can be measured by share of market and/or generation. It should also possible to measure avoided investments in distribution, transmission, and generation, for example, by comparing baseline investment plans to actual spend and identifying where DER was able to avoid the need for a planned investment. For demand response specifically, the following metrics can measure success: amount of demand reduced from DR programs, number of peak / critical periods (lower is better), demand response market participation, amount of consumer outreach, or the number of communication channels for DR.

ENVIRONMENTAL SUSTAINABILITY

Public utilities can play an integral role in achieving the environmental policy objectives of the Commonwealth. In recent years, the most prominent environmental policy goal has been the reduction of greenhouse gas (GHG) emissions from the power sector though the EPA's Clean Power Plan. Additionally, the reduction of criteria air pollutants, land reclamation, and increased deployment of low- and zero-emitting energy resources, are all part of the Commonwealth's environmental policy objectives.

Unlike other performance objectives, achieving environmental objectives typically results in non-energy benefits (NEBs), such as public health and climate stabilization, which can be difficult to quantify and have not historically been reflected in utility revenue recovery. Therefore, evaluating utility performance in achieving environmental outcomes requires strong Evaluation, Measurement and Verification (EM&V) procedures and suitable performance metrics to reach intended policy objectives. The following are performance categories that can be considered.

Energy Efficiency (EE) and Conservation

EE is an important tool for GHG and criteria air pollutant reductions. Through incentives and behavioral, equipment, and energy management measures, EE lowers energy demand, and in turn reduces air emissions at the stacks of power plants. Moreover, the low cost of energy efficiency makes it a valuable tool for achieving affordability goals. At the moment, Pennsylvania does not provide any positive incentives that align utility financial interests with the overall goal of energy efficiency. As such, efficiency is treated a cost to be recovered, rather than an investment that generates revenue. Including EE as a method by which to meet environmental policy goals requires that utilities see expanded deployment of EE resources as a new stream of revenue.

Comprehensive EM&V procedures are also important in using EE and conservation as tools for meeting environmental objectives. On the one hand, PUC staff is focused on utility spending, cost recovery, and the impact that efficiency programs have on customer bills. On the other hand, air regulators typically quantify emissions reductions at the stack of power plants, and do not usually look "beyond the fence line" for emission reductions. Therefore, from an air regulator perspective, it is difficult to measure the impact that demand-side EE has on the stack emissions of power plants. Depending on the future of the Clean Power Plan (or future GHG policies more broadly), there may be significant value for Pennsylvania in bridging this divide, and providing the incentives and tools necessary to quantify the GHG and other environmental impacts of energy efficiency through strong EM&V.

Gas Conservation

Like electric EE, gas conservation provides a host of benefits, which include reduced demand, lower customer bills, and deferred capacity upgrades. By installing more efficient residential and industrial equipment, gas consumption, and in turn CO_2 emissions, decrease. Equipment upgrades in particular can have a significant impact on gas consumption by replacing decades-old equipment with new high-efficiency models. However, there are some notable differences between gas conservation and electric EE as it relates to meeting environmental policy goals in the Commonwealth.

While regulated utilities, including natural gas distribution companies (NGDCs), must provide a low-income usage reduction program (LIURP), NGDCs are not subject to the larger Act 129 efficiency mandates. Some NGDCs have voluntarily expanded upon this minimum requirement, and used it as the basis to provide an enhanced LIURP program and other conservation offerings. Despite the lack of a legislative mandate, a benefit of gas conservations exclusion from Act 129 means that incentives for gas performance do not need to overcome the statutory barriers of existing conservation frameworks.

Brownfield Redevelopment

Although not a focus on this paper, we do include here a discussion of brownfield redevelopment. Redevelopment of abandoned and contaminated land provides benefits for local public health and economic development. Pennsylvania's Land Recycling Program, often called "Act 2," is the Commonwealth's voluntary site-remediation program that encourages developers to perform cleanups of contaminated and often abandoned industrial properties (brownfields). While brownfield development provides a host of benefits, there are a number of challenges in cleaning up brownfields, which include liability concerns for developers and future owners, technical concerns, time and financial concerns, and planning considerations within the broader community. Oftentimes, the potential downsides of brownfield development can outweigh the benefits, even when leveraging funding incentives provided by the EPA and the Pennsylvania DEP and DCNR.

While site remediation is not tied to the energy sector as explicitly as GHG emissions or other environmental metrics, there are a number of brownfield sites owned, or previously owned, by Pennsylvania utilities before the restructuring of electricity markets. These properties often include decommissioned power plants, substations, and coal refuse locations. The redevelopment of these properties by utilities represents a desirable performance area that could be included in PBR.

POTENTIAL METRICS FOR ENVIRONMENTAL SUSTAINABILITY

There are several metrics by which to track and reward utility EE performance. For example, if a utility program offers energy audits, the appropriate metric would be the number of energy audits completed. Many incentive programs can also be measured by the amount of funding spent. There are also shared net-benefit metrics, which allow recovery on a portion of the customer benefits provided by an EE program. In the context of GHG reductions, the relevant utility metric would be either energy savings, or direct GHG reductions attributable to a utility's efficiency program.

A utility's performance in contributing to energy efficiency is often measured by the actual amount of energy reduced by their efforts. This amount of energy consumption reduced is measured by an energy unit – often kilowatt hours – over a unit of comparison, often square feet or per capita. The numerator may also be specific to the energy fuel type, for example therms for natural gas. The denominator in this energy metric is also important in providing accurate comparisons across different buildings and energy end uses. Two of the most common denominators to use for energy efficiency metrics are building square footage, also known as Energy Use Intensity (EUI), and per capita.

A kWh per capita or per customer metric is easier to calculate as the number of utility customers is often known or easily estimated. It is necessary for both of these metrics to control for factors that are outside of the utility's control in determining energy consumption. These external factors include weather and the economy's performance, both of which can be accounted for with proper adjustment methods.

Although more difficult to quantify, utility EE performance could also be based on calculated GHG reductions. A basic version of this metric is already tracked by the Pennsylvania Statewide Evaluator (SWE) for the Commonwealth's Act 129 energy efficiency program. In the SWE, CO_2 emissions are calculated by multiplying cumulative MWh program savings by a 1,707 pounds of CO_2 per MWh conversion rate based on the latest available PJM emission report of the marginal-off peak annual CO_2 emission rate. This is similar to the EPA's recommended equivalency calculation, which uses the Emissions and Generation Resource Integrated Database (eGRID) U.S. annual non-baseload CO_2 output emissions rate to convert kWh into units of CO_2 emissions.

In Pennsylvania, gas conservation programs typically focus on residential weatherization and equipment rebates, both of which decrease overall gas consumption. As with electric EE, metrics for environmental performance of gas conservation can include both decreased consumption and GHG reductions. Total gas savings can be expressed in therms or thousand cubic feet (MCF) of natural gas divided by square-footage, or per capita, which can then be compared against a baseline measure.

Measuring CO_2 reductions attributable to gas conservation can be determined by applying the CO_2 emissions rate per therm or MCF using the average heat content of natural gas provided by EIA. Total CO_2 emission reductions could then be calculated by multiplying that rate by total gas savings.

As with other areas of environmental performance, putting a monetary value on the local environmental, public health, and economic development benefits of brownfield remediation is difficult. Moreover, performance metrics for brownfield redevelopment typically focus on cleanup classifications, and are not clearly linked to utility activities. One potential metric would be to identify total utility spending on brownfield redevelopment, then use that as a starting point to either modify utility ROE or cost recovery.

MARKET INNOVATION

Achieving the vision of a 21st Century Energy System in Pennsylvania requires specific activity by the distribution utilities to achieve the needed market innovations. These advances fall into five categories, defined as follows:

Market Animation

Innovation in energy technologies, services, and programs will develop alongside infrastructure investments. The extent to which investments enable and/or drive market opportunities will in turn support Pennsylvania's desire for economic growth in the energy sector, especially with regard to new technologies. Creating animated 21CES markets implies that customers will increasingly be aware of and adopt DER technologies and services, and use DER technologies in such a manner as to optimize their value to the grid and to the customer. It will also require market transparency to ensure that consumers have fair access and sufficient confidence that participation will provide them value. Distribution system and customer facing DER technologies support the utilities' ability to provide visibility, communications, and control functionalities needed to animate the DER market and transform it from being reactive to transactive.

Leverage Available Resources

A key tenet of 21CES is extending the grid to maximize the overall efficiency of a system that includes resources on both the utility's and the customer's side of the meter. Generation goes beyond large centralized plants to include multitudinous distributed generators, energy storage systems, and other distributed energy resources. Resource adequacy goes beyond traditional power plants to include both physical resources – distributed generation, storage, and others – as well as customer efficiency investments and demand response. A primary goal of 21CES is to achieve Pennsylvania's availability and reliability goals at the minimum total cost to society, including allowing for third-party resource investments that can be leveraged for all energy consumers.

Third-Party Engagement

Third parties provide the opportunity to meet Pennsylvania's 21CES goals using competition to continuously drive higher quality and lower cost in products and services, as well as take advantage of third-party capital from the perspectives both of reducing risk for utilities and of providing access to new capital sources. To best serve consumer requirements, utilities can design and operate systems that are adaptable and supportive of third-party investments that increase both the system and economic efficiency of the fully integrated grid. Such efficiency will improve via more cooperative and productive arrangements among regulated utilities, non-utility developers, and consumers.

Data Access and Exchange

Access to energy consumption data is important to all sectors. Customers should have ready access to the information that is collected about their own usage. Understanding how and when a customer uses energy is critical to being able to manage that usage. For large commercial, industrial and multi-family consumers, detailed usage information facilitates benchmarking and permits optimization of building management systems. Smaller customers can also benefit from ready access to detailed usage data – whether the energy management system consists of a fully automated control system, a simple programmable thermostat, or a decision to vary the hours of operation for a home appliance. However, in order to benefit, customers must have access to the information in a usable format, an understanding of the value of the information and access to products or services that empower them to act on the data. Third parties will play a crucial role in optimizing customer participation, as well as investing in distributed energy resources and improved access to data for these market participants. On the customer side, such access will enable energy service providers to deliver better and cheaper offerings. On the investment side, access to data about distribution planning and existing or imminent grid constraints will enable developers to maximize the value to the grid by locating new resources where they are most needed. The regulatory framework must balance that usefulness with appropriate protections related to individual privacy, critical infrastructure, trade secrets and other confidentiality concerns.

Interconnection

The performance of interconnection efforts directly impacts DER deployments. Interconnection standards, though they are essential to provide for the safe functioning of the grid, can be expensive and time-consuming to comply with. A well-developed and standardized performance expectation sends a strong signal that Pennsylvania values DER.

POTENTIAL PBR METRICS FOR MARKET INNOVATION

Several potential metrics can be used for measuring market animation. In respect to market animation, there are many metrics that would help measure the state(s) of market opportunities. Metrics could include those that that serve to assess the transparency of market data and the processes for ensuring fair access. Consumers' ability to access pricing and price signals, such as time varying rates, can be measured to ensure a variety of value propositions have market opportunities. Metrics that assess the administrative aspects of markets, such as the ease of access to markets to participants and the efficiency of dispute resolution, help to ensure functional markets. Lastly, market liquidity metrics would help monitor and reward stability.

Metrics that measure the ability to leverage available resources can include both demand and supply considerations. A metric that indicates levels of third-party resource deployment shows attempts to maximize efficiency from utility and customer resources. Additionally, metrics could assess how resources are leveraged in integrated resource planning, such as consideration of non-wires alternatives and the integration of demand and supply side resources.

Third-party engagement metrics should measure opportunities for competition. Examples may assess the nature of grid services tariffs and the standardization and streamlining of procurement of non-tariffed grid services. Metrics could also center on awareness and ease of access to market tools for third parties (e.g., tariffs, rules, system data, interconnection processing).

Data access and exchange metrics should assess the provision of system data for a variety of applications. This may include DER hosting capacity, location and expected timing of grid constraints, both short- and long-term, and other important factors. Metrics could also assess provision of consumer data such as consumption, bill amounts, default or competitive service options, utility tariff classification, and rates. Other metrics may include the timeliness of data request responses, automation of data exchanges, customers' ability to access data through self-service tools or application programming interfaces (APIs), and/or compliance with standards (including consistency across utilities and timely updates as new versions of standards are adopted).

Interconnection metrics may assess automated processing of applications for smaller projects (for example, under 50 kW), the standardization and streamlining of processing of applications for projects above 50 kW, and speed of processing interconnection requests. Satisfaction with the interconnection process could also be assessed.

PRIORITIZING PERFORMANCE METRICS

The foregoing discussion suggests that there are many potential metrics from which to choose, and thus, some prioritization is necessary to make the implementation of PBR manageable. In doing so, regulators and other stakeholders should focus utility performance objectives where there is most need for improvement, where there are opportunities to pursue regulatory priorities, and where there is opportunity for change. As articulated above, the advanced energy community believes performance metrics should serve as motivating instruments for the utilities to improve customer engagement, operational reliability and efficiency, environmental sustainability, and market innovation.

Within these four areas, many metrics are possible. Therefore, the Working Group has developed what it believes is a reasonable set of initial metrics. Experience in other states with PBR suggests beginning with a few, clear metrics.[13] While metrics should obviously be aligned with regulatory policy priorities, the Working Group considered two other basic criteria in developing a recommended list of initial metrics. These were, (i) the ability for near-term implementation, and (ii) the ability of individual metrics to inform multiple areas of performance within the four categories discussed above. While further analysis would be required within the context of a regulatory proceeding on PBR to refine and adjust the metrics, we believe that the metrics described below provide a good starting point for moving the PBR discussion forward in Pennsylvania.

Table 2 summarizes our recommendations for metrics, which are both implementable in the near term, and are linked to value across multiple categories of performance. We believe these provide the best opportunity for the Commission to take meaningful action to attempt to align the behavior and financial interests of regulated utilities with public interest objectives.

The selected performance metrics must also reflect the ability of utilities to control outcomes related to the metrics – the more control a utility has, the more responsible it should be. This allows the metrics to serve as an effective management tool. Of note, all prioritized metrics impact the Customer Empowerment performance category. Advanced energy technologies enable customer interaction and benefit, and the utility has a vital role in enabling the use of those technologies. Under PBR, the value proposition between utilities, third parties and customers becomes clearer, as utility objectives are more clearly linked and aligned to the energy needs of Pennsylvania's businesses and residents.

Data access. Timely data access is critical for achieving many performance objectives. Data access empowers customers (and their designated third-party providers) to make energy decisions consistent with their budgets and values, allows for consumers to contribute to operational reliability and efficiency, enables

[13] For example, New York selected four metrics for initial inclusion in its "Earnings Adjustment Mechanisms" as part of its Track 2 Order.

sustainable consumption options, and provides opportunity for significant market innovation. Data access crosses residential, commercial, and industrial classes.

Energy efficiency. Tracking energy usage and savings is a longstanding performance metric across utility regulation. Saving energy and/or altering usage patterns provides opportunities for consumer empowerment, enables reliable grid operations, and reduces environmental impacts from usage. The data to support an energy efficiency metric is becoming more widely available. Further, utility actions can readily be linked to increased demand reductions, providing a direct link to performance.

System Efficiency. Measurement of peak load reduction and peak load divided by average load would provide useful tracking of whether the utility is building out a resilient, reliable, efficient, system. Efficiency is related not just to operational efficiency but also capital asset utilization. Since lowering peak load and improving load factor cannot be achieved without active customer engagement and greater use of DER, this metric would also provide useful information in those areas. Measuring both peak load reduction and the peak to average ratio would provide information not just for peak reduction technologies (e.g., DR and DG), but also energy efficiency and energy storage, which would create opportunities for multiple DER technologies. We also note that the adoption of these system efficiency metrics would not replace the need to continue to track existing reliability metrics.

Third-party resource deployment. The deployment of third-party resources indicates that customers and their third-party providers are co-investing in the grid. Resource investments may contribute to optimization of energy use, represent alternatives to traditional utility investments, and indicate that the utility is effectively using markets to meet the needs of Pennsylvania consumers. A related metric that could be tracked is avoided or deferred utility investment resulting from deployment of non-utility DER.

Interconnection. Related to third-party investment, the number of interconnection requests, and appropriate processing of those requests (e.g., timeliness) are important utility responsibilities, and ready opportunities for monitoring performance. Interconnection of advanced energy technologies reflects customer empowerment, could improve reliability and resilience for the utility (with the notion that a more distributed grid is a more resilient one), and reflects a critical utility role in fostering market innovation.

Reach, Usage, Effectiveness, and Feedback. We view this framework as an essential element of making the utility more focused on the customer. This, in turn, is likely to lead to improved outcomes across all other performance areas.

Table 2: Recommended Performance Metrics

Performance Metrics		Performance Category				Sample Metrics
Metric	Description	Customer Engagement	Operational Efficiency and Reliability	Environmental Sustainability	Market Innovation	
Data Access	Consumer access to standardized and actionable energy consumption data; Third-party access to system data	✓	✓	✓	✓	• Timeliness of data request responses • Automation of data exchanges • Ability to access data through self-service tools or APIs
Energy Efficiency	Quantifiable reductions in usage, including periods of peak demand	✓	✓	✓		• kWh and therm reductions relative to baseline (gross or per capita)
System Efficiency	Combination of peak demand reduction and average system utilization	✓	✓		✓	• Peak load reduction (% or MW) • Ratio of average load to peak load (load factor)[14]
Third Party Resource Deployment	DER deployments by third parties (including on behalf of customers)	✓	✓	✓	✓	• MW of DER deployed (can distinguish by type) • Ease of access of market tools for third parties
Interconnection	Volume and process speed of filling requests to connect resources to the electricity system	✓	✓		✓	• Speed of processing valid interconnection requests • User satisfaction with interconnection process
Reach, Usage, Effectiveness, Feedback	Framework for customer empowerment metrics	✓	✓	✓	✓	• Percentage customers that has access to customer engagement communication • Number of customer interactions

[14] Load factor should not be used in isolation. Moreover, we expect peak load reduction will be the more prominent metric to track.

THE PATH FORWARD FOR PENNSYLVANIA

Approaching PBR will require the consideration of the Commonwealth's unique legal, institutional, and regulatory environment. As discussed previously, moving forward on PBR in Pennsylvania will require reexamining elements of the regulatory framework and ratemaking process, including regulatory oversight, benefit-cost analysis, ratemaking and cost recovery, and rate design. By leveraging the progress made so far, Pennsylvania has a clear path forward.

REGULATORY RESOURCE OPPORTUNITIES & LIMITATIONS

Over the past decade, Pennsylvania has taken a number of actions that have laid the foundation for implementing PBR. Using its broad grant of authority from the Public Utility Code, the PUC has the ability to facilitate a number of required PBR elements, including data tracking, smart metering infrastructure, energy efficiency, distributed energy resources, and others. At the same time, Pennsylvania's regulatory environment is unique, and there are a number of limitations in the Code that may prevent the PUC from aggressively pursuing PBR absent statutory changes from Pennsylvania's General Assembly.

OPPORTUNITIES

The Pennsylvania Public Utility Code contains an explicit grant of authority for the PUC to pursue PBR. The Public Utility Code grants the PUC the authority to "use performance based rates as an alternative to existing rate base/rate of return ratemaking. . . ."[15] Further, the PUC is vested with discretion to decide what factors it will consider in setting or evaluating a utility's rates.[16] The PUC has general administrative power and authority to regulate all public utilities doing business within the Commonwealth, and has the power and duty to enforce the Public Utility Code.[17] This explicit grant of authority empowers the PUC to consider new and innovative forms of ratemaking in lieu of existing ratemaking methodologies.

Additionally, the Public Utility Code empowers the PUC to consider performance factors, like the metrics outlined in this paper, in the setting of utility rates. Specifically, 66 Pa. C.S. § 523 empowers the PUC to consider utility performance in the setting of rates including any "relevant and material evidence of efficiency, effectiveness and adequacy of

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[15] Section 66 Pa. C.S. § 2806 (i).

[16] Popowsky v. Pennsylvania Public Utility Com'n, 683 A.2d 958 (Pa. Commw. Ct. 1996).

[17] PECO Energy Co. v. Township of Upper Dublin, 922 A.2d 996 (Pa. Commw. Ct. 2007).

service."[18] Thus, the PUC can take actions to establish PBR.

EXISTING BUILDING BLOCKS

Pennsylvania already operates a number of programs and initiatives that can serve as the building blocks for PBR implementation. These include:

- *Energy Efficiency Programs*: This is a natural starting point for establishing metrics on energy efficiency and customer engagement, and for utilities to build upon.
- *Alternative Energy Portfolio Standard*: Includes technologies that would be subject to metrics around DER deployment and interconnection, as well as environmental sustainability.
- *Advanced Meter Installation*: AMI provides a critical technology and market platform for utility activities that would be subject to performance measurement.
- *Distribution System Improvement Charge (DSIC)*: As efforts to modernize the grid continue, this source of funding could be used to move the grid in directions consistent with the desired outcomes of PBR.
- *Fully Forecasted Future Test Years*: This is consistent with the forward-looking nature of ratemaking under a PBR framework.
- *Alternative Ratemaking En Banc Hearing*: Development of PBR could build upon information covered in this hearing.
- *CHP and DR Integration*: These technologies are an important part of the options that would be covered under DER deployment and interconnection metrics.

LIMITATIONS

While it is clear that Pennsylvania has a strong foundation upon which to build, we have also identified the following limitations that could be addressed within the larger effort to implement PBR:

- Pennsylvania does not have a requirement for Integrated Resource Plans (IRPs). IRPs, or given the restructured nature of the market, Integrated Distribution System Plans, would be a powerful tool for meeting PBR metrics.
- Pennsylvania does have a Long Term Infrastructure Improvement Plan (LTIP) requirement, but it is only a precondition for the DSIC. There may be an opportunity to align the LTIP with an outcomes-based approach like PBR.
- Energy Efficiency programs contain only penalties, not positive incentives. This should be reconsidered within the context of PBR.

NEXT STEPS

Implementing PBR in Pennsylvania needs to be considered in the context of a utility system that is becoming increasingly complex. This suggests that combining a move towards PBR should also involve consideration of adjustments to the utility planning process as a

[18] Section 66 Pa. C.S. § 523(b)(7).

whole. This includes the concept of forward-looking rate plans, as discussed above, but also making more transparent the distribution system planning process that precedes the filing of investment plans. We believe that this should include greater involvement early on by various stakeholders who will ultimately play an integral role in the utility being able to meet its performance targets.

We also suggest an open and transparent process for the setting of performance targets and the associated incentive levels. Utilities might understandably try to set easily achievable targets, whereas the Commission or other stakeholders may argue for targets that seemed unachievable. Engaging in a collaborative process, with the overarching policy objectives to guide the discussions, is more likely to result in a set of targets and incentives that will promote success. To support the PBR framework described in this paper, utilities and the Commission will need to agree on a form of system planning that can better identify the benefits that come from the use of advanced technologies and greater customer engagement.

In terms of next steps, we believe it would be beneficial to conduct educational webinars or workshops for Commission staff on PBR as a precursor to opening a policy proceeding on

PBR. The proceeding would allow a range of stakeholders to contribute to the public record, which could set the stage for formal Commission action. Although the authority appears to exist in statute, the Pennsylvania PUC has not taken a formal position with regard to its authority to institute PBR or other forms of alternative ratemaking methodologies. The good news is that the time appears right to do so. As detailed in this paper, a confluence of circumstances and conditions suggests that the opportunity is attractive and is worthy of consideration now. As the utility landscape has continued to evolve, Commissions throughout the United States have implemented adjustments to the ratemaking process, such as revenue decoupling, forward test years, and capital trackers. With more profound changes anticipated in the coming years, PBR offers the potential for a more comprehensive and flexible approach to meeting the challenges these adjustments were meant to address.

CONCLUSION

The utility sector is entering a period of significant change, driven by new technologies, evolving customer needs, environmental imperatives, and an increased focus on grid resiliency. The energy infrastructure and markets of the future will be more complex, they will include a greater number and variety of actors, and they will present technical and business challenges. If managed successfully, these changes present opportunities for greater customer choice and engagement, the creation of a more efficient and resilient energy system, and opportunities for utilities to embrace new business concepts that will sustain them in the decades to come.

In this whitepaper, a working group of advanced energy companies has identified opportunities to align the behavior and financial interests of regulated utilities with public interest objectives and consumer benefits, using performance-based regulation (PBR). Certain PBR options are within statutory power of the Public Utility Commission. Categories of performance, including customer engagement, operational efficiency and reliability, environmental sustainability, and market animation present near-term options for implementing PBR.

Regulatory frameworks should strive to align the behavior and financial interests of regulated utilities with public interest objectives and consumer benefits, and reward utilities for achieving well-defined outcomes (performance metrics), as opposed to simply incentivizing capital investment (inputs). PBR provides an opportunity to maintain reasonable costs, meet policy objectives, and craft a market structure to deliver an array of consumer benefits while offering utilities a financial incentive structure that is better aligned with the changing nature of utility service.

APPENDIX

PBR Examples/Cases

- Massachusetts: Energy Efficiency Program
- United Kingdom: RIIO (Revenue = Incentives + Innovation + Outputs)
- New York: REV (Reforming the Energy Vision) Proceeding

Massachusetts Energy Efficiency

- Every 3 years the Massachusetts Energy Efficiency Advisory Council (MA-EEAC) establishes targets for each utility
- Performance incentives based on savings (kWhs and kWs) and Cost-Effectiveness/Value
- Incentive payouts based on performance: Threshold (75% of target), Design (100%), and Exemplary (125%)
- Results 2013 – 2015: $80MM Performance Incentive for MA; 2016 – 2018: $100MM; in 2015, utilities invested $560M, produced $2.8B in benefits

Investor owned utilities receive incentives to pursue all-cost-effective energy efficiency, with an emphasis on program effectiveness. Targets are set by an independent body. The program is administered by the Department of Public Utilities and Executive Office of Energy and Environmental Affairs. Incentive plans carry over a three-year period, and are derived from a combination of savings, utility cost-benefit analysis, and market impact metrics. Clear funding sources are identified, and performance incentives are critical to program success. Policy implementers chose to engage stakeholders early, in order to establish performance incentives in a transparent process.

Enabling Legislation	Implementation Guidance
• Green Communities Act of 2008	• Department of Public Utilities Order 8-50-A • Massachusetts Energy Efficiency Partnership

U.K. Office of Gas and Electric Markets
RIIO: Revenue = Incentives + Innovation + Outputs

- 8-year planning horizon with caps on maximum revenues, with multiple review periods to review and reduce regulatory burdens
- Performance targets can come with automatic penalties
- Heavy incentive weighting at later points in utility programs
- Rate of return is based on total expenditures, including operational and capital expenditures
- Varying revenue and earnings sharing options which allow for different business models

The UK RIIO model aims to incentivize outputs that connect consumer desires of energy networks while facilitating transition to a more sustainable energy sector. The incentives can reach +/- 300 basis points. Higher returns are available to system operators that deliver energy services at lower costs. Performance "output" categories include customer satisfaction, reliability and availability, safe network services, connection terms, environmental impact, and meeting other regulatory obligations.

Enabling Legislation	Implementation Guidance
• Regulating energy networks for the future: RPI-X@20 Recommendations	• Handbook for implementing the RIIO model

New York REV - Reforming the Energy Vision Proceeding	
• Goals include development of new energy products and services, opening up economic opportunities, and reforming the role of utilities in energy service provision • Earnings adjustment mechanisms (EAM) serve to facilitate business model reform by providing performance incentives o Targets and rewards are in development; maximum reward initially indexed on 100 basis points, but paid out at fixed dollar amounts, not basis point adders • Highly involved stakeholder processes	
The New York Reforming the Energy Vision is a broad effort across government to modernize the state's energy system while facilitating economic growth. Implementing agencies include the New York Public Service Commission (PSC), the New York Energy Research and Development Authority (NYSERDA), the New York Power Authority (NYPA), and the Long Island Power Authority (LIPA). Categories of performance within the EAMs include system efficiency (peak load reduction and load management), energy efficiency, interconnection, and greenhouse gas reductions tied to implementation of the state's Clean Energy Standard. The PSC decided not to require an EAM for customer engagement, but if utilities are to be successful in other areas, the PSC argued that they will have to be successful at engaging customers. Some decisions on EAMs will need to wait until individual rate cases, which only occur every three years. Interestingly, the PSC views EAMs as a transitional strategy - as Platform Services Revenues (PSRs – new revenues derived from the provision of new services based on the grid as a platform) grow in importance, the importance of EAMs is expected to decrease.	
Enabling Legislation • Carried out by state agencies under existing statutory authority	**Implementation Guidance** • NY REV Track 2 Order, Earnings Adjustment Mechanisms