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How PBR can go wrong

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ABSTRACT

This paper is a cautionary tale for performance-based regulation (PBR) to serve the public interest. There are different reasons for why PBR may fail to benefit utility customers. This paper provides a numerical example that shows that setting the wrong benchmark can have unintended consequences. The main message is that knowing whether a utility achieves a desirable outcome may be harder than what first meets the eye.

1. Introduction

Many observers believe that performance-based regulation (PBR) can overcome the major shortcomings of traditional, cost-of-service regulation in serving the public interest. Regulators, utilities, legislatures and "green" groups have shown increased interest in PBR to address these shortcomings (Advanced Energy Economy, 2018; and Trabish and Herman, 2019). New public policy goals and objectives, and improved technologies partially explain this heightened interest. The concern is that presently utilities have weak or even perverse incentives to satisfy those goals and objectives.

Consumer groups in general are skeptical of PBR, and rightly so (Colorado Public Utilities Commission, 2020; and AARP, 2019). They see utilities exploiting their information advantage by manipulating a PBR mechanism to increase their profits or reduce their risk at the expense of their customers. Consumer groups tend to favor prudence reviews, audits, and regulatory lag to motivate better performance from utilities.

This article attempts to show that utility exploitation is a real possibility that regulators cannot ignore in reviewing and approving a PBR mechanism. When done correctly, PBR can benefit both utility customers and society. From a regulatory perspective, good performance depends on how well utility management employs its available resources to best foster the public good. My main message is that knowing whether a utility achieves this outcome may be harder than what first meets the eye.

2. The good side of PBR

When PBR focuses on a specific utility function, it has three basic components: (1) the target or standard, (2) the sizes of the rewards and penalties (e.g., the share of "gains" and "losses" allocated to utility shareholders and customers), and (3) the maximum rewards and penalties to the utility. It is a common form of PBR for energy utilities that goes back several decades (Joskow et al., 1986 and Johnson and Leland, 1985)

PBR explicitly allows utilities to recover certain costs based on their performance. Distinguishing features of PBR from alternatives to improving utility performance are its formula-based structure, its substitution for retrospective reviews, and the predetermined sharing of benefits (losses) between utilities and their customers from exceptional good (bad) performance.

PBR can strengthen regulatory incentives so that utilities perform better. Improved performance, in turn, can lead to lower rates over time, higher quality of service, fewer rate cases, and avoidance of excessive utility costs. These are all good things that benefit utility customers and society.

How could one dispute that this isn't a good idea? After all, regulation's central purpose should be to induce high-quality performance from utilities. Achieving this objective demands that regulators measure and evaluate a utility's performance that can lead to a detailed investigation, cost disallowance, or triggering of more robust regulatory incentives. Regulators can also determine whether utilities are satisfying targeted objectives like energy efficiency and clean energy.

3. Today's heightened interest in PBR

Performance can relate to all sorts of things: Reliability, safety, customer satisfaction, utility financial health, energy efficiency, costs for specific functions, power plant performance, innovation and asset

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management (Costello, 2010). Key elements in choosing a utility function are its importance to the public interest and the discretion of management to influence performance.

Many observers contend that the *status quo* or traditional cost-of service ratemaking is a poor fit in an environment where distributed energy resources, the smart grid, energy efficiency, high investment requirements, and energy storage prevail (Lowry et al., 2016). There is increased interest in the U.S. for PBR. This is especially true in states undergoing electric industry restructuring.

The issues are complex, sometimes latent, requiring much effort for stakeholder agreement on various aspects of a PBR mechanism. Regulators in several states are considering PBR in different forms, either for specific utility functions or comprehensive utility performance that would motivate utilities to achieve public-public goals and, simultaneously, enhance the value customers receive from utility service (Lowry and Newton, 2020). These mechanisms reflect a new ratemaking paradigm that (1) rewards (penalizes) exceptional (subpar) utility performance and (2) gives utilities incentives to advance customer and society-wide interests.

4. Challenges and downsides

Regulators face several challenges with PBR:

1. Selecting the PBR mechanism that best addresses the problem at hand; the regulator might require a PBR mechanism for a utility in response to its history of poor customer service or inflated maintenance costs;
2. Utility performance depends on both management competence and factors beyond a utility's control (Joskow and Paul, 2006 and Johnson and Leland, 1985);
3. Knowing the proper benchmark or reference point (e.g., peer group, a utility's past performance); this is extremely important to avoid the utility profiting in the absence of any benefits to its customers or enjoying an undue share of the performance gains from a PBR mechanism;
4. Accounting for the tradeoff between the different objectives; for example, low cost and high reliability (Costello, 2010);
5. Recognizing that the utility has an advantage in bargaining with the regulator, among other things, to determine the benchmark for rewarding or penalizing a utility; regulators, for example, lack the ability to determine the minimum level of costs compatible with a utility operating efficiently;
6. Determining the sizes of rewards and penalties; they should be high enough to induce improved utility behavior but not too high to have a significant effect on the utility's financial condition; and
7. Measuring and verifying the benefits; this task requires the regulator to calculate how the utility would have performed with a PBR mechanism; that is, a counterfactual analysis that predicts how the utility would have behaved in the absence of a particular PBR mechanism (Johnson and Leland, 1985).

Performance depends on two broad factors: The first is management competence; the second is market and business conditions, as well as other factors beyond the control of a utility. Proper use of PBR depends on the regulator's ability to separate out the effects of external and internal factors on performance.

For service quality, several factors influence its level, some internal to a utility's control, others outside its discretion. The challenge for regulators is to distinguish between these two factors. Without this divide, applying PBR becomes more difficult to justify and even counterproductive — for example, penalizing a well-run utility or not penalizing a poorly-run utility.

The classic problem for regulators is what analysts call information asymmetry (Joskow et al., 1986), where they observe only a utility's performance, not management competence in cost control, service quality, and other outcomes affecting customer welfare. It has two critical implications: The first is that utilities can misrepresent their performance to regulators. The second is regulators need to exercise caution in interpreting a utility's performance. The first implication may result in regulators setting a skewed benchmark or standard for a PBR mechanism that unduly favors a utility over its customers.

The utility will argue for a benchmark that will facilitate earning a reward and avoiding a penalty. The utility might reveal its cost opportunities to be lower than what they really are; for example, the utility would argue that it has certain constraints in reducing costs when, in fact, it has no such constraints. Utilities could recover all of their costs even when they acted imprudently.

One often-overlooked problem that should concern regulators is a PBR that advances a single objective while compromising one or more other objectives. It can, for example, motivate a utility to be more cost conscious at the expense of service quality, with an overall decline in the public interest: A utility can overperform in one area of operation because of stronger incentives relative to those incentives it faces in other operational areas, with an overall negative benefit to its customers.

The challenge for regulators is to determine what constitutes a well-performing utility. They also have to define what is acceptable performance; for example, what is the benchmark or standard that separates satisfactory from unsatisfactory performance?

A poorly structured PBR mechanism can even lead to unintended consequences. Specifically, strategic behavior or gaming by a utility can result in a zero-sum outcome or, worse, distortive utility behavior. The first outcome allocates all the benefits to the utility while producing no gains for its customers.

Distortive utility behavior is a product of the utility devoting excessive resources to the functional area targeted by the PBR mechanism, which decreases the overall performance of the utility; for example, driving up the average cost of utility service.

5. Numerical example of a biased benchmark

5.1. Hypothetical PBR mechanism

Assume that a regulator has approved an PBR mechanism that focuses on purchased gas. The mechanism has a cost-sharing arrangement, expressed as the following:

$C_f = C_a + s{\cdot}(C_b - C_a)$, or

$C_a{\cdot}(1\text{-}s) + C_b{\cdot}s$,

where C_f is the costs flowed through to customers, C_a equals the actual costs incurred by the utility, s is the sharing parameter [i.e., the share of cost savings (excesses) retained (absorbed) by the utility], and C_b equals the "benchmark" costs.

Let C_a equals \$100 million, C_b equals \$120 million and s is 0.2. Then, C_f equals \$100 million + 0.2·(\$120 million - \$100 million) = \$104 million. The results seem positive: The utility earns \$4 million in rewards and customers ostensibly receive benefits of \$16 million from lower gas purchasing costs, after adjusting for the utility reward. The assumption is that the "benchmark" costs would equal \$120 million, or the actual costs in the absence of the PBR mechanism. Customers pay the *actual costs* plus the *reward* to the utility (when $C_b > C_a$), or the actual costs minus the penalty to the utility (when $C_b < C_a$).

Customers benefit only when the reduction in actual costs exceeds the reward to the utility. So for customers to benefit from the PBR mechanism, $(C_b - C_a)$ must be greater than $s{\cdot}(C_b - C_a)$. It therefore seems, at least mathematically, that customers always benefit when the utility surpasses the benchmark, since s is less than one. But this assumes that $(C_b - C_a)$ represents the real cost savings from the PBR mechanism. This presumption may not hold if C_b, in fact, does not reflect what the utility's costs would have been in the absence of the PBR mechanism (which I examine below).

When contemplating PBR mechanisms, regulators need to consider the tradeoff between: (1) creating strong incentives for superior performance and (2) achieving a balanced distribution of economic gains (e.g., actual costs less than the "benchmark" costs) between the utility and its customers. Any PBR mechanism tries to balance these two objectives, implicitly setting a value for s that reflects the relative weights assigned by the regulator to create "high-powered" incentives and the assurance of sufficient benefits to customers.

Cost-sharing mechanisms such as the one presented above represent a compromise that provides better incentives for cost efficiency than cost-plus arrangements (for example when s in the previous equation equals zero) while lowering the chances that utility customers would fail to earn a reasonably small share of the total economic gain from exceptional utility performance (Joskow et al., 1986). At the other extreme, when s is one the regulator determines a target or fixed cost that the utility can pass through to its customers. The utility therefore has a strong incentive to manage its cost but the target cost may be set too leniently for the utility, allowing it to profit even when its behavior is unchanged. The utility would have an incentive to propose a high cost-target, which the regulator would either have to accept or reject in favor of another target.

Under the above PBR mechanism, a utility receives additional revenues from improved performance. For "equity" purposes, regulators should ask: What benefits do customers receive when utility performance improves? Do these benefits at least cover the additional revenues that customers have to pay? Although in many instances the benefits to customers may be non-quantifiable, regulators should have some general idea whether the benefits to customers from improved performance correspond to the additional revenues that a utility receives. The significance of customer benefits falling short of additional revenues is that the utility receives a windfall gain at the expense of customers.

The benchmark is crucial for dividing up the gains between the utility and its customers. A major task for regulators under a PBR mechanism is to set the correct benchmark. The wrong benchmark can derive from: (1) *gamesmanship by utilities* (e.g., biased cost revelation by the utility), and (2) *incomplete information*.

The utility will argue for a benchmark that will facilitate earning a reward and avoiding a penalty; consumer groups will attempt to make it hard for the utility to earn a reward. The utility might reveal its cost opportunities to be lower than what they really are; for example, the utility would argue that it has certain constraints in reducing costs when, in fact, it has no such constraints. The regulator therefore finds it difficult to know the "true" benchmark: What costs should the utility incur under "reasonable" management? What would the utility's costs be in the absence of a PBR mechanism? What are reasonable utility actions deserving of neither a reward nor a penalty?

A good benchmark is also beyond the control of a utility. If the utility, through its actions, is able to affect the "benchmark" value, distortion can readily occur. A utility, for example, might be able to strategically manipulate the benchmark in its favor. The "benchmark" value should also vary over time in response to changing market and other conditions. In other words, it should adapt to changes in outside conditions, which include technological improvements and market dynamics.

5.2. An unintended consequence

We can express the cost effect on customers when a utility is able to manipulate the benchmark, and assuming no change in actual costs as: Let $\Delta C_f = \Delta C_a \cdot (1\text{-}s) + \Delta C_b \cdot s$; with $\Delta C_a = 0$, $\Delta C_f = \Delta C_b \cdot s = \Delta R$ (rewards). The result is a zero-sum game, in which the utility benefits at the expense of its customers, dollar-for-dollar.

Assume now that C_b equals the regulatory-approved benchmark and C_b^* is the true ("unbiased") benchmark, with $C_b > C_b^*$. One valid measure of the true benchmark is actual cost of the utility in the absence of the PBR mechanism. The utility receives a higher reward because of the incorrect benchmark, equal to $s \cdot (C_b - C_b^*)$. What is the effect on customers? It depends, but here we assume an alternative world without the PBR mechanism. The following calculates the effect on customers (i.e. the change in the costs flowed through to customers) from a benchmark cost that is set too high:

$\Delta C_f = \Delta C_a$ + Reward to the Utility

Let $C_b = C_b^* + ų$ and $C_b^* = C_{a0}$

Then, $\Delta C_f = (C_{a1} - C_{a0}) + s \cdot (C_b^* + ų - C_{a1})$

$\Delta C_f > 0$, when $s \cdot (C_{a0} + ų - C_{a1}) + (C_{a1} - C_{a0}) > 0$, or

$\Delta C_f > 0$, when $(1 - s) \cdot (C_{a0} - C_{a1}) < sų$

The regulatory-approved benchmark (C_b) exceeds the true benchmark by ų. The true or unbiased benchmark (C_b^*) equals the actual costs in the absence of the PBR mechanism (C_{a0}). One term not yet defined is C_{a1}, which equals the actual cost with the presence of the PBR mechanism. The mechanism should reduce the actual cost (i.e., $C_{a1} < C_{a0}$).

Taking a numerical example, assume that C_b^* (i.e., C_{a0}) is \$50 million, C_b is \$60 million, s is 0.2, and C_{a1} is \$49 million. With no PBR mechanism, customers pay \$50 million. With the PBR mechanism, customers pay \$49 million (C_{a1}) + 0.2·(\$60 million - \$49 million), which equal \$51.2 million. The second term is the reward that the utility receives for outperforming the regulatory-approved benchmark by \$11million (\$60 million minus \$49million).

In this example, utility customers become worse off by \$1.2 million even when the utility lowers its cost (from \$50 million to \$49 million). The reason is that customers pay an excessive reward to the utility because the benchmark cost was set too high. Performance assessment by regulators can help them establish an appropriate benchmark that would mitigate a utility from earning a "unfair" share of the economic gains when its performance improves.

One neutralizing factor is the "ratchet effect," which involves the regulator adjusting a future benchmark based on its observation that the utility seemed consistently in the past to "beat the past benchmarks" with little additional effort. Since the interaction between the utility and the regulator is what economists call a repeated game, over time the regulator knows more about the true "benchmark" cost as it (1) observes the utility's actual costs and (2) compares them with the benchmarks proposed previously. The "ratchet effect" reflects dynamic strategic behavior that analysts often ignore in their research on understanding regulatory incentives.

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