WUTC DOCKET: UE-230172 & UE-210852
EXHIBIT: AMT-16
ADMIT ☑ W/D ☐ REJECT ☐

Exh. AMT-16
Dockets UE-230172 and UE-210852
Witness: Alex M. Tellez

BEFORE THE WASHINGTON
UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PACIFICORP d/b/a PACIFIC POWER AND LIGHT COMPANY,** **Respondent.**	**DOCKETS UE-230172 and UE-210852 (Consolidated)**
In the Matter of **ALLIANCE OF WESTERN ENERGY CONSUMERS'** **Petition for Order Approving Deferral of Increased Fly Ash Revenues**	

EXHIBIT TO TESTIMONY OF

ALEX M. TELLEZ

STAFF OF
WASHINGTON UTILITIES AND
TRANSPORTATION COMMISSION

Copy of "Performance-Based Regulation for EU Distribution System Operators"

September 14, 2023

RAP™ Energy solutions for a changing world

Performance-Based Regulation for EU Distribution System Operators

Jim Lazar[1]

May 2014

Introduction and Overview

This paper encapsulates work derived from workshops in Europe in 2012 on setting future tariffs for distribution system operators (DSOs), particularly when it comes to incentivizing smart grid, distributed generation, and demand response. It also serves as a foundation document for future action to implement regulatory reforms that may follow from those workshops.

The report begins with an overview of performance-based regulation (PBR), including historical experience. It then addresses the type of mechanisms that may be appropriate for consideration in Europe. It concludes with caution about how electricity distributors may take advantage of any system that is promulgated, and suggests checks and balances as a mechanism is rolled out to ensure that societal goals are met and gaming of the mechanism is minimized.

Section 1: What Is PBR and How Does It Differ from Traditional Cost-Plus Regulation?

Traditional regulation of electricity distributors is cost-based, providing a tariff that is based on a fair return on the investment in assets serving the public, plus recovery of prudent operating expenses. This is best described as a cost-plus environment, and has been rightfully criticized for decades as encouraging excess investment in capital and too little attention to cost control.[2]

Broadly speaking, PBR, diverges from cost-based regulation in that it provides electricity distributors a tariff framework that encourages better performance. There are many different approaches to PBR, and all of them begin with identification of how a regulator seeks to change firms' behavior. Some are price-cap mechanisms that set a trajectory for prices, leaving the firm to find economies of scale; others are revenue-cap mechanisms, which seek to provide predictable revenues independent of sales volumes; still others are tied to specific metrics of service quality, reliability, and environmental performance. PBR can be referred to by different names, including "incentive regulation" and "output-based regulation." While there are differences between regulatory schemes focused on changing incentives, they all share in common the shift from a strictly cost-based incentive framework to one that encourages behavioral change. In this paper, we will broadly refer to these regulatory mechanisms as "performance-based."

a. All Regulation Is Incentive Regulation

Since it was formed two decades ago, RAP has repeatedly made the point that "all regulation is incentive regulation," meaning that every framework for utility regulation provides incentives for specific

[1] Edith Bayer, Richard Cowart, and Robert Lieberman provided valuable assistance on this paper.
[2] See, e.g., Averch, H. and L. Johnson (1962). Behavior of the Firm Under Regulatory Constraint. *American Economic Review* 52: 1052-1069.

behavior or specific outcomes, and those incentives guide behavior.[3] Conventional regulation may reward capital investment, while automatic adjustment mechanisms remove incentives for management oversight of whatever elements are flowed through. It is crucial to identify the incentives created by any proposed mechanism, and to ensure that those incentives guide behavior in the desired direction.

b. General Description of PBR

A PBR mechanism differs from traditional regulation in that it ties the allowed growth in revenue to a metric other than the sum of investment return plus operating expenses.

There are several performance-based frameworks in use around the world. These include:

- Rate cap regulation
- Revenue cap regulation
- Regulation tied to specific performance incentives

Rate cap regulation ties the allowed growth in revenue to the change in sales volume. A typical rate cap mechanism might allow tariffs to rise by 1 percent below the general rate of inflation between major rate reviews.

Revenue cap regulation "decouples" the allowed revenue collected by the DSO or other regulated entity from the sales volume. This approach sets a formula for the total allowed revenue, rather than the price per unit. That is, the total revenue collected remains fixed or adjusts according to a formula, while tariffs will change based on the actual level of sales realized over the relevant time period. The formula might be a fixed annual revenue allowance per connection point (revenue-per-customer, or RPC, decoupling), or a formula that allows the revenue to change with a combination of factors, including inflation, changes in investment, and changes in expenses between major rate reviews (attrition decoupling).

Incentive-based regulation is any form of regulation tied to specific performance incentives, such as reliability of service or achievement of specified resource objectives. The United Kingdom has developed a well-recognized incentive-based framework known as RIIO (Revenue set with Incentives for delivering Innovation and Outputs), which has replaced a much simpler rate-cap form of regulation that focused overwhelmingly on cost control.[4]

c. Ways in Which PBR Can Drive DSO Behavior

The framework of PBR will affect the behavior of the DSO. For example, **rate cap regulation** tells the DSO that increasing sales volume (throughput) is a means to increase revenue and income. If that can be done by encouraging off-peak usage, this increase in usage will come with no corresponding need for greater investment in distribution facilities, and the DSO's profits will rise. However, because increased power consumption brings with it significant economic and environmental costs and risks, this incentive may be counterproductive to the economy, public health, and the environment generally. Just as

[3] See, e.g., National Association of Regulatory Utility Commissioners (1989). Profits and Progress Through Least-Cost Planning. Retrieved from: http://www.raponline.org/docs/RAP_Moskovitz_LeastCostPlanningProfitAndProgress_1989_11.pdf.
[4] The UK regulator has a series of detailed papers on RIIO available at http://www.ofgem.gov.uk/Media/FactSheets/Documents1/re-wiringbritainfs.pdf.

traditional cost-of-service regulation encourages the DSO to maximize investment to secure a higher return, this approach encourages the DSO to maximize throughput.

Alternatively, **revenue cap regulation** tells the DSO that its revenues will be fixed (or, more accurately, will not be determined as a function of sales), and the only way to increase earnings is to reduce expenses and capital additions—that is, to make operations more efficient. Without proper safeguards, this will likely encourage the DSO to take cost-cutting steps that will hurt reliability, safety, and customer satisfaction. For this reason, revenue-cap regulation is generally paired with a service quality index mechanism, so that any diminishment of the quality of service will be penalized.[5] When this is done, revenue-cap regulation becomes a form of incentive-based regulation, providing dual incentives for cost control and service quality achievement while eliminating any DSO reward for throughput.

PBR can be constructed in a number of ways to achieve a diverse list of regulatory and governmental policy goals, including cost control, service quality, and resource management. PBR can be devised using either a rate-cap foundation or a revenue-cap foundation; our discussion below and detailed in Annex 1 concerns a multi-goal PBR framework based on a revenue-cap foundation.

Section 2: Choosing the Right Mechanism

The first step in implementing a PBR framework is to identify the problems that the regulator is seeking to address. (The second step is to develop a mechanism that addresses these concerns.) This must be done in such a way so as to not invite behavior that creates or exacerbates other problems.[6] That is, it is important to retain the incentives that are in place and working as intended, while creating new incentives where behavioral change is desirable.

The main factors to consider in determining the most effective mechanism are:

a. What Problems Have You Identified, and What Are Your Target Outcomes?

We have identified a number of goals that might guide the development of a PBR mechanism for a European DSO. These include:

1. More cost-effective distribution system investments
2. Roll-out of bidirectional smart meters and advanced metering infrastructure (AMI)
3. Gradual implementation of demand response (DR) programs
4. Support for hooking up distributed generation (DG)
5. Better voltage control, particularly needed as DG becomes more common
6. Improved reliability indicators: SAIDI, SAIFI, CAIDI, CAIFI
7. Lower line losses (this encompasses grid upgrades where congestion is high, demand response, implementing DG on congested circuits, phase balancing and voltage control)
8. Preservation of customer service quality

[5] See Alexander, B. (2002). Default Service for Retail Electric Competition: Can Residential and Low Income Customer Be Protected When the Experiment Goes Awry? The Regulatory Assistance Project. Retrieved from http://www.raponline.org/document/download/id/435.
[6] See Weston, F. (2000). Performance-Based Regulation for Distribution Utilities. The Regulatory Assistance Project. Retrieved from http://www.raponline.org/document/download/id/239.

Each of these is an important element of quality electric service, and each can be achieved by a well-crafted PBR. We note, however, that doing so without significantly raising the cost of electricity service will be the challenge. The challenge is not a simple one, and is discussed in more detail in Section IV.

b. What Should the Duration of the Mechanism Be?

A PBR mechanism must continue for a period of years to allow the DSO to actually make fundamental changes in its operation and management, so that the goals can materialize in the form of sufficient cost savings to augment earnings if the goals are achieved.

- *Minimum of three to five years, to allow DSOs to achieve goals and reap rewards (or suffer penalties).* This length of time allows the DSO to make fundamental changes in its staffing structure, but it is short enough that the regulator will be able to direct the benefit of lower costs to consumers in a reasonably short period of time.

- *Periodic interim examination by the regulator to see if mechanism is producing intended changes in DSO practices.* In a multi-year mechanism of this type, the regulator must preserve a means to periodically examine progress towards the desired goals, and may require minor adjustments during the initial period to prevent adverse impacts. We recommend that the regulator undertake formal mid-course reviews every 12 months during the initial three-to-five-year period of any mechanism.

c. What Has Been Tried?

The regulator can learn from past experiences in Europe and the US. The most aggressive PBR mechanisms in Europe have been implemented in the UK, and these are widely regarded as having been successful at modernizing the grid, reducing costs for consumers, and preserving service quality. However, families on limited incomes have suffered disproportionate increases in cost and decreases in service quality as competitive power suppliers seek to serve higher-income households and avoid service to low-income consumers, renters, and others for whom billing and collection require more effort per unit of revenue received.

The graphics that follow show how the cost of electricity service has declined in the UK and a breakdown of where the savings were achieved. Both the fixed or “standing charge” for being connected and the unit charge per kWh of usage were reduced significantly during the period 1994–2005.

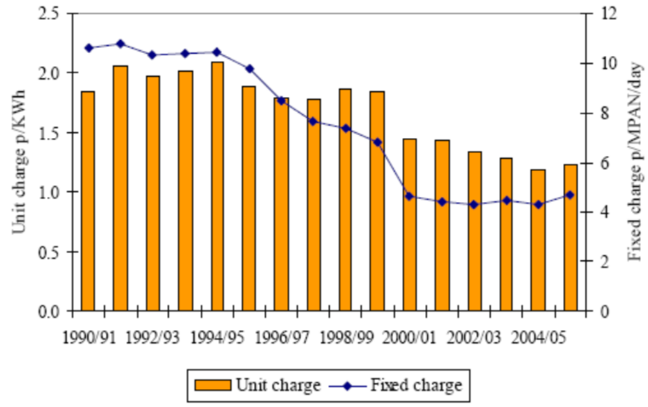

Figure 1: Domestic unrestricted charges (2005–06 prices)[7]

Source	%
Lower generation costs (mainly fuel)	10
Lower distribution and transmission charges	9
Lower supply business margin	1
Lower fossil fuel levy*	9
Total	29
* The fossil fuel levy was introduced to limit the effect of reform of the sector on coal industry. The levy was gradually phased out. Price reduction due to lower levy can therefore not be attributed to the effect of reform on prices.	

Figure 2: Breakdown of cost savings[8]

The shift from the previous simple rate-cap regulatory framework to RIIO brings with it many changes. These include:

- Moving to an eight-year price control term
- Establishing the £500 million Low-Carbon Networks Fund
- Making the grid smarter to adapt to high-renewable content
- Easing regulation for companies that meet service goals
- Increasing returns for companies that deliver quality service at lower cost

The concept draft in Annex 1 draws from many of the elements of RIIO while attempting to address the specific objectives expressed by regulators of other EU states.

Most PBR efforts in the US have been directed at encouraging greater reliance on energy efficiency (EE) by integrated utilities and DSOs. Revenue-cap PBR mechanisms have been established in about one-third of the states, and these states have had the best results in encouraging and financing cost-effective EE measures. Measures taken in California, Oregon, Washington, Wisconsin, Michigan, Hawaii, and New England have all produced significant improvements in EE without harming the financial condition of the

[7] Jamasb, T. and Pollitt, M. (2007). Incentive Regulation of Electricity Distribution Networks: Lessons of Experience from Britain. University of Cambridge. Retrieved from: http://www.dspace.cam.ac.uk/bitstream/1810/194689/1/0709%26EPRG0701.pdf.
[8] Ibid.

energy providers. It is important to note that revenue cap (decoupling) regulation has worked in both liberalized and unliberalized markets in the US. The graphics below show 1) the most successful states in EE and 2) those that have revenue cap mechanisms. The congruency of the two maps is not accidental.

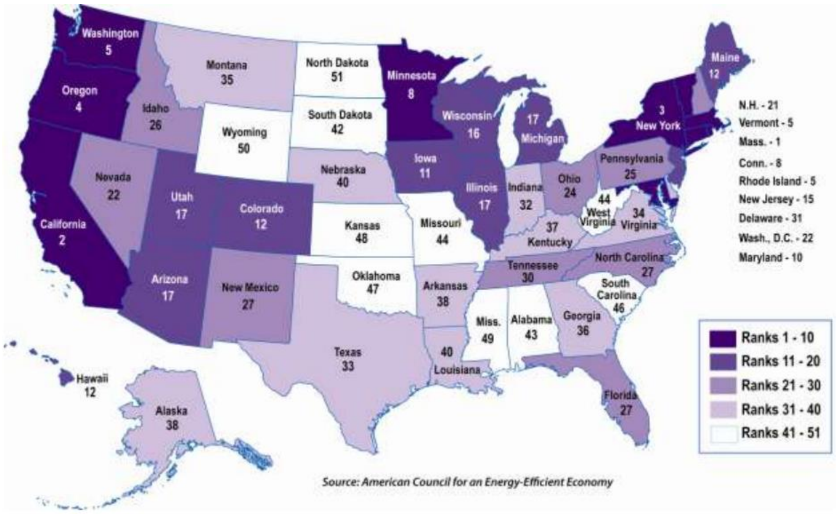

Figure 3: Map of Results from the 2011 State Energy Efficiency Scorecard[9]

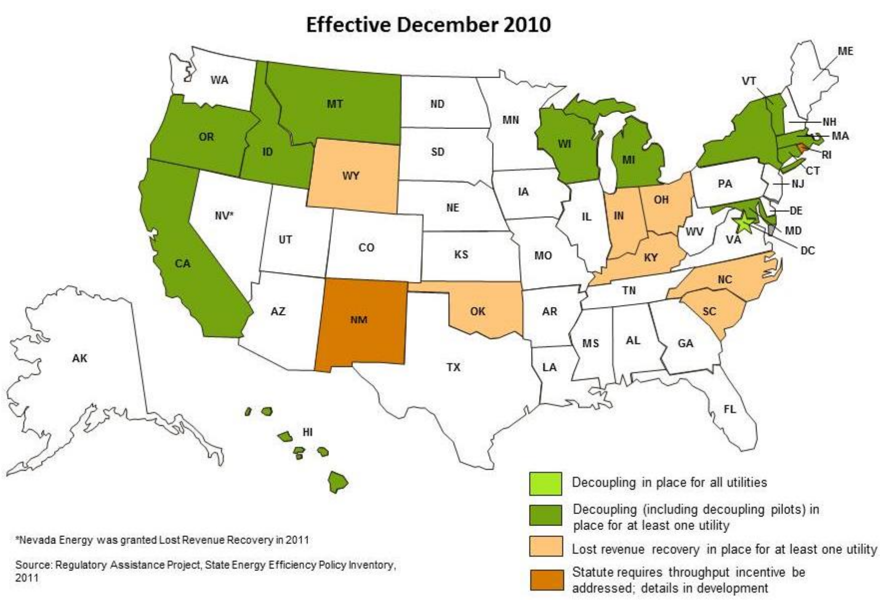

Figure 4: US States with Utility Decoupling and Lost Revenue Recovery Mechanisms in Place[10]

[9] ACEEE (2011). 2011 State Energy Efficiency Scorecard. Retrieved from: http://www.aceee.org/research-report/e115.

[10] Regulatory Assistance Project (2011). State Energy Efficiency Policy Inventory.

The move towards revenue-cap regulation in the US has been strongest in those states with well-defined commitments to pursuing EE. The reason for this is that when distributors help their consumers achieve EE, distribution revenues decline. To encourage distributors to take a lead role in widespread implementation of EE, some method to restore lost revenues is essential. While some states (shown in orange above) have simple lost revenue mechanisms—for each kWh of EE achieved, a specific amount of revenue is restored—it has actually proven more effective and much simpler to utilize a revenue-cap approach, assuring a defined level of revenue regardless of sales. The revenue-cap approach does not require detailed evaluation to determine how much of the sales change is caused by efficiency programs, and how much is a result of other factors such as energy codes, market transformation, or moral suasion.

The choice between RPC decoupling or attrition decoupling must be a decision made based on expected future conditions in individual EU states. If the number of customers to be served is expected to rise significantly, then RPC decoupling may work well, but if the number is expected to remain fairly constant, then attrition decoupling may be a better choice. The best-performing utilities in the ACEEE Scorecard above include a mix of RPC and attrition decoupling states.

Several US states have created specific incentives for smart grid investment. Most of these involve allowing recovery of such investment outside of a general rate proceeding, so that distributors can begin recovering increased costs immediately. Consumer advocates have opposed these measures because they may fail to adequately consider offsetting cost reductions that occur when smart grid investments enter service, such as lower line losses, fewer and shorter outages, and avoidance of meter reading expense.

d. What Are the DSOs Doing Well?

The list in Section 3a indicates areas that RAP has identified as needing attention for one or more EU states. The regulator could also determine what specific functions the DSOs are currently doing well. This should include consideration of cost of service, reliability, quality of customer service, and improvements in technical elements such as line losses, voltage control, and effects on customer behavior. Where the DSOs are succeeding, the framework that enables that success should not be abandoned or modified without consideration of alternatives that will preserve these functions.

e. What Areas Clearly Need Improvement?

The regulator will need to prioritize the areas where attention is needed from the long list in Section 3a. For each element of quality of service, the regulator should establish measurable criteria by which progress will be judged.

Section 3: What PBR Mechanisms Are Available?

There is a wide variety of PBR mechanisms that can meet the goals set forth above. In this section we describe these mechanisms in detail, to provide a more thorough picture of how they might be used to help the regulator meet its goals.

PBR mechanisms fall into several categories, differentiated by the particular means they use to encourage preferred outcomes.

a. Performance Incentives Tied to Measurable Achievement

The first group includes performance incentives linked to measurable achievement of specific goals. They provide a defined reward for achieving (or penalty for falling short of) the specific measurable goals identified. For example:

1. For each DSO, identify a specific number of smart meters to be installed and operating by dates certain for each tariff class of customers. **Example:** 100 percent of consumers over 100 kW demand by 2015, and 100 percent of all consumers over 20 kW demand by 2017.
2. For each DSO, identify specific dates by which specific components of AMI are to be installed. **Example:** installation of station transponders at each distribution substation by 2015 and on each circuit by 2017, and an operating meter data management system receiving and processing smart-meter data by 2018.
3. Meet targets for connection of distributed generation under 500 kW. **Example:** 5 percent of system load represented by small DG by 2015; 15 percent met by 2018.
4. Meet targets for contracting for and deploying demand response. **Example:** 5 percent of system peak demand under DSO control by 2015; 10 percent of system peak demand under DSO control by 2017.
5. Achieve specific targets for reliability, voltage control, and losses. **Example:** SAIDI, SAIFI below defined limit by 2016; voltage within allowable parameters of 8,759 hours per year for average consumer; total distribution line losses below 5 percent by 2017.
6. Achieve specific targets for customer service quality. **Example:** ten-point customer service quality (CSI) index, with a minimum of nine metrics met in each year.

Enforcement of these can be ensured by simple measurement and financial opportunities or consequences. For example, DSOs that meet all of the targets could be allowed a 1 percent increase in revenue, while DSOs that do not meet specified targets could be precluded from all or part of scheduled annual rate adjustments or subjected to greater scrutiny of allowable costs.

b. Shared Savings Mechanisms for Energy Efficiency

Shared savings mechanisms for EE achievement are relatively common in the US. These typically provide the DSO full recovery of program expenses, full recovery of lost distribution revenue, and a share of the net economic savings from achievement of EE savings.

Programmatic cost recovery is generally handled through a system benefit charge (tariff rider) with a periodic adjustment (e.g., quarterly or annually) to ensure that all allowable costs are recovered from consumers. There are numerous examples of EE tariff riders; Puget Sound Energy's, outlined below, simply divides allowed costs (by customer class) by projected sales to generate a uniform increase for each tariff class:

SCHEDULE 7	
Energy Charge:	0.4632 cents per kWh
SCHEDULE 24*	
Energy Charge:	0.4212 cents per kWh
SCHEDULE 25*	
Energy Charge:	0.4146 cents per kWh

Figure 5: Puget Sound Energy Conservation Tariff Rider for Residential and Commercial Customers as of May 23, 2013[11]

Recovery of lost distribution revenues is generally handled either through a revenue cap mechanism, where any shortfalls or excess revenue are flowed through in a subsequent period, or through a lost revenue adjustment mechanism (LRAM) that provides dollar-for-dollar recovery of measured losses in distribution revenue as a result of company-funded EE. The example PBR in Annex 1 begins with a revenue-cap framework, in which a defined amount of revenue would be recovered independent of sales volumes; under this approach, revenue lost to decoupling is recovered in an annual adjustment.

Experience in the US has shown that the amount of shared savings incentive is typically a relatively small portion of the gross total savings. Conversely, programmatic cost recovery and, to a lesser degree, lost distribution revenue recovery absorb a more significant part of the net economic savings.

c. Price Cap Regulation

Price cap regulation, also referred to as RPI in the UK, is the most traditional form of PBR. It sets a fixed price or a price formula for a multi-year period (such as annual increases 1 percent below the rate of inflation). For example, in the UK, price cap regulation prior to RIIO was structured according to the formula RPI – x. RPI refers to the revenue price index, a measure of inflation. X is a productivity factor, determined by the regulator to be the appropriate annual level of improved productivity that DSOs should attain. DSOs that that can contain costs to a slower trajectory can achieve higher net earnings for their investors. Price cap regulation should be combined with some sort of customer service quality index to ensure that cost-cutting does not impair reliability, safety, or responsiveness to consumers.

d. Benchmark/Yardstick Regulation So That the Highest-Performing DSOs Are Also the Most Profitable DSOs

This is a special form of price cap regulation. It has been used for about a decade in Chile and has been advanced more recently in Germany. Distribution prices are set for all DSOs based on the cost characteristics of an average or slightly better-than-average company. DSOs that can provide service at a lower-than-average cost therefore earn higher-than-average profits. Every three to five years, a new tariff case is convened, and the distribution prices are again set to an average or better-than-average level for all DSOs. This approach may not be applicable when different DSOs have fundamentally different cost characteristics, such as urban vs. rural, or areas with more severe weather that requires more hardy infrastructure.

[11] Puget Sound Energy (2013). Electric Tariffs & Rules. Retrieved from https://pse.com/aboutpse/Rates/Pages/Electric-Rate-Schedules.aspx?Schedule_x0020_Type=Rate%20and%20Adjusting%20Schedules.

e. Revenue Cap Regulation

Revenue cap regulation, or decoupling, is a PBR framework that sets allowed revenue levels for a multi-year period and assures the recovery of those levels, regardless of actual sales volume. The allowed revenue requirement can be a fixed revenue amount, a fixed amount per connection point (RPC), or a formula that adjusts future revenue according to multiple factors that do not include sales volume.[12] Revenue levels are said to be "fixed," but in fact may be adjusted annually to account for changes in various exogenous factors such as number of customers, inflation, productivity, and implementation of regulator-required programs such as smart grid or EE.

The first step is to hold a general tariff proceeding in which an initial revenue requirement for the DSO is established. This is identical to the process used in price-based conventional regulation.

The next step is to identify the adjustment method to be used. For growing systems, where distribution circuits are being added, the RPC method has worked well; 2 percent growth in the customer base results in 2 percent growth in allowed revenue. For systems that are not growing, an "attrition" approach has been more common; in this approach, the regulator holds an abbreviated proceeding each year to determine what has changed since the general tariff proceeding, and adopts a new revenue requirement reflecting those known and measurable changes.

The third step is to compare the actual revenue received by the DSO to allowed revenue, which is done monthly or annually. The difference between these is either recovered immediately (current decoupling) or deferred for recovery in a subsequent period (deferral decoupling). In some countries, where the regulator is required to annually determine the allowed revenue level, this step can be integrated into the existing framework of regulation very easily.

The final step is to collect (or refund) the deferral amount. In periods when sales increased faster than allowed revenue, consumers receive a rebate; in periods when allowed revenue increased faster than sales, consumers must pay a surcharge.

This approach creates a powerful incentive for controlling both capital expenditures and operating expenses. The DSO knows that its revenue will be limited, so it cannot recover the cost of new facilities by making additional sales, except as necessary (under RPC) to extend facilities to serve new connection points. But the utility also knows that recovery of the allowed revenue will be ensured, even if sales decline. This makes revenue cap regulation very attractive to the DSO when sales are declining or growing more slowly than the number of connection points, or when there is a public policy goal to promote EE, which will reduce sales. It is important to note that decoupling does not create an incentive for EE (it provides lost margin recovery, not a reward), but it removes a very significant disincentive (the threat of lost net revenues) to invest in EE and other demand-side measures.

Most EU states need to give serious consideration to a mechanism for addressing lost revenues, such as revenue cap regulation, in light of the EU Energy Efficiency Directive. Achieving the target savings of 1.5 percent per year will significantly affect the level of DSO revenue. If the DSOs are to be receptive and even active partners in achieving this goal, mechanisms for both programmatic cost recovery and for

[12] For an extensive discussion of this topic, see: Shirley, W., Weston, F., and Lazar, J. (2011). Revenue Regulation and Decoupling. The Regulatory Assistance Project. Retrieved from: http://www.raponline.org/document/download/id/902.

lost margin recovery are essential, and an incentive mechanism to reward superior performance may also be desirable. The revenue cap regulation mechanism described in Annex 1, plus a separate programmatic cost recovery tariff rider, similar to that shown above for Puget Sound Energy, are examples of the package of measures that would help achieve compliance.

Section 4: How to Frame a System of PBR

There are three critical elements to framing a performance-based ratemaking mechanism:

1. The regulator must identify the overarching goals.
2. The regulator must set forth specific requirements by which progress toward those goals will be measured.
3. A reward and penalty mechanism needs to be developed to reward achievement and penalize inactivity.

We have identified some potential overarching goals for an EU PBR mechanism, which were noted above in Section 3a: increasing network reliability, improving cost control, enabling smart grid, improving customer service quality, enabling demand response and distributed generation, and reducing line losses, among other quality-of-service elements. The Regulator should consider adding aggressive pursuit of EE to the list, which is not only consistent with the Energy Efficiency Directive but is also an important tool for controlling total system costs, which, given the significant investment needed in most state power systems, are under great pressure to rise.

Annex 1 identifies, for illustrative purposes, how PBR can advance these goals.

The second step is establishing specific requirements for those improvements that the regulator deems important. These must be easy-to-measure metrics, so that the regulator is not forced to expend massive effort and expense to measure the performance of each DSO, and DSOs are clear on what is required of them.

These may include measurable progress on installation of smart meters and smart grid components, specific targets on line losses and voltage control, specific obligations for new customer connections, and resource integration targets for demand response and customer-sited renewable resources. These targets may include metrics for compliance with the requirements under the Energy Efficiency Directive as well. Annex 1 identifies, for illustrative purposes, how each of these metrics would be evaluated to determine achievement level.

The third step is setting specific cost recovery mechanisms and penalty and reward levels for DSOs that achieve or fail to achieve the targets established. These should be large enough to motivate DSO management to act in the desired ways, but the regulator will want to take care to ensure that consumer prices are not driven higher than necessary as a consequence of setting unnecessarily high rewards. As RAP demonstrated during the workshops in the graphic shown below, even a 1 percent change in revenue can result in a large change in DSO net income. This enabling framework will require new expertise by the DSOs to implement, and new expertise by the regulator to oversee and evaluate.

	Revenue Change ($)	Impact on Earnings			
% Change in Revenue	Pre-Tax	After-Tax	Net Earnings	% Change	Actual ROE
5.00%	$9,047,538	$5,880,900	$15,780,900	**59.40%**	17.53%
4.00%	$7,238,031	$4,704,720	$14,604,720	**47.52%**	16.23%
3.00%	$5,428,523	$3,528,540	$13,428,540	**35.64%**	14.92%
2.00%	$3,619,015	$2,352,360	$12,252,360	**23.76%**	13.61%
1.00%	$1,809,508	$1,176,180	$11,076,180	**11.88%**	12.31%
0.00%	$0	$0	$9,900,000	**0.00%**	11.00%
-1.00%	-$1,809,508	-$1,176,180	$8,723,820	**-11.88%**	9.69%
-2.00%	-$3,619,015	-$2,352,360	$7,547,640	**-23.76%**	8.39%
-3.00%	-$5,428,523	-$3,528,540	$6,371,460	**-35.64%**	7.08%
-4.00%	-$7,238,031	-$4,704,720	$5,195,280	**-47.52%**	5.77%
-5.00%	-$9,047,538	-$5,880,900	$4,019,100	**-59.40%**	4.47%

Table 1: Earnings Impact of DSO Revenue Changes[13]

The cost recovery mechanisms can be a mix of market-based mechanisms, such as competitive bidding for demand response,[14] and regulatory mechanisms, such as incentive returns for meeting targets for smart grid investment and cost control.

In general, one part of the financial incentive should be tied to achieving the targets, and another to the cost control exercised in doing so. With this approach, the DSO will have an incentive to meet the targets in a cost-effective manner. If each target carries a portion of the potential reward (and of the penalty), a DSO that meets all the targets will be more profitable than one that meets only some of them. The choice between a balanced reward/penalty structure and one that contains only rewards for achievement, without penalties for shortfalls, may be important for some of the targets.

The DSO may be able to meet some targets by contracting out responsibility for implementation. This may enable more rapid implementation, but may leave the DSO without the in-company expertise to maximize the value from, for example, smart grid components. It is important that the pressure to meet interim targets does not result in shortcuts that hamper or prevent progress toward the long-run goals.

[13] Lazar, J., and Shirley, W. (2010). Decoupling Workshop; Arizona Corporation Commission [PDF document]. Regulatory Assistance Project. Retrieved from: http://www.raponline.org/document/download/id/388. Also see Annex 1, Table 7.

[14] Gottstein, M., and Skillings, S. (2012). Beyond Capacity Markets: Delivering Capability Resources to Europe's Decarbonised Power System. The Regulatory Assistance Project. Retrieved from: http://www.raponline.org/document/download/id/4854.

Annex 1 includes examples of cost recovery mechanisms. We stress that they are illustrative only, and that the specific cost recovery mechanisms must be determined by the regulator through an informed process that takes input from the DSOs and other stakeholders.

Section 5: Lessons Learned From Experience With PBR

Many approaches to PBR have been attempted over recent decades, and not all of them have been successful. It is important to be aware that, because all regulation is incentive regulation, a PBR mechanism is likely to have unintended consequences, and it is crucial to understand the incentives that it creates. This requires extreme caution on the part of the regulator. Attempting to see the flaws in a proposed mechanism is one of the most challenging aspects of any regulatory framework, and is compounded when a PBR mechanism has multiple goals.

a. Know What Incentive You Are Creating

The first test is to know what incentive is being created. A few examples of successful and flawed incentive mechanisms give an indication of how results will follow the incentive design.

Example 1, Puget Sound Energy (PSE)—Bonus Return for Energy Efficiency Investment: in 1980, the Washington State Legislature enacted Revised Code of Washington 80.28.025, which granted a 2 percent higher return on equity investments in EE measures than applies to other system investments. PSE responded by providing large incentive payments to consumers with electric resistance space heat to install electric heat pumps – but targeted the program to areas where the competing natural gas utility was planning to expand natural gas service. The net effect was that many consumers chose the heat pumps, and paid higher energy bills than they would have had their space and water heat been converted to natural gas. The Washington Utilities and Transportation Commission ordered major revisions to the PSE efficiency program once this flaw was identified.

Issue: The commission neglected to specify that EE investments would be subjected to a clearly specified cost-effectiveness test.

Example 2, Pacific Gas and Electric (PG&E): In 2006, the California Public Utilities Commission established a three-part mechanism to encourage investment in EE. The first was a cost-recovery mechanism, funded through a system benefits charge to all electricity consumers. The second was a decoupling mechanism that recaptured net lost distribution revenues when sales declined. The third was a shared savings mechanism to give PG&E a portion of the value that the EE savings produced for customers. PG&E invested very heavily to achieve near-100 percent penetration of compact fluorescent lamps. The utility then claimed savings for *all* the lamps installed under its program, even though it was estimated that about 50 percent of those installations would have occurred without the PG&E program. PG&E was able to claim the incentive for the “gross” savings levels, and boost its share of savings.

Issue: The commission neglected to specify that only incremental savings resulting from the PG&E program would be considered for the shared savings mechanism. This left the utility with a powerful incentive to invest in low-cost savings measures, even if they would have occurred anyway as a result of market forces.

Example 3, Pacific Northwest Bell Telephone Company (PNB): In 1985, the Washington Utilities and Transportation Commission adopted a five-year rate-cap PBR mechanism that did not provide for any rate increases. Once this was in place, PNB dramatically reduced its maintenance, repair, and customer service staffing levels, which resulted in a severe decline in system reliability and a sharp rise in customer frustration.

Issue: The commission neglected to include a customer service quality mechanism as a part of a multi-year rate plan.

b. Assume That DSOs Will Be Clever, Will Take Advantage of the Mechanism, and Will Work to Maximize Profit

The regulator should always assume that the DSO will be clever and will take advantage of any mechanism created. One way to address this is to direct a separate team of regulatory staff to attempt to "break the code" of—in other words, find the flaws in—a proposed mechanism before it is adopted. That group should be given specific direction to "think like the DSO" and attempt to find a way to maximize profit without actually accomplishing the objective of the mechanism.

c. Periodically Review Performance and Make Adjustments

Whatever mechanism is adopted should include provisions for periodic review and adjustment to ensure that the mechanism is directed at achievement of the specified goals. While the regulator should not make numerous changes to a mechanism during its term—the goal is to provide a stable regulatory environment for the DSO, so that it will embrace creativity to achieve program goals—if the mechanism is not working, it needs to be fixed promptly.

We recommend annual reviews of progress toward the goals of the mechanism. This can be done in combination with the progress reports that the DSO files with the regulator, and are used to determine eligibility for the incentives set forth in the mechanism. For a four-year mechanism, there would be annual reviews after 12 months, 24 months, and 36 months.

A decision on whether to extend the mechanism after the initial term should be made after the periodic review; in the example above of a four-year mechanism, that would occur after 36 months. For an extended term, new targets would be established and the reward/penalty mechanism modified.

d. Include a Method to Measure and Incentivize Service Quality

Every mechanism that inhibits the regulator's ability to promptly address issues of service quality should be combined with a well-defined quality assurance program. This should include measurement of reliability, safety, customer responsiveness, and customer satisfaction. An independent entity, accountable to the regulator, should be employed to measure service quality under the mechanism.

e. Have a Complete Mechanism in Place Before You Abandon Something That Currently Works

Has the existing regulatory framework provided relatively reliable service at relatively affordable cost? If so, it is not a "failure" by any means. Replacing the existing framework with a new, performance-based framework should not be undertaken lightly. Every current obligation of the DSO under the existing framework should remain in place until the regulator has adopted a complete alternative mechanism and any appeal process available to the DSO or other parties has been concluded. This assures consumers that an unambiguous framework of regulation is clearly understood and in place at all times.

Summary

This discussion has been directed at the creation and implementation of a new performance-based ratemaking framework applicable to European DSOs. It outlines a series of checks and balances that can ensure that a new mechanism will be highly likely to produce the desired results, and that “gaming” of the mechanism by DSOs is kept to a minimum. The regulator must take the responsibility to ensure that a new mechanism is complete, well-designed, tested for flaws, and subject to periodic review to ensure it is working.

Annex 1 to this report consists of an illustrative example of a comprehensive PBR mechanism directed at the goals identified in Section 3a. The targets and incentives set forth are arbitrary and not based on analysis; rather, they are used to ensure that the example mechanism is complete and are not intended for adoption by the regulator. To move ahead with consideration of a mechanism, regulators would need a deliberative process to determine appropriate targets and appropriate incentives.

Annex 1: Example PBR Mechanism

1. Overview

The following is an example of a performance-based ratemaking (PBR) mechanism, designed to generally conform to the goals and policies previously identified by regulators in discussions with RAP.

It is an example mechanism only—no attempt has been made to test whether the targets and thresholds, or the rewards and penalties, set forth are appropriate. Both must be reviewed by the regulator, in consultation with consumers, distributors, and industry experts, to identify targets that are appropriate for each EU member state.

The foundation of the mechanism is a revenue-regulation framework, in which the DSO is assured recovery of a revenue requirement approved by the regulator. That assured recovery is designed to make the DSO unaffected by system sales, so that it can concentrate management expertise on performance and cost control.

The performance metrics mechanism consists of three parts. The first is a set of targets relating to smart grid implementation. The second is a series of targets relating to system reliability and engineering standards. The third is a series of targets related to customer service quality. Each of these is important, and each can contribute to the DSO receiving a greater or lesser amount of revenue than the foundational revenue-regulation framework. In addition, of course, the earnings of the DSO will be affected by effective cost control measures over labor, outside services employed, and other cost drivers.

2. The Revenue Regulation Framework

In most EU member states, the regulator determines an allowable revenue requirement for each DSO, then computes rates designed to produce that revenue based on expected sales volumes. That process does not change. The regulator may elect to adopt a multi-year revenue requirement formula, based either on growth factors (e.g., the number of connection points) or attrition factors (inflation, new investment, retirement of obsolete plants, and productivity). With or without an adjustment in future years, the resulting revenue requirement for each year of the rate period is then known.

	Year 0	Year 1	Year 2	Year 3
Revenue Allowed Without Adjustment	1,000,000	1,000,000	1,000,000	1,000,000
Connection Points	5,000	5,100	5,200	5,300
Revenue Allowed Per Connection Point	200	200	200	200
Allowed Revenue by Year	1,000,000	1,020,000	1,040,000	1,060,000

Table 1: Revenue Per Connection Point Approach

	Year 0	Year 1	Year 2	Year 3
Revenue Allowed Without Adjustment	1,000,000	1,000,000	1,000,000	1,000,000
Revenue Needed for Net Plant Additions		10,000	10,000	10,000
Inflation (increase)		+3%	+3%	+3%
Productivity (decrease)		-2%	-2%	-2%
Allowed Revenue by Year	1,000,000	1,020,000	1,040,000	1,060,000

Table 2: Attrition Approach

Under revenue regulation, once per year the regulator will examine the actual revenue received and compare that with the revenue allowed. The amount of excess (or deficient) actual revenue will be applied to the subsequent year's revenue requirement, and new prices determined for the subsequent year. An example below, based on the revenue requirements above and in which expected sales growth matches connection point growth, shows how this is computed.

	Year 0 (current)	Year 1	Year 2	Year 3
Allowed Revenue	1,000,000	1,020,000	1,040,000	1,060,000
Allowed Revenue With Adjustment for Prior Year		1,030,000	1,029,902	1,055,048
Expected Sales Volume	1,000,000	1,020,000	1,040,000	1,060,000
Price Per Unit	1.00	1.0098	0.9902	0.9953
Actual Sales	990,000	1,030,000	1,045,000	1,050,000
Actual Revenue	990,000	1,040,098	1,034,853	1,045,095
Excess/Deficient	(10,000)	10,098	4,951	9,953

Table 3: Example Calculation of Revenue Regulation Deferral and Recovery

First and foremost, while the price changes annually, it does not change very much, remaining within 1 percent of the original value throughout the period. Any surplus or deficiency of revenue is recovered or refunded in the subsequent year. It is a simple mechanism to calculate.

3. The Performance-Based Ratemaking Mechanism

Having begun with a foundation of **revenue** regulation, rather than **rate** regulation, we now move on to defining a PBR mechanism and computing how it would operate in future years. The first step is to adopt performance targets. We reiterate these are illustrative only, and not based on analysis applicable to DSOs in the EU.

a. Smart Grid Performance Targets

The first set of performance targets are for smart grid elements. The regulator will need to decide which elements should be considered and what numerical targets should be set. This will be a deliberative process, with input from all interested perspectives.

		Year 0	Year 1	Year 2	Year 3
SG1	Percent of commercial consumers greater than 100 kW with smart meters	0	10%	50%	100%
SG2	Percent of commercial consumers less than 100 kW with smart meters	0	0	10%	30%
SG3	Percent of residential consumers with smart meters	0	0	0	10%
SG4	Percent of distribution substations with smart grid controls	0	10%	20%	30%
SG5	Percent of distribution circuits with smart grid controls	0	0	10%	20%
SG6	Percent of commercial consumers > 100 kW with interval data collected in mdms	0	0	10%	50%
SG7	Percent of commercial load enrolled in demand response programs	0	5%	15%	25%
SG8	Percent of total peak demand enrolled in demand response programs, including critical peak pricing	0	2%	5%	15%

Table 4: Smart Grid Targets

Each of these targets must be technologically feasible, and must be within the financial capability of the DSOs in light of the revenue requirement determined for them above. The particular target elements identified above are not meant to be definitive or exclusive. The regulator must determine the correct target areas and the correct target levels.

b. System Reliability and Performance Indicators

The second group of targets is for system reliability and system performance. As with the other targets, the target areas and the target levels shown below are illustrative only. The regulator must determine the correct target areas and levels.

		Year 0	Year 1	Year 2	Year 3
SP1	System-wide distribution line losses	6%	5.8%	5.6%	5.4%
SP2	Minutes per year that voltage is outside of specified range for average customer	150	140	130	120
SP3	Number of outages per year per customer	3.05	3.00	2.95	2.90
SP4	Minutes of outage per year per customer	200	195	190	185
SP5	Average time for crew to arrive at Downed power line or transformer failure	60 minutes	55 minutes	50 minutes	45 minutes
SP6	Percent of peak demand met with customer-sited renewable energy resources	0	0.2%	0.4%	0.6%
SP7	Percent of peak demand met with customer-sited combined heat and power resources	20%	21%	22%	23%
SP8	Average telephone on-hold time for customer service inquiry	85 seconds	80 seconds	75 seconds	70 seconds

Table 5: System Performance Indicators

c. Customer Service Quality Indicators

The final group of metrics is for customer service quality. This involves factors that customers notice, and that makes them feel like the company is attempting to satisfy their needs. We have included EE efforts in this category, although it may be better to treat that as a separate category.

		Year 0	Year 1	Year 2	Year 3
CS1	Complaints per 1,000 customers received by the regulator	0.204	0.20	0.195	0.190
CS2	Percentage of new residential consumers connected within three days of application	90%	91%	92%	93%
CS3	Percentage of new commercial consumers connected without delay to construction	90%	91%	92%	93%
CS4	Days to connect power supplier under 100 kW and not requiring new construction	10	9	8	7
CS5	Days to connect power supplier greater than 100 kW and requiring new construction	30	25	22	20
CS6	Customer satisfaction with DSO based on survey of all consumers	90%	91%	92%	93%
CS7	Average telephone on-hold time for customer service inquiry	30 seconds	28 seconds	26 seconds	25 seconds
CS8	Commercial energy conservation program savings, annual percent of commercial energy use	0	0.2%	0.4%	0.6%
CS9	Residential energy conservation program savings, annual percent of residential energy use	0	0.2%	0.6%	1.0%

Table 6: Customer Service Quality Indicators

4. Using the Measurement Data

Setting targets and measuring performance towards those targets is important only if the data is used for something. In the context of PBR, the appropriate "use" is to make a portion of the revenue contingent upon meeting the targets, and providing the DSO the opportunity to obtain additional revenue by exceeding the targets or making more rapid improvement than the targets require.

For a typical DSO, the "return on equity" that flows to shareholders is only about 10 percent to 20 percent of the total distribution revenue. Thus, a PBR mechanism that enables the DSO to earn an additional 5 percent of total distribution revenue would enable them to increase their return by an additional 25 percent to 50 percent, a very large increment to net income. That 5 percent of distribution revenue, in turn, amounts to only about 2 percent of the total electricity bill paid by consumers when power supply costs are included.

This level of opportunity creates a strong motivation for the DSO to meet and exceed the standards, while creating relatively little risk for consumers. Conversely, if a DSO failed to meet the standards, and was penalized by up to 5 percent of distribution revenue would be a severe punishment, manifest in a sharply decreased return. The table below is an example of how relatively small changes in revenues (in this case, from sales, but the earnings impact of a PBR reward/penalty of up to 5 percent of revenues) would have a large impact on net income.

	Revenue Change ($)	Impact on Earnings			
% Change in Revenue	Pre-Tax	After-Tax	Net Earnings	% Change	Actual ROE
5.00%	$9,047,538	$5,880,900	$15,780,900	**59.40%**	17.53%
4.00%	$7,238,031	$4,704,720	$14,604,720	**47.52%**	16.23%
3.00%	$5,428,523	$3,528,540	$13,428,540	**35.64%**	14.92%
2.00%	$3,619,015	$2,352,360	$12,252,360	**23.76%**	13.61%
1.00%	$1,809,508	$1,176,180	$11,076,180	**11.88%**	12.31%
0.00%	$0	$0	$9,900,000	**0.00%**	11.00%
-1.00%	-$1,809,508	-$1,176,180	$8,723,820	**-11.88%**	9.69%
-2.00%	-$3,619,015	-$2,352,360	$7,547,640	**-23.76%**	8.39%
-3.00%	-$5,428,523	-$3,528,540	$6,371,460	**-35.64%**	7.08%
-4.00%	-$7,238,031	-$4,704,720	$5,195,280	**-47.52%**	5.77%
-5.00%	-$9,047,538	-$5,880,900	$4,019,100	**-59.40%**	4.47%

Table 7: How Changes in Revenues Affect Earnings[15]

In this particular example, developed for a specific US distribution company, a 5 percent change in revenues translated into a 59 percent change in net income. Based upon this, we believe that placing 5

[15] Lazar and Shirley, 2010.

percent of revenue at risk in a PBR mechanism is an upper bound of what is reasonable. The combination of a revenue regulation framework that provides assured recovery of a defined amount of revenue, subject to an adjustment of plus or minus 5 percent for PBR metrics, means that:

1. The DSO is reasonably assured of covering its operating expenses and debt service costs under any reasonable scenario; the revenue regulation mechanism provides protection against weather, business cycle, and conservation variance in sales; and
2. The DSO has an opportunity to earn its expected return by meeting the minimum targets set forth for it, and achieving above its expected return by exceeding the targets, assuming the mechanism approved by the regulator provides for a "bonus" for exceeding the targets.

The next issue is what level of revenue should be associated with each of the targets set forth by the the regulator. In the three categories above, we have identified a total of 25 separate metrics. If the regulator were to make 0.2 percent of revenue contingent upon meeting the specified target, this would total 5 percent of revenue at risk. We do not necessarily suggest that each target should be given equal weighting, but it is simple to look at the concept this way.

In addition, the regulator could provide a "bonus" of 0.1 percent of allowed revenue for each metric where the DSO exceeds the target by a margin of 10 percent or more. That would enable the DSO, in theory, to increase their distribution revenue by 2.5 percent above the allowed level based on the revenue regulation framework. Using the US example in Table 7, that would potentially enable the DSO to increase their net income and return on equity by up to 30 percent above the return on equity set in the tariff proceeding at the outset of the process.

Why should the "bonus" be smaller than the penalty? That is obviously a decision for the Regulator in implementing a mechanism, but in general, the targets are "minimum" standards, and failing to meet minimum standards should generally be subject to a significant penalty; consumers are suffering from unexpectedly poor service quality, and a significant monetary penalty (flowed through to consumers) is compensatory. Exceeding the targets provides unexpectedly "good" service, and this should be rewarded, but it comes at a financial cost to consumers. In our opinion, a mechanism that provides the opportunity to increase the return on equity from (in our illustrative example) from 11 percent to 14 percent or more is a significant reward to investors.

We reiterate (redundantly to avoid any illusion of precision) that these examples are illustrative only, and do not represent any analysis of appropriate targets for EU DSOs. We simply feel it is more meaningful to assign values so that readers will understand that each target should be a specific, measurable, verifiable quantity.

5. Example of Implementation

Finally, we think it is useful to show how the full mechanism we have described would operate over a three-year implementation period. First, we show the effect on a DSO that meets all of the minimum standards, and exceeds five (out of twenty-five) of the standards by at least 10 percent. Then we show the effect on one that falls short of five of the standards. We use the allowed revenue developed in Table 3, and apply the penalty or reward to the original allowed revenue (before true-up for sales variation in the prior year).

	Year 0 (current)	Year 1	Year 2	Year 3
Allowed revenue	1,000,000	1,020,000	1,040,000	1,060,000
Allowed revenue with adjustment for prior year		1,030,000	1,029,902	1,055,048
Number of indicators met		20	20	20
Number of indicators exceeded		5	5	5
Reward @ 0.1% per indicator		0.5%	0.5%	0.5%
Number of indicators failed		0	0	0
Penalty @ 0.2% per indicator		0	0	0
Combined adjustment %		0.5%	0.5%	0.5%
Combined adjustment $		5,100	5,200	5,300
Adjusted allowed revenue, including revenue regulation and PBR rewards and penalties		1,035,100	1,035,102	1,060,348
Expected sales volume	1,000,000	1,020,000	1,040,000	1,060,000
Price for year	1.00	1.0148	0.9953	1.0003

Table 8: Implementation of Revenue Regulation and PBR Mechanisms With 20 Indicators Met and Five Exceeded

	Year 0 (current)	Year 1	Year 2	Year 3
Allowed revenue	1,000,000	1,020,000	1,040,000	1,060,000
Allowed revenue with adjustment for prior year		1,030,000	1,029,902	1,055,048
Number of indicators met		20	20	20
Number of indicators exceeded		0	0	0
Reward @ 0.1% per indicator		0	0	0
Number of indicators failed		5	5	5
Penalty @ 0.2% per indicator		1.0%	1.0%	1.0%
Combined adjustment %		1.0%	1.0%	1.0%
Combined adjustment $		(10,200)	(10,400)	(10,600)
Adjusted allowed revenue including revenue regulation and PBR rewards and penalties		1,019,800	1,019,502	1,044,448
Expected sales volume	1,000,000	1,020,000	1,040,000	1,060,000
Price for year	1.00	.9998	0.9803	0.9853

Table 9: Implementation of Revenue Regulation and PBR Mechanisms With 20 Indicators Met and Five Failed

These two illustrative examples show how the allowed revenue and required price is easily computed from the tariff proceeding data, with adjustments for sales volume (revenue regulation) and DSO performance (PBR), to produce a bottom line in each of the years of the example.

We hope that this simplified numerical example makes it possible to follow the logic of both the revenue regulation framework and the PBR framework.