

# The Simple Analytics of Performance-Based Ratemaking: A Guide for the PBR Regulator

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*Professor Navarro discusses and evaluates the use of Performance-Based Ratemaking (“PBR”) as a substitute for traditional Rate Base Regulation (“RBR”) in determining the rates which regulated industries may charge to their customers. After discussing the importance of PBR from a theoretical perspective, the author analyses a California case study involving the first comprehensive application of PBR to the regulation of base rates. Next, the author examines the basic premises of PBR, focusing on the criticisms of traditional RBR. This is followed by a discussion of the mechanics of PBR both in theory and with respect to the California case study. The Article goes on to consider the use of PBR in both one-period and multi-period contexts, and finishes with an evaluation of the potential success of PBR as a regulatory alternative. The author concludes that PBR is unlikely to be a panacea for the ills of traditional RBR, and that its potential success rests in large part on its application, design, and implementation.*

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Introduction

Adoption of a PBR implies that the traditional rate of return regulation does not necessarily reveal the efficient costs of the regulated utility and that the incentive of the PBR will more likely reveal these costs . . . . [A]doption of PBR regulation indicates that the regulator believes that the utility is not minimizing costs.  
California Public Utilities Commission<sup>1</sup>

In the alphabet soup of regulatory acronyms, “PBR” promises to be one of the most important and potentially dangerous forces shaping public utilities regulation well into the next century.<sup>2</sup> At present, the Federal Energy Regulatory Commission (“FERC”)<sup>3</sup> and public utility commissions (“PUCs”) in twenty states are considering or have already begun to implement some type of PBR system.<sup>4</sup> Over the next few years, the PBR experiment is expected to spread to virtually every state.<sup>5</sup>

PBR stands for Performance-Based Ratemaking,<sup>6</sup> a particular technique through which utility regulators set the rates which utilities may charge to their customers. PBR involves two basic steps. First, the PBR regulator sets an initial price based on the utility’s observed and projected costs. Next, the regulator provides the utility with incentives to reduce these costs and pass some of the resulting savings on to the consumer. To assure that the utility does not achieve cost savings simply by cutting safety, reliability or quality, the PBR system must also include a quality-control mechanism.

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1. DIVISION OF RATEPAYER ADVOCATES, CAL. PUB. UTIL. COMM’N, REPORT ON PERFORMANCE-BASED RATEMAKING FOR SOUTHERN CALIFORNIA EDISON CO. at III-C-12 (1994) (analysis, conclusions, and recommendations to Administrative Law Judge (ALJ)).

2. This paper focuses on the application of Performance-Based Ratemaking to the setting of base rates. As we shall discuss below, PBR mechanisms have also been developed to lower fuel costs, encourage conservation, increase resource mix diversity, improve capacity factors and heat rates, reduce pollution, and reward good management practices.

3. For a summary of FERC’s latest activities, see FOSTER ASSOCIATES, INC., REPORT NO. 2016, UPDATE: STATE REGULATORY AGENDA FOR LDCS SHIFTS TO UNBUNDLING AND PERFORMANCE-BASED INCENTIVES TO IMPROVE GAS SUPPLY RELIABILITY AND LOWER COSTS, FOSTER NATURAL GAS REPORT, February 9, 1995, app. at 1.

4. See G. ALLEN COMNES, LAWRENCE BERKELEY LABORATORY, UNIVERSITY OF CALIFORNIA, REVIEW OF PERFORMANCE-BASED RATEMAKING PLANS FOR U.S. GAS DISTRIBUTION COMPANIES (1994) (discussing the status of PBR in the gas distribution industry).

5. See generally Craig S. Cano, *Former Regulators Look to ‘Brave New World’ in Electric Business*, INSIDE F.E.R.C., Nov. 21, 1994, at 6 (citing former regulators from across the country who favor the adoption of PBR mechanisms).

6. As Comnes points out, “PBR has its analytical roots in the area of economics known as incentive regulation.” COMNES, *supra* note 4, at 1. For a review of the literature which surrounds incentive regulation, see J. J. LAFFONT & JEAN TIROLE, *A THEORY OF INCENTIVES IN PROCUREMENT AND REGULATION*, (1993); Paul Joskow & Richard Schmalensee, *Incentive Regulation for Electric Utilities*, 4 YALE J. ON REG. 1 (1986).

PBR is being touted as an evolutionary method of reforming traditional rate base regulation for industrial sub-sectors characterized by economies of scale such as electricity and gas distribution.<sup>7</sup> PBR is also being advanced as a useful transitional ratemaking scheme along the road to more radical deregulation in technologically changing and increasingly competitive industrial sectors such as electricity generation<sup>8</sup> and telecommunications.<sup>9</sup>

The basic premise motivating PBR, reflected in the quotation above, is that under traditional, cost-plus, rate base regulation ("RBR"), utility managers not only fail to minimize costs but also attempt to conceal the firm's true minimum cost curve.<sup>10</sup> This is because RBR creates perverse incentives which encourage managers to inflate the firm's operation and maintenance expenses, "goldplate" or over-invest in capital, avoid optimal risk-taking, and otherwise operate inefficiently.

The purpose of PBR is to solve this "cost minimization-cost revelation" problem of traditional RBR in a way that encourages utility managers to operate their firms more efficiently. Ultimately, the goal of PBR is to provide consumers with lower rates for two important reasons. First, the regulator's traditional concern with equity has always supported this goal. Second, in a world of increasing competition not only among countries but also among states,<sup>11</sup> regulators have become increasingly aware of the negative role that inefficient regulation can play in diminishing the competitive advantage of companies within their jurisdictions.<sup>12</sup> Accordingly, these regulators are always searching for mechanisms that will make the RBR framework more

7. See DIV. OF RATEPAYER ADVOCATES; CAL. PUB. UTIL. COMM'N, *supra* note 1, at II-1 ("PBR may well be a permanent fixture in the regulatory landscape for those monopoly functions which continue after the Commission completes its plan for restructuring the markets for electricity in California.").

8. For a challenge to the view that electricity generation no longer exhibits the characteristics of natural monopoly, see Douglas Gegax & Kenneth Nowotny, *Competition and the Electric Utility Industry: An Evaluation*, 10 YALE J. ON REG. 63 (1993). See also Peter Navarro, *The Restructuring Regulator: A Guidebook and Research Agenda For the Electric Industry*, 16 ENERGY L.J. 2 (forthcoming Feb. 1996).

9. As the California PUC has stated, one PBR goal is to "accelerate (and ultimately, to complete) the trend of increasing competition in the generation side of the business . . . ." DIV. OF RATEPAYER ADVOCATES, CAL. PUB. UTIL. COMM'N, *supra* note 1, at II-14.

10. The reason is that if regulators could ascertain the firm's minimum cost structure, they could, under efficient regulation, set rates so as to force the utility to go there.

11. See, e.g., DIV. OF RATEPAYER ADVOCATES, CAL. PUB. UTIL. COMM'N, *supra* note 1, at II-30 (quoting CPUC President Daniel Fessler's statement that "what San Diego Gas & Electric and other California utilities are competing against is . . . the cost of service in states that are adjacent to the state of California.").

12. See Peter Navarro, *The U.S. Regulatory Environment and International Trade: Lessons From the Electricity Sector*, 8 J. OF POL'Y ANALYSIS & MGMT. 466 (1989) (analyzing impact of rate base regulation on economic competitiveness in electricity sector) [hereinafter Navarro, *The U.S. Regulatory Environment*]; Peter Navarro, *Creating and Destroying Competitive Advantage*, 13 J. OF COMP. ECON. 205 (1989) (analyzing effect of rate base regulation on economic competitiveness).

business-friendly. At this critical point in time, PBR has emerged as the leading reform candidate, particularly in trend-setting California which has been particularly hard hit in recent years by a weak economy.<sup>13</sup>

This paper addresses the basic policy question of whether PBR is an effective tool to achieve these goals, or whether, as one critic has warned, it is merely “a warmed-over version of existing regulatory mechanisms.”<sup>14</sup> This paper examines this question both in theory and in practice in an effort to provide legislators and regulators with a framework for designing, evaluating, and implementing Performance-Based Ratemaking systems.

At the same time, to borrow from the Bard, we will show that PBR is neither good nor bad—but that application, design, and implementation make it so. We shall also argue that PBR is sufficiently flawed as a concept that would-be reformers should approach it with far less zeal and much more caution than is now being exhibited in many quarters.

Section I of this paper establishes the empirical foundation of the Article. It first looks at the role which increasing global competition has played in motivating the PBR reform trend, and then it briefly reviews the status of PBR nationwide. The section concludes with a more detailed case study of the *first comprehensive application of PBR to base rate regulation*. The case study involves the California PUC’s approval of a PBR mechanism for San Diego Gas & Electric. As we shall see, the California experiment provides an almost perfect paradigm of how *not* to implement PBR and is therefore a useful referent for the theoretical points developed later in the Article.

As mentioned above, the underlying premise behind PBR is the assumption that regulated firms do not minimize costs. Section II examines this assumption by briefly presenting the major criticisms of traditional RBR. Section III provides a theoretical investigation of the three basic steps of PBR: setting a “baseline revenue requirement,” specifying a “sharing mechanism” to distribute cost savings, and designing a “quality control” mechanism. Section IV illustrates why PBR is much more likely to be effective as a transitional tool in a “one-period and deregulate” framework than in a multi-period model of continuing regulation. The paper concludes with a summary and discussion of policy implications, including the very central observation that PBR is unlikely to be a panacea for the ills of traditional RBR.

## I. PBR in Practice

While calls to reform traditional rate base regulation have historically

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13. See DIV. OF STRATEGIC PLANNING, CAL. PUB. UTIL. COMM’N, CALIFORNIA’S ELECTRIC SERVICES INDUSTRY: PERSPECTIVES ON THE PAST, STRATEGIES FOR THE FUTURE (1993).

14. DIV. OF RATEPAYER ADVOCATES, CAL. PUB. UTIL. COMM’N, *supra* note 1, at II-15.

been motivated by concerns over fairness to ratepayers, the intense pressures of an increasingly competitive global economy have significantly raised the regulatory reform stakes. Indeed, the perceived need within the regulatory community to increase the economic competitiveness of America's key regulated industries ultimately is the major motivation driving PBR, particularly in California, the cradle of this regulatory evolution.<sup>15</sup>

For example, over the past decade, California's industrial base has been rocked by increasing competition both in low-end, labor-intensive industries such as textiles and high-end, technology-driven industries such as aerospace and computers.<sup>16</sup> This competition has come not only from countries like Japan and Taiwan but also from adjacent "job pirating" states like New Mexico and Arizona where electricity rates range as low as half of those in California.

Both within the regulatory community and throughout the broader political environment, there is an increasing realization that key industrial sectors such as electricity, gas, and telecommunications can play key roles in creating or destroying competitive advantage.<sup>17</sup> The recent realization of the economic consequences of inefficient regulation takes the ratemaking critique far beyond traditional concerns with ratepayer equity into the even more politically super-charged realm of employment opportunities, tax base, and wage levels. Indeed, it is the deep and growing concern over industrial competitiveness that is ultimately fueling the PBR experiment. In evaluating PBR, it is important to keep this in mind, because *a poorly designed PBR experiment can actually make the economic situation worse.*

#### A. *The Growing PBR Trend*

Incentive regulation has no universally accepted definition, but it can be seen as an attempt to . . . encourage efficient utility performance. Central to any effective incentive strategy is a test to measure utility performance in the absence of the competitive marketplace.<sup>18</sup>

PBR is a subset of what economists refer to as "incentive regulation."<sup>19</sup>

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15. See generally DIV. OF STRATEGIC PLANNING, CAL. PUB. UTIL. COMM'N, *supra* note 13 (stating that regulatory regime was a dinosaur which was incompatible with industry structure, and proposing various reforms).

16. See *id.* at 94-112.

17. See generally Navarro, *The U.S. Regulatory Environment*, *supra* note 12.

18. DAVID BOND, CAL. PUB. UTIL. COMM'N, *USE OF INCENTIVES IN ELECTRIC UTILITY REGULATION 2* (1991).

19. For an in-depth discussion of incentive regulation, see generally LAFFONT & TIROLE, *supra* note 6.

Incentive regulation has been proposed as an alternative to traditional rate base regulation. Under this very broad definitional umbrella, regulated utilities may be offered rewards and/or penalties as incentives to minimize costs, lower rates, or improve some other aspect of performance.<sup>20</sup> Incentive regulation has been used extensively in both the telecommunications and railroad industries.<sup>21</sup> While its use in both the electricity and natural gas industries is less extensive,<sup>22</sup> in both of these industries its use is rapidly growing. At the federal level, FERC passed a comprehensive policy statement in 1992 in which it approved incentive ratemaking for natural gas pipelines, oil pipelines, and electric utilities.<sup>23</sup>

Performance-Based Regulation is one variant of incentive regulation. As its name suggests, PBR focuses on various aspects of the regulated utility's performance characteristics. While the subject of this Article is the comprehensive use of PBR for base rate determination (explained further below), PBR mechanisms have also been developed to lower fuel costs, encourage conservation, increase resource mix diversity, improve capacity factors and heat rates, reduce pollution, and reward good management practices.

Each of these PBR mechanisms sets some sort of *threshold performance level*. This might be a target capacity factor or fuel price. Alternatively, it may be an overall price cap. If the utility beats the target, it is either rewarded or, in a tougher variation, simply not penalized.

For example, if a utility is able to lower its fuel costs through improved fuel procurement or increased powerplant efficiency, its shareholders may be allowed to share in the savings. Similarly, if the utility increases the level of conservation or the amount of renewables in its resource mix, it may be given a higher rate of return. In the harshest case, a utility might simply be able to avoid a penalty or cost disallowance by meeting or beating the target.

In the electricity industry, *Fuel Cost PBR mechanisms* focus on fuel and purchased power costs as well as powerplant performance. They are used to encourage utilities to improve their fuel procurement practices, improve their heat rate efficiencies, and increase the capacity factors of those baseload power plants with the lowest marginal costs of generation (e.g., nuclear). Regulators in Arkansas, Arizona, Colorado, Connecticut, Delaware, Florida, Maryland,

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20. See Lorenzo Brown, et al., *Toward Improved and Practical Incentive Regulation*, 3 J. OF REG. ECON. 323 (1991); Sanford V. Berg & Jinook Jeong, *An Evaluation of Incentive Regulation for Electric Utilities*, 3 J. OF REG. ECON. 45 (1991).

21. See, e.g., M. N. Lowry, *The Case for Indexed Price Caps for U.S. Electric Utilities*, 4 ELECTRICITY J. 8 (1991).

22. See COMNES, *supra* note 4 (discussing use of incentive regulation in natural gas industry).

23. 57 Fed. Reg. 55231 (Nov. 24, 1992) (PL92-1-000). FERC established only general principles and left it up to the utilities to devise specifics.

Massachusetts, Michigan, New Jersey, Ohio, Oregon, and New York have all used or are currently using Fuel Cost PBR mechanisms. Some of these states, such as Arkansas, Arizona, and Delaware, have used a system of rewards *and* penalties while other states, such as Colorado and Connecticut, have used only penalties.<sup>24</sup>

*Conservation PBR mechanisms* and the related *Resource Acquisition PBR mechanisms* are also being used in the electricity industry to promote utility investment in Demand Side Management (DSM) and renewable energy sources through Integrated Resource Planning (IRP). For example, in Kansas, the PUC allows a higher rate of return on investment in such measures.<sup>25</sup> Similarly, in Oregon, the PUC provides a cross-subsidy to conservation investments.<sup>26</sup> Other states with such programs include California and Washington.

*Managerial PBR mechanisms* are designed to improve overall efficiency in some aspect of the utility's operation. For example, the Iowa PUC has established a set of management efficiency standards which are applied to rate cases. The PUC has the discretion to reward good management practices and penalize bad ones. The criteria it may consider include but are not limited to price per unit of service, operations and maintenance per unit of service, the five highest managerial salaries in relation to total revenues, the company's bad debt ratio, and innovative ideas implemented by management.<sup>27</sup> Other states with Managerial PBR mechanisms include Texas and Wisconsin.<sup>28</sup>

As indicated above, the focus of this Article is on *Base Rate PBR mechanisms*. This is arguably *the* most important type of PBR since it is the most comprehensive application possible. Under a Base Rate PBR mechanism, an overall revenue requirement for the utility is calculated. Using cost of service criteria, rates for each individual customer class can then be set. In the electricity industry, San Diego Gas & Electric was the first and is to date the only electric utility to secure approval of a Base Rate PBR mechanism. As we shall discuss in much greater detail below, establishing a Base Rate PBR mechanism involves three basic steps.

First, the PBR regulator must set a starting point or "baseline" revenue requirement to begin the experiment. In doing so, it must also adjust the baseline upwards for inflation and downwards for projected productivity increases. Second, the PBR regulator must provide utility managers with a package of incentives to encourage these managers to produce at a cost *below* this baseline. Operationally, this means designing a sharing mechanism to distribute any realized cost savings between ratepayers and shareholders. This

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24. BOND, CAL. PUB. UTIL. COMM'N, *supra* note 18, at 5-6.

25. *Id.* at 18-19.

26. *Id.* at 19.

27. *Id.* at 24.

28. Wisconsin has also adopted a PBR mechanism to reduce air pollution emissions.

must be done in a way which preserves the managers' incentives to pursue such savings while also passing some savings on to the consumer, so as to advance the goals of equity and economic competitiveness. Finally, the PBR regulator must include some type of "quality control" mechanism to insure that the utility does not pursue cost savings at the expense of system reliability, safety, customer satisfaction, or other measures of quality.

At present, San Diego Gas & Electric is the only electric utility in the nation with a Base Rate PBR. However, in California, both Southern California Edison and Pacific Gas & Electric have applied for their own PBRs. At the same time, the possible use of Base Rate PBRs has become an essential part of a broader national policy discussion regarding the restructuring of the electricity industry.<sup>29</sup> The restructuring blueprint typically includes three steps: (1) complete deregulation of electricity generation; (2) fair and open access to the transmission grid; and (3) replacement of traditional rate base regulation of electricity distribution with a Base Rate PBR. The California PUC, which is at the forefront of this restructuring movement, has published a comprehensive rulemaking decision embracing all three of these steps.<sup>30</sup> Other states, including Connecticut, Maryland, Massachusetts, and Rhode Island are now in some stage of the deliberative process on restructuring.<sup>31</sup>

#### B. *San Diego Gas & Electric's Base Rate PBR*

In October of 1992, San Diego Gas & Electric (SDG&E) filed an application with the California PUC to convert from a traditional RBR system to a PBR framework for the purpose of establishing base rates.<sup>32</sup> In filing its application, SDG&E stated its belief that "market forces should have an impact on utility and regulator decision-making" and cited the need to "reduce the

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29. For an in-depth analysis of restructuring issues, see Navarro, *The Restructuring Regulator: A Guidebook and Research Agenda*, *supra* note 8.

30. CAL. PUB. UTIL. COMM'N, PROPOSED POLICY DECISION ADOPTING A PREFERRED INDUSTRY STRUCTURE, (Decision Number 95-05-045) (May 24, 1995).

31. For details regarding Massachusetts and Rhode Island, see *The News in Focus*, ELECTRICITY J., July 1995, at 13-14 (describing recent developments in deliberative processes in Rhode Island and Massachusetts). See also *Industrial Energy Bulletin*, September 8, 1995 (summarizing recent electric industry regulatory reforms in twenty-six different states).

32. Application of San Diego Gas & Electric Company to Establish an Experimental Performance-Based Ratemaking Mechanism Before the Cal. Pub. Util. Comm'n (Application Number 92-10-017) (October 16, 1992) [hereinafter Application].

The SDG&E application was part of a broader three-part experimental program to restructure rate regulation for natural gas procurement, electric generation and dispatch, and energy procurement. SDG&E first proposed such an experiment in the above-cited application. For a more complete legislative history, see Proposed Decision of ALJ Wetzell regarding the Application of San Diego Gas & Electric Company to Establish an Experimental Performance-Based Ratemaking Mechanism, at 4-7 (Application Number 92-10-017) (Cal. Pub. Util. Comm'n, July 1, 1994) [hereinafter ALJ Decision].

significant burden and regulatory inefficiency that arise from traditional regulatory oversight . . . .”<sup>33</sup> SDG&E was subsequently joined by the California PUC’s Division of Ratepayer Advocates (“DRA”) and the Federal Executive Agencies (“FEA”) in submitting a Joint Proposal on December 7, 1993,<sup>34</sup> while the consumer advocacy group, the Utility Consumers Action Network (“UCAN”), submitted testimony in opposition to the Joint Proposal.<sup>35</sup>

In its application, SDG&E made proposals regarding the three necessary mechanisms of a PBR system: (1) a revenue baseline requirement; (2) a sharing mechanism; and (3) a quality control mechanism. It first proposed a revenue requirement baseline and adjustments to that baseline according to its own firm-specific, econometric data. As we shall see below, these econometric results may have been “strategically gamed” for the purpose of inflating the baseline revenue requirement. In addition, the California PUC specifically rejected the use of a “Statistical Benchmark Model” which could have been used to better calibrate the baseline. Second, SDG&E argued for a *regressive* sharing mechanism that featured 100 percent of savings to shareholders for the first 100 basis points above the company’s authorized rate of return, 75 percent of savings between 100 and 150 basis points, and 50 percent above 150 basis points.<sup>36</sup> As we shall argue below, the preferred sharing mechanism should have been a *progressive* sharing mechanism in which the utility’s share of savings would rise with the amount of cost savings achieved. Third, SDG&E proposed quality control parameters of employee safety, customer satisfaction, and system reliability. In addition to these three mechanisms, SDG&E advocated a fourth mechanism which was not directly linked to SDG&E’s performance. This mechanism involved a comparison of SDG&E’s rates to a national rate index.<sup>37</sup> However, as we shall argue further below, the use of this fourth mechanism is inappropriate for quality control because such a rate index is influenced far more by exogenous factors such as relative fuel prices than managerial decisions.

On August 3, 1994, the California PUC issued a decision<sup>38</sup> that

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33. Application, *supra* note 32, at 4-5.

34. Prepared Direct Joint Testimony on Performance-Based Ratemaking Base Rate Mechanism for San Diego Gas & Electric Co. (Application Number 92-10-017) (Cal. Pub. Util. Comm’n, December 7, 1993) [hereinafter Joint Testimony].

35. See William B. Marcus, Utility Consumers Action Network, UCAN’s Evaluation of SDG&E’s Performance-Based Ratemaking Base Rate Mechanism (Cal. Pub. Util. Comm’n, Dec. 7, 1993) (Application Number 92-10-017) (prepared testimony) [hereinafter UCAN’s Evaluation].

36. Joint Testimony, *supra* note 34, at 15.

37. *Id.* at 17.

38. As the California Department of General Services has noted, “This case is additionally important because the Commission’s resolution of many of the issues in this proceeding may be viewed as precedent-setting for the upcoming Southern California Edison Company (“SCE”) and Pacific Gas & Electric Company (“PG&E”) PBR cases.” Opening Brief of the California Dept.

essentially endorsed, *in toto*, SDG&E's application. This decision came despite significant opposition from the consumer advocacy group UCAN.<sup>39</sup> In its testimony, UCAN argued that the SDG&E baseline revenue requirement was too high and would lead to false accounting savings rather than real ones.<sup>40</sup> UCAN also argued that the regressive sharing mechanism would lead to minimal cost savings,<sup>41</sup> that it was inappropriate to reward utilities for maintaining quality,<sup>42</sup> and that the use of a national rate index was inappropriate.<sup>43</sup> UCAN's testimony predicted that the SDG&E package would not result in significantly lower rates for electricity customers and predicted that rates would actually rise, in direct contradiction to the California PUC's avowed goal of improving the competitiveness of the California economy.<sup>44</sup>

UCAN's warnings seem to have been borne out by the first report filed by SDG&E. This report documents the results of its PBR experiment to date.<sup>45</sup> In the first year of PBR, SDG&E earned a rate of return of 10.17 percent or 114 basis points above the established baseline of 9.03 percent, and achieved \$55.4 million in before-tax cost savings. Under the regressive sharing formula, utility shareholders received \$31.9 million in additional profits while ratepayers received only \$1.1 million.

In addition, SDG&E shareholders received \$7 million in rewards associated with their quality control mechanism. It received \$3 million for its non-price performance regarding employee safety—even though it failed to meet its 1994 safety goal.<sup>46</sup> More importantly, SDG&E received an additional \$2 million based on its performance relative to the national rate index. This was despite the fact that, based on its rates, SDG&E's position on the index actually *rose* from 132 percent in 1992 to 135 percent during the PBR period.<sup>47</sup>

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of General Services at 2, Application of San Diego Gas & Electric Co. to Establish an Experimental Performance-Based Ratemaking Mechanism (Cal. Pub. Util. Comm'n, Feb. 24, 1994) (Application Number 92-10-017).

39. See UCAN's Evaluation, *supra* note 35. For an overview of UCAN's critique, see also Opening Concurrent Brief of Utility Consumers' Action Network, Application of San Diego Gas & Electric Co. to Establish an Experimental Performance-Based Ratemaking Mechanism (U 902-M) (Cal. Pub. Util. Comm'n, February 24, 1994) (Application Number 92-10-017) [hereinafter UCAN's Opening Concurrent Brief].

40. UCAN's Opening Concurrent Brief, *supra* note 39, at 25.

41. UCAN's Evaluation, *supra* note 35, at 20.

42. See UCAN's Opening Concurrent Brief, *supra* note 39, at 66.

43. *Id.* at 71.

44. William Marcus's Memo to UCAN, *SDG&E PBR Rate Forecasting* (July 22, 1994) (on file with author).

45. SAN DIEGO GAS & ELECTRIC CO., PBR BASE RATE MECHANISM FINAL PERFORMANCE REPORT [FOR] 1994 (May 15, 1995) (on file with author).

46. SDG&E achieved a score of 1.04 on the OSHA lost-time accident index. Its goal was 1.0.

47. The remaining two million dollars in performance bonuses came about from improved customer satisfaction, as measured by a customer survey.

The bottom line is that under PBR, *SDG&E shareholders gained almost \$40 million* in after tax earnings.<sup>48</sup> At the same time, after receiving 1.1 million dollars in shared savings and paying seven million dollars in performance bonuses, *ratepayers lost \$5.9 million*.<sup>49</sup>

If the goal of PBR as stated by the California PUC is to reduce electricity rates and thereby improve the economic competitiveness of the state, California's PBR experiment appears, at least thus far, to be an abject failure. It should serve more as a warning sign of the dangers of PBR than as a precedent or model for other states to adopt. In the remainder of this paper, we shall conduct a theoretical examination of the important properties of PBR in order to demonstrate why and how the California experiment went wrong. We shall begin this examination with a discussion of the basic assumption underlying PBR, and the argument as to why it should be substituted for traditional rate base regulation.

## II. The PBR Premise

The three-part economic rationale for traditional cost-plus, rate base regulation or "RBR" is illustrated in Figure One. First, electricity and natural gas distribution are sectors which have traditionally been thought to be natural monopolies due to the economies of scale and density which extend over the relevant range of their production. Government intervention into pricing in natural monopolies is thought necessary to minimize the deadweight loss which results from the allocative inefficiency of monopoly pricing. This deadweight loss is measured by the triangle AFD in Figure One. The loss results because, absent government intervention, the profit-maximizing monopolist will set price at  $P_m$  and quantity at  $Q_m$  where *marginal revenue* equals marginal cost rather than at the allocatively efficient  $P_{mc}$  and  $Q_{mc}$  where *price* equals marginal cost.<sup>50</sup>

Second, given the need for government intervention, cost-plus regulation in which price ( $P_{ac}$ ) is set to average cost (at point C in the Figure) is a second-

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48. For further discussion, see Michael Shames, Utility Consumers' Action Network, Comments in Response to Proposed Majority and Minority Decisions, (Cal. Pub. Util. Comm'n, July 24, 1995) (Rulemaking Number 94-04-031) (Investigation Number 94-04-032) [hereinafter UCAN's Comments]; See also San Diego Gas & Electric Co., Memo to Cal. Pub. Util. Comm'n (Aug. 23, 1995) (on file with author).

49. This figure is obtained by subtracting the \$1,100,000 ratepayers gained in shared savings from the \$7,000,000 they gave to SDG&E in performance bonuses. UCAN's Comments, *supra* note 48, at 36.

50. This result can be found in any microeconomics textbook. There is an entire literature on "contestable markets" that argues that in the case where monopoly markets are contestable, the monopolist will actually price closer to the competitive model than the monopoly model. See, e.g., WILLIAM J. BAUMOL & ALAN S. BLINDER, *ECONOMICS: PRINCIPLES & POLICY* 533-34 (1985).

best option that avoids the political problem of providing a government subsidy for private industry. This subsidy would be necessary under the “price equals marginal cost” or allocatively efficient pricing rule because, as noted above, under such a rule the regulator would set price at  $P_{mc}$  and quantity at  $Q_{mc}$ . At these price levels, the utility would be operating at a loss and would need a government subsidy roughly equal to the area within  $P_{mc}P_{ac}CD$  in Figure One in order to break even.

Finally, regulation is the preferred form of intervention in America because it avoids the more socialistic option of government ownership of the industry itself.<sup>51</sup>

Under traditional RBR, rates are set by the following average cost or “cost plus” formula:<sup>52</sup>

$$R = rB + \text{VOCs} \quad (\text{Equation 1})$$

$R$  is the firm’s revenue requirement,  $r$  is the firm’s market cost of capital,  $B$  is the capital stock or “rate base” (net of depreciation), and VOCs are the variable operating costs associated with production, such as fuel and labor. Price is set by dividing the revenue requirement  $R$  by projected demand  $Q$  as shown below:

$$P = R/Q \quad (\text{Equation 2})$$

While regulators have developed numerous mechanisms such as “prudency reviews” and the “used and useful standard” to prevent utilities from simply passing through unnecessary costs, the regulatory bureaucracy has been just as busy devising mechanisms such as attrition allowances and fuel adjustment clauses which facilitate such cost pass-throughs.<sup>53</sup> At the same time, the discretionary nature of estimating a firm’s actual market cost of capital has preserved a great deal of flexibility in the crafting of revenue requirements, regardless of the precision with which the rate base and variable

51. Japan is the only other major country in the world that uses RBR on a wide scale. Most other major countries prefer public ownership of their electricity industry. See Navarro, *Creating and Destroying Competitive Advantage*, *supra* note 12, at 207-08.

52. A classic primer on rate base regulation is JAMES C. BONBRIGHT, *PRINCIPLES OF PUBLIC UTILITY RATES* (1961).

53. The hazard of such pass-throughs for cost efficient operations is obvious. For example, the California PUC’s Electric Revenue Adjustment Mechanism (ERAM) “guarantees that [Southern California] Edison’s base rate revenues will arrive intact no matter what happens to affect sales . . . .” Because of this, the Commission’s Division of Ratepayer Advocates rails at “the predicament of Edison’s customers who chafe at having to take harsh steps to compete in difficult economic times as they see Edison unscathed, immune from the ordinary pressures of the marketplace.” DIV. OF RATEPAYER ADVOCATES, CAL. PUB. UTIL. COMM’N, *supra* note 1, at II-13.

operating costs are measured.<sup>54</sup>

Because of the cost-plus nature of the formula and the discretionary component of the market return, rate cases have far too often deteriorated into a litigation-intensive “game” in which utility managers strategically seek to overstate their costs, obtain generous pass-throughs, and inflate their market cost of capital, while ratepayer interests face strong incentives to do just the opposite.<sup>55</sup> PBR is a response to this game-theoretic problem and is based on the assumption that *utility managers will not voluntarily minimize costs under RBR and regulators will lack the complete information to force them to do so.* This premise is illustrated in Figure Two.

In Figure Two, the firm’s minimum average cost curve is at  $AC_{\min}$  and its observed average cost curve is at  $AC_{\text{obs}}$ . Under RBR, price is set equal to  $AC_{\text{obs}}$ , and the utility operates at point A at a price of  $P_{\text{obs}}$ .<sup>56</sup> However, if the utility’s  $AC_{\min}$  were known, the RBR regulator could set price at  $P_{\min}$ , and the utility would be forced to operate at point B. The result would be cost savings roughly equal to the area of the polygon  $P_{\text{obs}}ABP_{\min}$ . (As discussed below, the distribution of these potential cost savings is a key factor in the design of PBR’s incentive structure.)

A major focus of the PBR experiment is to design a system of incentives that encourages utility managers to pursue these savings both in the short and long run.<sup>57</sup> Operationally, this means moving the utility from operating on  $AC_{\text{obs}}$  to  $AC_{\min}$ .<sup>58</sup>

54. For an excellent discussion of the numerous and often competing methodologies to estimate a utility’s cost of capital, see HOWARD THOMPSON, *REGULATORY FINANCE: FINANCIAL FOUNDATIONS OF RATE OF RETURN REGULATION* (1991). These methodologies include comparable earnings and discounted cash flow, risk analysis and the capital asset pricing model, and arbitrage price theory. See also Jeffrey A. Dubin and Peter Navarro, *Regulatory Climate and the Cost of Capital*, in *REGULATORY REFORM AND PUBLIC UTILITIES* 141 (Michael A. Crew ed., 1982).

55. Viewed through the lens of George Stigler’s capture theory, the ultimate result depends on the relative political power of the rent-seekers involved in the game, principally ratepayers and shareholders. (Note, however, that different classes of ratepayers, e.g., residential versus industrial, are often also at war with each other over issues such as cross-subsidization and interruptibility of service.) The capture theory is presented in George J. Stigler, *The Theory of Economic Regulation*, 2 *BELL J. OF ECON. & MGMT. SCI.* 3 (1971).

56. Of course, regulators will conduct prudence reviews and the like, but the operative PBR assumption is that because of incomplete information and the set of perverse incentives which the utility faces, the result will be  $P = AC_{\text{obs}}$ .

57. In the longer run, capital is allowed to vary. Since non-optimal capital investment is one of the major symptoms of inefficient RBR, it is useful to keep this distinction in mind. (The primary short run problem is inflated operations and maintenance expenses).

58. This dynamic shares some similarities with the expected behavior of utilities under traditional RBR in the presence of regulatory lag. In particular, in a general rate case in which rates are set over a three or five-year period, the utility has strong incentives to produce at costs lower than those projected in the rate case and thereby earn an actual rate of return higher than the allowed return. The difference with PBR is that the utility is given an explicit “green light” to achieve the cost savings while there is also a provision for any savings to be shared with consumers.

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**Table I. Traditional Complaints About Rate Base Regulation**

- (1) Inflated Operations and Maintenance Costs
  - (2) Over or Under-Investment in Capital
  - (3) Reduced Rate of Technological Change
  - (4) Excessive Administrative and Compliance Costs
  - (5) Destruction of Competitive Trade Advantage
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In considering the effective design of such a PBR system, it is first useful to explore the set of perverse regulatory incentives that historically have caused the observed AC to deviate from the minimum AC under traditional RBR. Only by understanding these incentives will it be possible to determine whether the PBR system can alter them and achieve the desired goal of moving the utility from point A to point B, thereby minimizing costs.

Table I summarizes what has become a rather long litany of well-accepted criticisms of the perverse incentives which RBR creates. These complaints fall into two broad categories: (1) concerns over the inefficiencies associated with cost-plus RBR in natural monopoly industries; and (2) the impact that RBR has had on potentially competitive segments of regulated industrial sectors.

A. *RBR and the Ills of Monopoly*

According to proponents, a major goal of Performance-Based Ratemaking is to eliminate the inefficiencies of cost-plus, rate base regulation in monopolistic industries characterized by economies of scale or density.<sup>59</sup> The electricity and gas distribution sectors share these characteristics, and as such they suffer from regulatory inefficiencies such as inflated operation and maintenance costs, over-investment or under-investment in capital, and excessive administrative and legal costs.

1. *Inflated Operations and Maintenance Costs*

It has become almost axiomatic that cost-plus anything—whether it be rate of return regulation or defense contracting procurement—is an open

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59. See, e.g., COMNES, *supra* note 4, at 4-10. Note also that the proponents of PBR assume that PUCs are working on behalf of consumers rather than as “captured” regulators promoting the monopoly goals of their regulatees—an assumption not always supported by the evidence.

invitation to what economist Harvey Leibenstein first called technical or “X-inefficiency.”<sup>60</sup> Specifically, Leibenstein argued that absent competitive pressures, monopolists seeking the “quiet life” will fail to pursue aggressive cost-minimization even though this might increase profits to shareholders. The result is Leibenstein’s X-inefficiency, portrayed in Figure Two as the chasm between the firm’s observed and minimum average cost curves. Subsequent discussion has identified at least two sources of this X-inefficiency: expense preferencing and risk-aversion.

First, utility-maximizing managers face strong incentives to bloat the cost curve by using the firm’s revenue stream to finance the consumption of “expense preferences” and perquisites such as larger and more plush offices, the use of corporate jets or company cars, excessive staff, and so on.<sup>61</sup> Such consumption of “perks” may be traced back to the separation of ownership and control in the modern corporation. This separation in an imperfect capital market allows managers to pursue their own goals at the expense of shareholders.<sup>62</sup>

The PBR experiment to date does not recognize this separation and makes the heroic assumption that utility managers will pursue cost savings for the sake of enriching *shareholders*.<sup>63</sup> The separation of ownership and control makes this assumption extremely problematic. Until the PBR experiment takes into account this divergence of interest, it will be difficult for the PBR mechanism to eliminate this particular source of cost inefficiency. The best antidote to this “agency theory problem” is increased competition in all sectors of the electricity market—particularly generation and distribution. This is because firms in a competitive environment will face loss of market share in the short run and bankruptcy in the long run if they bloat their cost structure. Hence, the greater the competition, the less organizational slack there is in the system and the less likely it will be that managers will favor the consumption of expense preferences over the delivery of shareholder profits.

As we discuss below in Section IV, competitive pressures in a PBR

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60. Harvey Leibenstein, *Allocative Efficiency vs. X-Efficiency*, 56 *Am. Econ. Rev.* 392 (1966). Leibenstein’s argument focused on the quiet life of monopolists but is easily extended to the regulatory environment. See also M.A. CREW AND P.R. KLEINDORFER, *THE ECONOMICS OF PUBLIC UTILITY REGULATION* (1979).

61. There is a rich literature on the topic of utility maximization and expense preferences that arguably begins with the path-breaking theory of managerial discretion set forth in OLIVER E. WILLIAMSON, *THE ECONOMICS OF DISCRETIONARY BEHAVIOR: MANAGERIAL OBJECTIVES IN A THEORY OF THE FIRM* (1964).

62. This issue is also often discussed in terms of the “principal-agent” problem. For discussion within the context of incentive regulation, see GLENN BLACKMON, *INCENTIVE REGULATION AND THE REGULATION OF INCENTIVES* (1994).

63. As noted earlier, it also makes the perhaps equally heroic assumption that the PUCs are working on behalf of consumers rather than as “captured” bureaucrats of their monopoly regulatees.

framework are much more likely to emerge in a “one period model” in which PBR is used as a bridge to the deregulation of electricity generation than in a multi-period model in which PBR is used as a substitute for RBR in the distribution market. However, we shall also show that in the multi-period model, it may be possible to improve the outcome by introducing “direct access” for customers and “retail wheeling” into the distribution market, as well as specific “Managerial PBRs.” In addition, we shall point out that the “contestability” of the electricity market will play an important role in the ultimate success of PBR. As William Baumol has argued, a monopoly firm will tend to price more like a firm under perfect competition if the market is “contestable,” i.e., if there is a credible threat of entry into the market. Moreover, the greater the contestability, the closer the price will be to the competitive outcome in which price equals marginal cost.<sup>64</sup> Utilities in the electricity-generation market are already being *directly* contested by independent power producers and *indirectly* contested by the growing threat of system bypass. Such bypass can occur at the individual customer level when large industrial consumers choose to self-generate, or at the local level when a city uses its powers to “municipalize” the distribution grid.

The second, and perhaps more tractable problem is excessive risk aversion.<sup>65</sup> Under a regulatory umbrella that allows full cost recovery, utility managers have a reduced incentive to pursue risk-taking investment that might reduce costs.<sup>66</sup> The reason is straightforward: under the cost-plus system, all reasonably incurred costs are recoverable and it is very difficult to prove in a regulatory proceeding that the failure to undertake a cost-saving *investment* such as a new powerplant is responsible for creating unreasonable costs. Put another way, cost-plus regulation breeds risk-averse managers, and PBR seeks to solve this by designing a system of rewards that encourages risk-taking by allowing the utility to share in the benefits of cost savings.<sup>67</sup>

## 2. *Averch-Johnson and Reverse Averch-Johnson Effects*

As a variation on the X-inefficiency theme described above, RBR can

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64. For a general discussion of contestable markets, see BAUMOL & BLINDER, *supra* note 50, at 533-34.

65. Excessive risk aversion may actually be viewed as a perk.

66. See DIV. OF RATEPAYER ADVOCATES, CAL. PUB. UTIL. COMM’N, *supra* note 1, at II-11 (“Since the utility’s revenue requirement is largely on cruise control, and since it is virtually made whole for departures from expected revenues or fuel expenses . . . management’s motivation to control expenses and thus prices is largely absent.”).

67. As San Diego Gas & Electric Co. stated in its PBR application, “Existing regulation does not encourage utilities to take risks that might benefit customers because it fails to reward the utility for beneficial outcomes arising from having taken such risks.” Joint Testimony, *supra* note 34, at 4-5.

also lead to long run cost inefficiencies due to a non-optimal level of capital investment but for a different reason than simple risk aversion. Specifically, economists Averch and Johnson wrote a seminal paper in the 1960s arguing that when the allowed regulatory rate of return is set higher than the firm's market cost of capital, utility managers will "goldplate" or over-invest in capital equipment.<sup>68</sup> This creates an allocatively inefficient deadweight loss and causes rates to be higher than they otherwise would be.<sup>69</sup>

Twenty years later, in an era of high inflation, rapidly rising energy costs, and regulatory "rate suppression" due to the political influence of ratepayers, economists extended the AJ argument to include a "Reverse AJ Effect."<sup>70</sup> This argument predicts that when the allowed rate of return falls below the market cost of capital, utilities may well *under-invest* in capital equipment.

In the case of the electricity industry, for example, this Reverse-AJ Effect might manifest itself as a tendency to defer maintenance (the "O+M Squeeze"), the failure to build enough new capacity to meet projected demand, or a preference for fuel-intensive options such as gas turbines as opposed to more capital-intensive options such as central station powerplants.<sup>71</sup> Over time, this Reverse AJ Effect can lead to inefficiencies in the form of electricity supply shortages or higher rates as a result of a non-optimal generation mix.

### 3. *Dynamic Inefficiency*

The third major complaint with RBR is that it can interfere with the optimal rate of technological change in the regulated industry.<sup>72</sup> The primary source of the problem is regulatory lag that introduces significant delays into decisions which can affect growth.

### 4. *Excessive Regulatory Costs*

The fourth major complaint with RBR is that it is expensive to administer. RBR's direct costs include both the firm's compliance costs and

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68. H. Averch & L. L. Johnson, *Behavior of the Firm Under Regulatory Constraint*, 52 AM. ECON. REV. 1053 (1962). See also W. Baumol & A. Klevorick, *Input Choices and Rate of Return Regulation*, 1 BELL J. OF ECON. & MGMT. SCI. 162 (1970).

69. The empirical literature is mixed with regard to the presence of the AJ effect. For a review and extension, see FREDERIC H. MURPHY & ALLEN L. SOYSTER, *ECONOMIC BEHAVIOR OF ELECTRIC UTILITIES*, Chapter 4 (1983).

70. For discussion of the reverse AJ effect, see PETER NAVARRO, *THE DIMMING OF AMERICA* 15-16 (1985).

71. For discussion of the "O+M Squeeze," see *id.* at 61-63.

72. For a discussion of this problem, see C.F. PHILLIPS, JR., *THE ECONOMICS OF REGULATION* 691-726 (1969). See also CREW & KLEINDORFER, *supra* note 59, at 125-27.

the regulatory commission's operations budget. In addition, there are opportunity costs associated with the intensive use of legal and other resources in the regulatory sector.<sup>73</sup> Hence, one goal of PBR is to *simplify the process and thereby reduce these administrative, compliance, and opportunity costs.*

B. *RBR and the End of Monopoly*

The rationales for PBR which we have looked at thus far have all assumed that the electricity sector's monopoly status will continue. Some scholars disagree with this assumption and propose PBR for an entirely separate reason. They cite rapid technological change and increasing competition in formerly monopolistic industrial sectors and sub-sectors such as telecommunications and electricity generation as evidence that these industries are no longer natural monopolies. They see PBR not as a long-term solution, but rather as a short-term bridge between traditional RBR and a more radical and complete deregulation.<sup>74</sup>

In the telecommunications industry, for example, wireless technologies now promise to obliterate the economies of density arguments not only for traditional plug-in phone service but also for cable TV as well.<sup>75</sup> Similarly, it has been argued that advances in cogeneration and alternative technologies such as photovoltaics have introduced significant competition into the electricity generation market. Such competition has been spurred by the Public Utilities Regulatory Policies Act of 1978 ("PURPA")<sup>76</sup> and the National Energy Policy Act of 1992 ("NEPA").<sup>77</sup> PURPA has given rise to a new industry in independently owned "qualifying facilities" that now compete with utilities in the electricity generation market, while NEPA has given federal regulators

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73. A discussion of the concept of opportunity cost can be found in any introductory microeconomics textbook. *See, e.g.*, BAUMOL & BLINDER, *supra* note 50, at 6-7.

74. The use of PBR as a bridge to deregulation is not universally accepted. Former FERC Commissioner Branko Terzic, for example, has made clear that he does not believe that incentive rates "are the bridge to competitive market prices." He thinks that "they are the bridge to efficient monopoly operation." Cano, *supra* note 5, at 2.

75. A natural monopoly may arise from either economies of scale or economies of density. For example, the traditional argument that electricity generation is a natural monopoly hinges on the assumption that the unit costs of generation decrease steadily as plant size increases. Similarly, in industries like cable television and residential telephone service, the economies of density argument is the motivator: per unit costs decrease with density of hookups. Other arguments include economies of scope and vertical integration.

76. Pub. L. Number 95-617, 92 Stat. 3117 (codified as amended at 16 U.S.C. § 2601-2645 (1988)).

77. For a discussion of the opposing view (that the electricity generation market may *not* yet be competitive), see Navarro, *supra* note 8; Gegax & Nowotny, *supra* note 8.

the power to open transmission lines to competing electricity generators.<sup>78</sup>

### III. PBR Mechanics

The policy question examined in this Article is whether PBR is likely to improve the performance of current RBR regulation or whether it will, as its detractors predict, be simply “a luxury trip to nowhere, at the ratepayers’ expense.”<sup>79</sup> To answer this question, it is useful to discuss the mechanics of PBR as well as its potential pitfalls.

As outlined in Table II, PBR is an *evolutionary*, as opposed to revolutionary, approach to traditional RBR that involves three basic steps:

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**Table II. Mechanics of PBR**

- (1) Establish a baseline revenue requirement:
    - Allow for inflationary, productivity, and other adjustments to the baseline over time.
  - (2) Provide utility managers with an incentive to beat the moving baseline:
    - Design a sharing mechanism to distribute cost savings.
  - (3) Incorporate a quality control mechanism:
    - Insure cost savings are not achieved at the expense of safety, reliability, or some other quality parameter.
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First, the PBR regulator must set a starting point or “baseline” revenue requirement to begin the experiment. In doing so, it must also adjust the baseline upwards for inflation and downwards for projected productivity increases. Second, the PBR regulator must provide utility managers with a package of incentives to encourage these managers to produce at a cost below this baseline. Operationally, this means the PBR regulator must design a

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78. For an overview, see Jeffrey D. Watkiss and Douglas W. Smith, *The Energy Policy Act of 1992—A Watershed for Competition in the Wholesale Power Market*, 10 YALE J. ON REG. 447, 452-54.

79. UCAN’s Evaluation, *supra* note 35, at 1.

sharing mechanism to distribute any realized cost savings between ratepayers and shareholders in a way which preserves the incentive of managers to pursue such savings while also meeting the regulator's goals of an equitable distribution and increased economic competitiveness. Third, the PBR regulator must include some type of "quality control" to insure that the utility does not pursue cost savings at the expense of system reliability, safety, customer satisfaction, and other measures of quality.

In taking these three steps, the PBR regulator faces several major potential pitfalls. These pitfalls are outlined in Table III.

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**Table III. Potential Pitfalls of PBR**

(1) Baseline "Too High"	(Bogus Cost Savings)
(2) Baseline "Too Low"	(Reverse AJ Effect or "O+M Squeeze")
(3) Wrong Sharing Mechanism	(Failure to Achieve Maximum Cost Savings)
(4) Wrong Quality Mechanism	(Reduction in Some Measures of Service Quality)

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First, the baseline revenue requirement must not be set too high or too low. If it is set too high, i.e., *above* the observed  $AC_{obs}$ , the result will be bogus accounting cost savings rather than real savings. If the baseline is set too low, i.e., *below* the minimum  $AC_{min}$ , the baseline will simply be punitive. This could result in a "Reverse AJ Effect," which would involve an underinvestment of capital, or an "O+M Squeeze," which would involve the deferment of necessary operations and maintenance expenses. Second, the sharing mechanism must encourage the utility to pursue the maximum achievable cost savings rather than simply allowing the utility to reap the lion's share of the most easily achieved cost savings without pursuing the more difficult cost savings. Third, there must be a reasonable conditionality or linkage between the penalty system for quality deterioration and the reward system established by the sharing mechanism. In this regard—and this caveat is included only because the California PUC has already chosen to ignore it<sup>80</sup>—the PBR system must not include any additional alleged "incentives"

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80. As discussed earlier, California's PBR regulators included a national price index as part of their incentive system that arguably is inappropriate.

which, in reality have little or no relationship to the utility's strategic behavior.

### A. *The Baseline Revenue Requirement in Theory*

Recall from Figure Two that the optimal price and quantity combination under efficient rate base regulation occurs at point B where price equals average cost on the firm's minimum cost curve,  $AC_{\min}$ . Clearly, this point should be the regulator's desired ending point or target goal under PBR. Also recall that under inefficient regulation, price is set to point A on the firm's observed cost curve ( $AC_{\text{obs}}$ ) because the regulator cannot determine the firm's minimum AC and the firm will not reveal it.

The task of the PBR regulator is to set some *baseline starting point* relative to point A and then to design a set of incentives so that over the course of the ratemaking period, the *PBR ending point* moves as close to point B as possible. It is useful at this point to explore five different PBR scenarios and their associated starting and ending points.<sup>81</sup> Assume a simple one-period model in which the PBR regulator establishes a baseline at time  $t$  and adjusts the baseline over the length of the period for inflation, productivity, and other factors.<sup>82</sup> Figure Three traces four possible average cost curves and five possible scenarios associated with this model.

As in Figure Two, curves  $AC_{\min}$  and  $AC_{\text{obs}}$  in Figure Three represent the minimum cost curve under efficient regulation and the observed cost curve under RBR, respectively. In addition, a "bloated" cost curve  $AC_{\text{blt}}$  lies above  $AC_{\text{obs}}$ . Finally, a "rate suppression" cost curve  $AC_{\text{rs}}$  lies below  $AC_{\min}$ .

#### 1. *The Best Case*

In the "Best Case" scenario, the omniscient PBR regulator successfully determines the firm's minimum AC at the beginning of the period and sets the baseline at point B. The utility is forced to minimize its costs and move from its observed  $AC_{\text{obs}}$  without any added PBR incentives.

This theoretical scenario is rendered impossible in the real world by incomplete information and strategic behavior by utility managers with regard to revealing the necessary information. Indeed, if this "impossible dream" were possible, it would be equally possible under RBR and there would be no need for PBR. The scenario is presented only as a reference point.

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81. While there are numerous combinations of outcomes, these five basic scenarios essentially bracket the possibilities.

82. The implications of extending the model to multiple periods are discussed below in Section IV.

2. *The Second Best Case*

In the PBR regulator's "Second Best Case" scenario, the regulatory game determining the baseline revenue requirement continues much as it has under a traditional RBR proceeding. A baseline rate of  $P_{obs}$  is set at point A where  $P_{obs} = AC_{obs}$ . Over the course of the PBR period, the PBR incentive system guides the utility to point B where  $P_{min} = AC_{min}$ . In this scenario, all possible cost savings under an average cost pricing rule are attained and output increases, although the beneficiaries of the cost savings are yet to be determined.

3. *Bogus Cost Savings*

In the PBR regulator's "Bogus Cost Savings" scenario, utility managers use their political clout and/or their advantage in asymmetric information to successfully "game" the system.<sup>83</sup> The result is a bloated baseline set too high at  $AC_{blt}$ . The initial price or rate is set at  $P_{blt} = AC_{blt}$ , point C in Figure Three. In the more benign variation of this scenario, the utility responds weakly to PBR's incentives during the experiment and moves from point C to point A. The result is "paper" or bogus accounting cost savings rather than the real ones associated with moving to point B.

4. *The Worst Case*

In the "Worst Case" variation of the PBR regulator's Bogus Cost Savings Scenario, utility managers totally ignore PBR's incentives and simply choose the quiet life. They operate at point C at a price of  $P_{blt}$  with a cost structure even more bloated than it had to begin with and an even lower output.<sup>84</sup>

5. *Rate Suppression*

Finally, in the "Rate Suppression" scenario the PBR regulator sets the baseline below the firm's minimum AC and the price at point D.<sup>85</sup> This forces the utility to scramble to cut costs and operate efficiently. Eventually, however,

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83. For discussions of the game aspects of the regulatory environment, see WILLIAM T. GORMLEY, JR., *THE POLITICS OF PUBLIC UTILITY REGULATION* (1983). See also DOUGLAS D. ANDERSON, *REGULATORY POLITICS AND ELECTRIC UTILITIES* (1981).

84. Fortunately, there is no reason to expect, *a priori*, that any utility would be more successful at this under PBR than under a traditional RBR framework.

85. This could happen under intense pressure, for example, from ratepayer groups that, for whatever reason, have gained the upper hand in the ongoing political struggle with the utility. For a general discussion of the concept of rate suppression and its political origins, see Navarro, *supra* note 70.

because point D is below  $AC_{\min}$ , managers will face a short run choice of either cutting the shareholders' realized rate of return or adopting an "O+M Squeeze" strategy of deferring maintenance and cutting costs beyond what efficiency and quality concerns would dictate.<sup>86</sup>

## B. *The Baseline Revenue Requirement in Practice*

From the five scenarios described above, it should be clear that setting the baseline correctly is absolutely critical to the success of PBR. If this baseline is set too high (point C) or too low (point D), the experiment will be doomed to failure. These scenarios also shed light on the first paradox of the PBR experiment, which is that in setting the baseline revenue requirement under PBR, the regulator faces the same problems of gamesmanship, incomplete information and cost revelation that it faced under RBR. In coping with these problems, the PBR regulator may use the same methodology it has historically used in the RBR process to set the baseline, use a newly emerging "statistical benchmark model" approach, or apply some combination of the two methods.

### 1. *Traditional RBR Ratemaking*

Using option one, the traditional methodology, the baseline will be set in exactly the same way that the revenue requirement is set in an RBR proceeding according to the formula in Equations 1 and 2 above. Specifically, the utility will provide estimates of its cost of capital and capital expansion plans to aid in the determination of the rate base. It will provide historical data and projected estimates of its variable operating costs and propose indices to adjust for inflation, such as the Producers Price Index. It will provide adjustments for productivity to offset inflation, and it will provide a demand forecast by which the revenue requirement shall be divided to arrive at a rate or price. Finally, it will propose pass-through clauses and a set of exclusions to the system.

In reviewing all this material, the PBR process will be subject to exactly the same gaming behavior associated with RBR. Utility managers may try to strategically inflate costs, and ratepayer advocates may strategically understate costs. The regulatory outcome will be determined by a complex political calculus involving the relative strengths of the competing interests, the ideological orientation of the regulatory commissioners and bureaucrats, and

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86. As a strategic matter during PBR proceedings, utility managers will typically try to claim they are in a rate suppressive Scenario Five world while ratepayer advocates will be prone to warn of a bloated Scenario Four world.

the completeness and reliability of the available information.<sup>87</sup>

The good news for PBR advocates is that there is no *a priori* reason to suggest that the baseline will be set at a more bloated level under PBR than it is now set under straight RBR. However, it should be remembered that if care is not taken in setting the initial baseline, PBR will not fulfill its cost-cutting promises but rather will be nothing more than a reformist cloak for unwarranted rate increases and continued X-inefficiency.

In order to lend empirical content to this discussion and illustrate the problem of strategic gaming, it is useful to relate the above theoretical discussion to the California PBR experiment. In filing its application, San Diego Gas & Electric used its own firm-specific data and accompanying econometric analysis to forecast its preferred baseline revenue requirement and escalation factors. After reviewing SDG&E's data, the consumer advocacy group UCAN argued that the SDG&E baseline was "too high"<sup>88</sup> and that "the starting point for the benchmark was inflated by at least \$10 million."<sup>89</sup> According to UCAN, "[s]etting the benchmark inaccurately means that either SDG&E will have little incentive to cut costs or it will realize false cost savings."<sup>90</sup>

UCAN countered SDG&E's proposal with its own econometric analysis that yielded a significantly lower baseline. It also called for the PUC to "order an electric rate reduction of \$20 million to take effect when the Base Rate Mechanism is adopted to compensate for the high level of expenses approved in 1993."<sup>91</sup> SDG&E branded UCAN's analysis as "illogical, incomplete, and incorrect"<sup>92</sup> and lamented that "San Diego would start the era of performance-based ratemaking needing to make up \$30 million annually just to break even."<sup>93</sup> Stripped of rhetoric, this battle over which econometric analysis is more credible offers a typical example of the kind of strategic gaming that regularly occurs in the regulatory arena between utilities and ratepayers. Consider the following stylized interpretation of the events in this case.<sup>94</sup>

Player One, SDG&E, argues that its baseline is reasonable, i.e., that it

87. For a theoretical and empirical analysis of this political calculus, see Peter Navarro, *Public Utility Commission Regulation: Performance, Determinants, and Energy Policy Impacts*, ENERGY J., Mar.-Apr. 1982, at 119.

88. UCAN's Opening Concurrent Brief, *supra* note 39, at 25.

89. *Id.* at 25.

90. *Id.* at 26.

91. UCAN's Evaluation, *supra* note 35, at 9.

92. Opening Brief of San Diego Gas & Electric Co. at ix, Application of San Diego Gas & Electric Co. to Establish an Experimental Performance-Based Ratemaking Mechanism (Cal. Pub. Util. Comm'n, February 24, 1994) (Application Number 92-10-017) (U 902-M).

93. San Diego Gas & Electric Co., Prepared Rebuttal Testimony, regarding Application of San Diego Gas & Electric Co. to Establish an Experimental Performance-Based Ratemaking Mechanism (January 12, 1994) (Application Number 92-10-017, Phase II).

94. This is a stylized version of the facts, not the actual arguments of the stakeholders.

lies somewhere between minimum cost point B and its observed cost point A in Figure Three. It further characterizes UCAN's baseline as rate suppressive (perhaps as low as point D), warns of severe financial hardship, and threatens to withdraw its PBR application if UCAN's baseline is approved. Player Two, UCAN, counters that SDG&E wants to start at a bloated baseline, i.e., point C in Figure Three.<sup>95</sup> It believes that any cost savings that are achieved will be bogus accounting cost savings rather than *real* cost savings, which properly lie in the interval between points A and B in the Figure. UCAN further insists that its own baseline is reasonable.

The PBR regulator must choose between these two competing econometric interpretations. This is an extremely difficult task, particularly for administrative law judges who have not been schooled in the arcane subject of econometrics and who must work within the limitations of firm-specific data.<sup>96</sup> The typical regulatory solution is to "split the difference." This practice creates incentives for each player in a recurring game to strategically "high ball" or "low ball" its estimates, depending on its own interests.<sup>97</sup>

This stylized interpretation makes clear that PBR is indeed likely to be subject to the same kind of gaming as traditional RBR if base rate calculations are left to an ALJ. However, an alternative method of calculating the appropriate baseline known as "Statistical Benchmark Modeling" may offer at least a partial way out of this strategic gaming trap.

## 2. *The Promise of Statistical Benchmark Modeling*

Recent advances in the application of econometric techniques to the utility industry have given rise to a whole class of analytics called "Statistical Benchmark Modeling" ("SBM").<sup>98</sup> SBM represents a potentially cutting-edge advancement in ascertaining the firm's true minimum cost curve. Accordingly, SBM may be useful both in setting the initial baseline revenue requirement and in providing the PBR regulator with a better estimate of the desired PBR end point (point B at  $P_{\min}$  on the minimum cost curve  $AC_{\min}$  in Figure Three).

95. UCAN in fact argued that "the Joint Proposal sets its revenue benchmark higher than the company's current cost structure." UCAN's Opening Concurrent Brief, *supra* note 39, at 6.

96. As UCAN itself acknowledges: "[T]he nature of econometrics is such that it is not easy to distinguish between well-specified and correctly estimated equations and poorly specified, statistically weak equations." *Id.* at 26.

97. In this particular case, however, the administrative law judge chose to side with SDG&E. In its decision, the ALJ found that, "while both proposals are reasonable, on balance the Joint Proposal's equations have greater support in the record because they were developed using more data points . . ." ALJ Decision, *supra* note 32, at 58.

98. See ECONOMIC SCIENCES CORP., PERFORMANCE EVALUATION: CALIFORNIA INVESTOR-OWNED UTILITIES, CONSUMER ALLIANCE FOR ELECTRIC RATE REDUCTIONS (May 1994) (statistical results measuring cost performance of three major investor-owned California utilities, including SDG&C).

To see how SBM works, it is useful to contrast it with the approach in a traditional RBR proceeding. Under RBR, the basic unit of measure is the firm itself, or perhaps a small cluster of firms operating within the regulatory jurisdiction.<sup>99</sup> When San Diego Gas & Electric files a General Rate Case application, for example, it presents firm-specific data to the California PUC.<sup>100</sup> Typically, it provides both historical and forecast data on elements of the rate base as well as the variable operating costs associated with factors such as fuel and labor. The purpose of the data is to estimate future costs based on past history. In this sense, the utility's revenue requirement is prepared in a "vacuum" devoid of information about other utilities. Accordingly, this approach provides no reference point to determine whether the utility's costs are reasonable, i.e., whether the utility is close to operating on its minimum cost curve.<sup>101</sup>

In contrast, the Statistical Benchmark Modeling approach typically examines a utility's cost structure within the context of a much wider sample of utilities.<sup>102</sup> SBM normalizes this utility's data relative to the sample group by adjusting for geography, weather, fuel mix, and other operating conditions and characteristics. By applying this normalized data to specific firms, SBM can do a potentially better job of revealing a firm's true minimum cost curve.<sup>103</sup>

### a. *The SBM Methodology*

SBM starts with the presumption that the economically efficient minimum cost curve ( $AC_{\min}$  in Figure Three) is *directly unobservable* for any specific utility. SBM also presumes that each utility has a different efficiency frontier based on its own unique production, transmission, and distribution characteristics.<sup>104</sup> Because these characteristics vary from utility to utility,

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99. On occasion, the data of a small cluster of other regulated firms within the jurisdiction may also be used as a reference point or benchmark.

100. While the PUC and intervenors may also use for comparison the capital and operating characteristics for Pacific Gas & Electric and Southern California Edison, the other two major utilities in its jurisdiction, final determination of rates is largely driven by the Commission's analysis of the SDG&E data.

101. By the California PUC's own admission, "There has never been such a comprehensive benchmarking analysis presented in any California PUC proceeding." DIV. OF RATEPAYER ADVOCATES, CAL. PUB. UTIL. COMM'N, *supra* note 1, at II-4.

102. In its benchmarking analysis of three California utilities, Economic Sciences Corporation used a model that included the operating statistics of the top 100 utilities in the country. *See* ECONOMIC SCIENCES CORP., *supra* note 98.

103. To date, utilities have responded in an extremely negative manner to the use of Statistical Benchmark Modeling. *See, e.g.*, Southern California Edison Company, Southern California Edison Company's Evaluation and Response to the CAERR Study (Sept., 1994) (testimony before California PUC regarding Application Number 93-12-029).

104. ECONOMIC SCIENCES CORP., *supra* note 99, at 2.

it is inherently difficult to compare the true efficiencies of different utilities without running into an “apples and oranges” problem.

One utility, for example, may operate in a jurisdiction where the average annual temperature is 40 degrees Fahrenheit (and residential electricity bills are relatively high), where the utility is close to cheap reserves of coal, where environmental pollution regulations are lax, where there is a large industrial base (and lower fixed distribution costs), where taxes are high, and where average hourly wages are relatively low. In this jurisdiction, electricity usage and taxes are relatively high, but fuel, labor, and regulatory compliance costs are relatively low.

In contrast, another utility may operate in the Sunbelt with an average temperature of 70 degrees (and low residential electricity bills), expensive petroleum as a major fuel source, stringent air pollution laws, a small industrial base, low taxes, and high wages. In this jurisdiction, electricity usage is relatively low, but labor, fuel, and regulatory costs are relatively high.

To address this problem, the SBM model establishes a “comparison group” of utilities. The idea is to isolate those cost components such as power plant efficiencies over which the utility management has direct control from other components such as weather and regulatory climate that it does not. Using econometric techniques, SBM can then normalize the various geographic, demographic, fuel mix, and other variables. As Berndt, Doane, and Epstein explain:

In the case of electricity, differences in regional, economic, and regulatory factors influence system-average rates independent of management. Regression analysis yields rate comparisons that control for these differences. Given data describing a national sample of utilities, this method can be applied to answer the following question: *If the sample utilities faced the same regional, economic, and regulatory conditions as the utility under investigation, what rate, on average, would they charge?* Systematic differences, if any, between the average rate for the utility and the national sample that cannot be explained on the basis of specified factors can be attributed to the residual performance of management and/or the omission of a relevant factor(s) from the analysis.<sup>105</sup>

The SBM model has its roots in a 1990 study performed by George Tolley and Edward Bodmer. The authors used a regression model to estimate and adjust for specific factors that influenced rates in different areas. Tolly and

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105. Ernst Berndt et al., *Electric Utility Rates and the Evaluation of Management Performance*, ELECTRICITY J., Aug.-Sept. 1995, at 71.

Bodmer concluded that “electric rate differentials are largely explained by costs inherent in serving a particular geographical area and by timing anomalies which arise from the way utility companies are regulated.”<sup>106</sup>

In their study, Tolley and Bodmer used at least 15 different variables to differentiate rates. These variables ranged from customer characteristics such as load factor and industrial sales percentage and regulatory variables such as rate of return, regional business costs, state and local taxes per kilowatt hour, service territory density, and line loss percentages.

More recently, Economic Sciences Corporation (“ESC”) updated the Tolley and Bodmer model to examine the rate performance of California’s three largest utilities, San Diego Gas & Electric, Pacific Gas & Electric (“PG&E”), and Southern California Edison (“Edison”). In its study, ESC gathered data on 100 of the largest electric utilities for customer characteristics, power source characteristics, fuel cost and plant characteristics, labor cost, state and local taxes, and general productivity.

This rate model was simulated to yield “standard average rates” (“SAR”) estimates for each of the 100 utilities. These utilities were then ranked according to the size of the difference between the actual observed SARs and the SARs predicted by the model. A negative difference or “residual” indicated that the utility out-performed the model’s predictions regarding its rate efficiency. In contrast, a positive residual indicated the utility under-performed against the model.<sup>107</sup>

### b. *The California PBR Experiment—SBM*

Using the above methodology, ESC found that the subject of our case study, SDG&E, ranked 65th out of the sample of 100 utilities. Within the context of our analysis, this would suggest that SDG&E was operating very inefficiently, i.e., closer to point C on the bloated cost curve in Figure Three than 64 other utilities examined. ESC also found two other California utilities, PG&E and Edison, to rank 98th and 100th, respectively.

During the PBR proceeding, UCAN suggested that the Commission consider the use of SBM to help set the baseline revenue requirement, but the Commission declined. In a subsequent hearing in which Edison applied for its own PBR, the Commission had another chance to use SBM.

In that hearing, ESC presented the aforementioned statistical results in which Edison ranked dead last in performance. Edison countered that ESC had omitted or misspecified many variables in its regression equations and accused

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106. George S. Tolley & Edward C. Bodmer, *Utility Rate Comparisons and Management Efficiency*, PUB. UTIL. FORTNIGHTLY, Jan. 4, 1990, at 29.

107. ECONOMIC SCIENCES CORP., *supra* note 98, at 6.

ESC of “sloppy” and “partisan” research.<sup>108</sup> It also charged that ESC had strategically dropped six utilities from the original sample and had passed over eleven other utilities in selecting the six substitutes. The clear implication of Edison’s critique is that ESC had “cooked the books” on behalf of its client, a coalition of electricity consumer groups with a strategic agenda of “low balling” Edison’s rates.<sup>109</sup>

It is not the purpose of this Article to resolve this dispute. Whether or not Edison was correct in its accusations against ESC, however, the accusations themselves highlight a perennial problem in the regulatory arena: the potential manipulation of statistical methods and data for the purpose of strategically gaming a regulatory outcome. Whether in a traditional RBR hearing or a “reformist” PBR hearing, regulators must be ever vigilant against such manipulation and do their best to find an “honest broker” who will use the appropriate methods in a careful and rigorous manner.

Properly applied, however, Statistical Benchmark Modeling is a potentially useful tool in a PBR proceeding both as an independent check on the traditional, firm-specific method of determining the baseline revenue requirement and as a guidepost to the target ending point of the PBR experiment.<sup>110</sup>

### C. *The Sharing Mechanism*

The second major component of PBR is a sharing mechanism that distributes any realized cost savings between ratepayers and shareholders. Proper design of a PBR sharing mechanism involves both equity and efficiency considerations as well as a consideration of the broader goal of promoting the economic competitiveness of utility customers.

As noted in Figure Two, the basic efficiency goal of the sharing mechanism is to provide the utility with an incentive to move from the starting point baseline of point A on the observed cost curve,  $AC_{obs}$ , as swiftly as possible to the ending point B and  $P_{min}$  on the minimum cost curve,  $AC_{min}$ .

The PBR regulator faces a basic tradeoff which represents the second paradox of PBR: while the best way to insure that maximum cost savings are realized is to simply give the utility 100 percent of all such savings, such a distribution defeats the basic goal of reducing the costs for utility customers and enhancing their economic competitiveness. This is illustrated in Figure Four, which depicts the “supply” and “demand” curves for cost savings, as

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108. Southern California Edison Company, *supra* note 104, at 1-2.

109. *See Id.*

110. The application of SBM techniques need not be limited to the PBR arena. Such techniques can also help solve the cost revelation problem in any traditional RBR proceeding.

viewed from the utility's perspective.<sup>111</sup>

The vertical axis measures the utility share of cost savings by percent. At zero percent, all cost savings accrue to the ratepayer while at one hundred percent, all cost savings accrue to shareholders. The horizontal axis measures the number of basis points the utility earns over its allowed baseline rate of return ("ROR") and for illustrative purposes ranges from zero to 400. Thus, if the utility's allowed baseline ROR is 12 percent under PBR and it pursues cost savings such that it actually earns a return of 14 percent, the cost savings will be 200 basis points.

Two alternative "supply curves" for cost savings are depicted in Figure Four,  $S_{acs}$  and  $S_{scs}$ . These curves are similar to other supply curves in economics and their upward slopes reflect an underlying assumption of increasing marginal costs, implying that the utility will find each additional increment of cost savings more expensive to achieve than the last.

The slopes of  $S_{acs}$  and  $S_{scs}$  also reflect the relative abundance of, and cost of achieving, potential cost savings.  $S_{acs}$ , the "abundant cost savings" option, has a relatively flatter slope than  $S_{scs}$  and lies to the right of  $S_{scs}$ . It represents the case in which cost savings are both relatively abundant and inexpensive to achieve. In contrast, the slope of  $S_{scs}$ , the "scarce cost savings" curve, is much steeper and lies to the left of  $S_{acs}$ . In this case, potential cost savings are both relatively scarce and expensive to achieve.

On the demand side, Figure Four depicts four possible "demand curves" for savings associated with different sharing arrangements. D100 represents the case where shareholders receive 100 percent of all cost savings, D75 represents a 75/25 percent split for shareholders and ratepayers, D50 a 50/50 split, and so on.<sup>112</sup>

Under the neo-classical assumption that the profit maximizing utility will pursue cost savings up to the point at which the marginal benefit to shareholders equals the marginal cost of achieving the cost savings, equilibrium in this PBR "market for cost savings" will occur at the intersection of supply, which reflects marginal cost, and demand, which reflects the utility's marginal revenue.

For example, at a utility share of 100 percent, equilibrium occurs at point D on the  $S_{scs}$  curve with savings of roughly 70 basis points or at point H on the  $S_{acs}$  with savings of 400 basis points. Similarly, at a utility share of 75

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111. The figure depicts gross, rather than net after-tax, cost savings. In doing so, it assumes away the negative impact that the corporate tax will have on utility incentives to engage in cost savings by lowering the net reward. However, adding tax considerations is a needless complication that does not change the overall point or basic analysis, namely, that a progressive sharing mechanism provides a greater reward as the level of cost savings rises so that it encourages maximum cost savings while a regressive mechanism discourages savings.

112. Each of these demand curves is horizontal because benefits are defined in terms of a constant percentage of the available basis point savings.

percent, equilibrium occurs either at point C or at point G, respectively.

From the Figure, two points are obvious. First, the amount of cost savings follows an upward progression with regard to utility share regardless of whether cost savings are relatively scarce or abundant. That is, the higher the share of cost savings that accrue to the utility, the greater the cost savings it will pursue. This suggests that in general, as we shall demonstrate below, a “progressive” sharing mechanism in which the utility’s share increases with the amount of cost savings achieved will be preferred to a “regressive” mechanism in which the utility’s share falls as cost savings rise.

Second, as noted above, maximum cost-effective savings will be achieved when the utility’s share is 100 percent, either at point H when cost savings are relatively abundant, or at point D when they are not. Note, however, that giving utility shareholders *all* of the cost savings defeats at least two other goals of PBR: an equitable sharing of benefits with ratepayers and, perhaps most importantly, improving the economic competitiveness of utility customers and their own customer base.<sup>113</sup>

The important policy question, then, is this: what type of sharing mechanism best reconciles these tradeoffs between efficiency and equity, and between maximum cost savings and economic competitiveness? As we shall see below, answering this question is far easier in a one-period model in which the utility participates in the PBR experiment and then is deregulated than it is in a multi-period framework in which the utility remains under regulation indefinitely. However, we shall first see that in most cases a progressive sharing arrangement will be preferred to a regressive one.

### 1. *A Progressive Versus a Regressive Sharing Mechanism*

As shown in Figure Four, in a world of perfect information in which the supply curve for cost savings is known, the optimal PBR sharing mechanism is one in which the “perfectly discriminating” PBR regulator sets a progressively increasing share for the utility that perfectly tracks upward along the  $S_c$  curve, much like the perfectly discriminating monopolist tracks downward along the demand curve in setting price.<sup>114</sup>

Under such a scheme, the utility’s marginal share of the cost savings would always equal its marginal cost, and the utility’s share would steadily increase along the vertical axis until its share of the cost savings reached 100 percent exactly at the desired equilibrium point D or H. Under such a scheme,

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113. This point is demonstrated in Navarro, *The U.S. Regulatory Environment*, *supra* note 12. Using input-output tables for the U.S., Navarro also demonstrates how electricity price shocks from the regulatory arena can ripple through an entire domestic economy with significant implications for trade and economic competitiveness.

114. See, e.g., EDWIN MANSFIELD, MICROECONOMICS 316-17 (1994).

both utility cost savings and the ratepayer's share of these cost savings are maximized.

The obvious implementation problem, however, is that in a world of incomplete information, the precise savings cost curve is unknown. At the same time, in a world of transaction costs such a complex scheme may be expensive to administer. It follows that a multi-tiered progressive mechanism may be a more practical compromise for the PBR regulator. Such a mechanism is illustrated in Figure Five and then contrasted with a multi-tiered regressive sharing mechanism in Figure Six.

a. *A Multi-Tiered Progressive Sharing Mechanism*

In Figure Five, the progressive, multi-tiered sharing mechanism rewards the utility with 25 percent of the first 100 basis points of cost savings, 50 percent of the next 100 basis points, 75 percent of the next 100 basis points and 100 percent thereafter. This mechanism is embodied in the "ascending staircase" demand curve  $D_{pg}$  where the solid portions of the staircase curve trace the utility's share of the cost savings.

In Figure Five, equilibrium occurs at precisely the same point that it did in Figure Four for the abundant cost savings option, namely at point H where  $D_{pg}$  intersects  $S_{acs}$ . As in Figure Four, maximum cost-effective cost savings are achieved.

However, unlike in Figure Four where ratepayers got nothing, ratepayers now enjoy a substantial portion of the savings. This share is equal to the area of the polygon beginning at 25 percent on the vertical axis, moving through points A, I, J, K, L, M, and N, and then back over to 100 percent on the vertical axis. Thus, both equity and efficiency goals are advanced as well as the goal of increased economic competitiveness.

Note, however, that regulatory efficiency in the scarce cost savings equilibrium does not fare nearly as well. Under these conditions, equilibrium occurs at point A in Figure Five which is lower than the achieved equilibrium point D in Figure Four. Nonetheless, because of the steep slope of  $S_{acs}$ , relatively small potential cost savings are foregone (70 minus 30 basis points as measured along the vertical axis).

b. *A Multi-Tiered Regressive Sharing Mechanism*

By way of contrast, Figure Six illustrates a regressive sharing mechanism in which the utility gets 100 percent of the first 100 basis points, 75 percent of the second 100, 50 percent of the third 100 basis points, and 25 percent of the points thereafter. This mechanism is embodied in Figure Six as the "descending staircase" demand curve  $D_{rg}$  where the solid portions of the curve

once again trace the utility's share of the savings.

In the abundant cost savings option, utility managers stop reducing costs at point F, well before point H, the result under a progressive retention system. This illustrates the major danger of a regressive sharing mechanism: it is much more likely to result in "cream skimming" of the easiest cost savings with no attempt at achieving relatively difficult cost savings. Having said this, it is nonetheless true that the regressive sharing mechanism outperforms the progressive mechanism in the scarce cost savings scenario. Equilibrium occurs at point D, as opposed to point A in Figure Five, and maximum cost savings are achieved.

Note, however, that this scarce savings scenario runs contrary to the basic premise of PBR, namely that traditional RBR has bred a bloated, inefficient cost structure. Moreover, even if we assume that potential cost savings are scarce, the regressive mechanism fails to increase economic competitiveness, a major goal of PBR. In this case, the only benefit of PBR is a small reduction of deadweight loss with no compensation to the ratepayer and a small reward to shareholders.

Putting this sharing mechanism debate in perspective, *if PBR regulators truly believe that potential cost savings are small and potential rate reductions are negligible, there really is no point in embarking upon an admittedly speculative PBR experiment. On the other hand, if PBR regulators truly believe that utility cost structures are bloated, a regressive sharing mechanism is unambiguously undesirable and a progressive sharing mechanism will always be preferred.*<sup>115</sup>

## 2. *The Sharing Mechanism Under Shareholder Losses*

The final important issue faced by the PBR regulator is what to do if a utility incurs losses rather than achieving cost savings during the PBR period. This question is easy to answer under the PBR assumption that the regulated firm is operating on an observed AC well above the minimum AC. Under this assumption, utility shareholders should be given no further incentive to operate inefficiently. Shareholders should therefore absorb 100 percent of all losses.

## 3. *The California PBR Experiment*

In its application, SDG&E argued for a *regressive* sharing mechanism that featured 100 percent of savings to shareholders for the first 100 basis

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115. It can easily be shown that the more tiers in the progressive schedule, the greater the probability the utility will continue to pursue all cost savings up to the efficient point. At the limit, a PBR mechanism with infinite tiers will be perfectly discriminating.

points above the company's authorized rate of return, 75 percent of savings between 100 and 150 basis points, and 50 percent above 150 basis points.<sup>116</sup> In contrast, UCAN proposed a *progressive* sharing mechanism in which shareholders would receive 30 percent of the cost savings up to 50 basis points above the benchmark, 50 percent between 50 and 200 basis points, and 70 percent of the savings above 200 basis points.<sup>117</sup>

In arguing for the use of a regressive sharing mechanism, SDG&E stated that "the greatest economic efficiency is gained through an allocation of *all* savings representing efficiency gains to shareholders." Acknowledging that this was not a "practical approach," SDG&E opted for 100 percent of the first 100 basis points and stated that "it provides substantial incentives to the utility to effect savings." SDG&E further argued that the regressive sharing mechanism provided its shareholders with "a balance and a safeguard."<sup>118</sup>

UCAN countered that "a mechanism which gives the utility all of the first dollars saved and fifty percent of the dollars beyond a benchmark will encourage the utility to save as many of the first dollars as possible and discourage saving the more difficult ones."<sup>119</sup>

In accepting SDG&E's arguments, the Administrative Law Judge argued that "any sharing with ratepayers is a departure from current regulation."<sup>120</sup> More importantly, the ALJ also seemed to accept the view implicit in SDG&E's argument that there may not be substantial savings for the utility to pursue.<sup>121</sup> Within the context of the theoretical framework we have outlined above, the ALJ's perspective is consistent with a world of "scarce cost savings" as represented by the savings supply curve  $S_{scs}$  in Figure Four. In contrast, UCAN implicitly believes that SDG&E is in a world more consistent with  $S_{acs}$  which represents the case in which cost savings are both relatively abundant and inexpensive to achieve.

Based on the first year results of PBR, it is impossible to unequivocally determine whether SDG&E and the ALJ or UCAN are right. All we know thus far is that SDG&E achieved 114 basis points of savings above the benchmark.<sup>122</sup> This figure may represent the full extent of SDG&E's potential cost savings. On the other hand, it may well be that under UCAN's progressive sharing mechanism, SDG&E might have achieved as many as 200 or more basis points of savings.

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116. Joint Testimony, *supra* note 34, at 15.

117. UCAN's Evaluation, *supra* note 35, at 3.

118. Opening Brief of San Diego Gas & Electric, *supra* note 93, at 45.

119. UCAN's Evaluation, *supra* note 35, at 20.

120. ALJ Decision, *supra* note 32, at 64.

121. For example, the ALJ writes that "the theory that SDG&E can be spurred to achieve large savings . . . is not supported by the empirical evidence regarding SDG&E's operations and costs." *Id.* at 65.

122. SAN DIEGO GAS & ELECTRIC, *supra* note 45.

In light of this unresolved controversy, it is perhaps worth restating a point made above: if the PBR regulator (in this case, the ALJ) truly believes that potential cost savings are small and potential rate reductions are negligible, there really is no point in embarking upon an admittedly speculative PBR experiment. On the other hand, if the PBR regulator truly believes that utility cost structures are bloated, a regressive sharing mechanism is unambiguously undesirable and a progressive sharing mechanism will always be preferred.

#### D. *The Quality Control Mechanism*

The third major component of PBR is a quality control mechanism that establishes a clear linkage between utility cost savings and various measures of utility performance.

The potential problem here should be obvious: in order to “beat” the moving baseline and cream rewards from the sharing mechanism, the utility may be tempted to achieve false cost savings by deferring necessary maintenance, reducing service personnel, or engaging in some other type of cost cutting that reduces some measure of performance. The equally obvious solution to this problem is to devise a system that penalizes utilities in such a way as to directly link the sharing of cost savings to the maintenance of quality standards.

It must be stressed here that the quality control mechanism should be a *penalty* system only, not a *reward* system as well. From a mathematical optimization point of view, the objective of the PBR regulator is to insure that the utility minimizes costs subject to the maintenance of certain quality constraints. From this perspective, cost cutting under PBR is *rewarded* through the sharing mechanism while violations of the quality constraint are *punished* through the quality control mechanism. Viewed from this perspective, *there is no need to offer the utility any reward for maintaining quality.*

In designing this third component of the PBR system, the regulator must: (1) determine what measures of quality to include in the system; (2) set thresholds or floors for each of the quality parameters; and (3) establish a system of penalties for violations of the quality constraints.

##### 1. *Determining Quality Parameters*

The relevant quality parameters should include, but not be limited to, system reliability, customer service, and employee safety. Each of these parameters is regularly measured by utilities and is therefore easy to monitor. One common measure of system reliability in the electricity industry, for example, is the “average number of customer interruption minutes.” Employee safety, in turn, can be measured by the accident rate. Similarly, customer

satisfaction is typically measured, albeit less precisely, through the use of annual customer surveys for areas such as Field Service and Meter Reading, Local Office, Telephone Center, Service Planning, and Energy Services.

This discussion leads to the third PBR paradox: while the various quality parameters may be easy to measure, they are difficult to value. For example, what is the dollar value of a five percent decrease in service reliability or customer satisfaction? As discussed below, this valuation problem poses a significant implementation hurdle for the PBR regulator both in terms of setting thresholds and assessing penalties.

## 2. *Setting Quality Thresholds*

Establishing thresholds for each of the quality parameters is an important regulatory function with significant political implications. In this regard, the PBR regulator may be tempted to simply peg quality at its existing level. These levels may not be optimal, however. Under cost-based PBR the utility may have padded its service force, for example, leading to the provision of excessive service. Alternatively, it may have over-built its generation system beyond a reasonable reliability standard. However, if the PBR regulator volitionally cuts levels of target quality, he or she runs the risk of political criticism when customer satisfaction falls or system interruptions increase. The point here is simple: there is an interaction between a bloated observed average cost curve ( $AC_{bt}$ ) and existing levels of quality that the PBR regulator should be mindful of when approaching the quality threshold issue.

Threshold levels pose a significant analytical problem because while kilowatts of electricity or cubic feet of gas are assigned dollar values in the market place, other non-price dimensions of performance like service and safety are not. This problem is discussed in more detail in the next sub-section within the broader context of the economics of assessing penalties.

## 3. *Assessing Penalties*

In theory, the optimal penalty system is straightforward: the profit maximizing utility will cut costs at the expense of quality up to the point where the marginal gains from cutting costs are equal to the marginal losses from the penalties of reducing quality.<sup>123</sup> Recognizing this calculus, the PBR regulator must devise a system of penalties that insures that the marginal penalty from reducing quality below the quality floor is always greater than the utility's marginal benefit.

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123. This assumes there are no external costs associated with reduction in quality such as loss of customers.

This, of course, is easier said than done. In order to implement such a system, one must first assign dollar values to changes in the various quality parameters. The problem, however, is that non-price performance indicators such as customer service and employee safety share the same characteristics as non-marketed public goods: they are difficult to value precisely because they are not assigned any explicit prices in the market place.<sup>124</sup>

Again, in theory, it is feasible to estimate a valuation schedule for changes in quality using methodologies such as contingent valuation or hedonic pricing, for example.<sup>125</sup> From such data, it would be possible to calculate penalties to reflect sound marginal cost pricing economics, i.e., the penalty or “price” of violating the quality constraint should be set above the utility’s marginal cost of violating it.

However, in practice, contingent valuation and other such studies are very expensive to conduct and would defeat one of the other goals of PBR: to reduce regulatory and administrative costs. With these difficulties in mind, it is nonetheless possible to discuss some rules of thumb to help guide PBR regulators.

The easiest and toughest rule would be to deny the utility its share of cost savings should any quality parameter be breached. Under such a rule, the quality threshold is inviolable. The danger here is that such a rule would discourage risk-taking on the part of utility managers and would likely lead to a non-optimal “quality cushion” well above the quality threshold.

A second, more flexible approach is to assess the penalty as some fraction of the cost savings that increases as quality falls. If one accepts the intuitive notion of increasing marginal costs to the ratepayer of lowered quality, then it follows that the “penalty fraction” should rise as quality falls further below the quality floor. As with the sharing mechanism, for administrative simplicity the fraction may be multi-tiered rather than continuous.

Regardless of the method used to assess penalties, the most important rule is that the magnitude of the penalty should be commensurate with the magnitude of the cost savings. Put another way, do not impose small penalties for big violations and vice versa.

As a final comment, it should be clear from this discussion that any penalty system should be based on a clear linkage between cost savings and quality reductions. This may seem like an obvious point, but as we have discussed briefly above, the California PUC incorporated a comparison with a “national rate index” into its PBR incentive system. This makes little sense

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124. For a discussion of this problem, see RICHARD T. CARSON AND ROBERT C. MITCHELL, *USING SURVEYS TO VALUE PUBLIC GOODS: THE CONTINGENT VALUATION* (1989).

125. For an analysis of the various methods, see *id.*

because SDG&E's position in such an index is influenced far more by exogenous factors such as relative fuel prices than by its own managerial acumen.

#### 4. *The California PBR Experiment*

In its application to the PUC, SDG&E proposed three quality control mechanisms involving employee safety, customer satisfaction, and system reliability. In addition, it proposed a national rate comparison as a fourth performance indicator. It further proposed that the system employ a so-called "two way conditionality," or symmetrical system of penalties and rewards for reductions and improvements in quality relative to the established thresholds.<sup>126</sup>

The proposed Employee Safety performance indicator was based on the "lost-time frequency standard" employed by the Occupational Safety and Health Administration ("OSHA"). It measures total employee lost time against total employee working hours. SDG&E proposed a benchmark of 1.20 units of OSHA lost time, with \$3 million of rewards for moving below the benchmark and up to \$5 million in penalties for moving above it.

The Customer Satisfaction performance indicator was based on customer survey data in the company's Customer Service Monitoring System. The established benchmark was set at 92 percent "very satisfied" with a \$2 million maximum reward for 95 percent or above very satisfied, and a \$2 million maximum penalty for 89 percent or below very satisfied.

The System Reliability Indicator was based on a "System Average Interruption Duration Index." The benchmark was set at 70 minutes with a plus or minus range of 20 minutes, a \$100,000 adjustment per one-half minute decrease or increase in adjusted interruptions, and a maximum \$4 million reward or penalty.

Finally, the national rate performance indicator was based on SDG&E's ranking in a National Rate Index compiled annually by the Edison Electric Institute. The benchmark was pegged at 137, with \$10 million in potential penalties or rewards. In supporting this index on behalf of SDG&E, the Division of Ratepayer Advocates argued that "California is an island of high electricity prices" and that the rate index goes directly to the rate problem "by focusing on national rates and setting a benchmark that requires SDG&E's performance to improve relative to national performance."<sup>127</sup>

In its critique of SDG&E's performance indicators, UCAN opposed two-way conditionality. It argued that "rewards for non-price factors were not

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126. See Joint Testimony, *supra* note 34, at 16-21.

127. UCAN's Opening Concurrent Brief, *supra* note 39, at 21.

warranted” and further pointed out that even the Division of Ratepayer Advocates which supported SDG&E’s overall plan agreed with this point of view.<sup>128</sup> UCAN also argued that the benchmarks for each of the various indicators were set too high because they relied upon historical performance to arrive at a performance level. According to UCAN, “SDG&E should be judged based upon the company’s present performance, not upon historical performance.”<sup>129</sup>

With regard to specific indicators, UCAN further argued that existing state and federal regulations were sufficient to motivate the maintenance of employee safety standards and that any further rewards were “not necessary.” UCAN also called for the development of “more sophisticated customer service indicators.”<sup>130</sup> Finally, UCAN stated that “the national rate index is a deeply flawed proxy of the environment in which SDG&E managers will have to make decisions.”<sup>131</sup>

In its decision, the ALJ rejected all of UCAN’s criticisms and proclaimed SDG&E’s approach “not only reasonable, but essential for achieving the objectives and criteria of regulatory reform.”<sup>132</sup> As discussed above, the result is that SDG&E shareholders received \$7 million in rewards associated with the quality control mechanism. Three million dollars were received for SDG&E’s non-price performance regarding employee safety, even though the company failed to meet its 1994 safety goal.<sup>133</sup> More importantly, SDG&E received an additional \$2 million based on its performance relative to the national rate index. This was despite the fact that, based on its rates, SDG&E’s position on the index actually *rose*—from 132 percent in 1992 to 135 percent during the PBR period.<sup>134</sup>

#### IV. PBR in One-Period and Multi-Period Models

Proponents of PBR frequently cite two broad applications for this regulatory experiment.<sup>135</sup> First, PBR is advanced as a useful transitional

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128. *Id.* at 66.

129. *Id.* at 66.

130. *Id.* at 68.

131. *Id.* at 71.

132. ALJ Decision, *supra* note 32, at 69.

133. SDG&E achieved a score of 1.04 on the OSHA Lost-time Accident index. Its goal was 1.00.

134. The remaining \$2 million in performance bonuses came about from improved customer satisfaction, as measured by a customer survey.

135. The most concise statement is perhaps that offered by the Division of Ratepayers Advocates: “A performance-based regulatory approach for those functions that remain in the monopoly, or customer access side of the business, and the discipline of marketplace competition in the generation side of the business.” DIV. OF RATEPAYER ADVOCATES, CAL. PUB. UTIL. COMM’N, *supra* note 1, at II-15.

ratemaking tool along the road to a more radical deregulation of technologically changing and increasingly competitive industrial sectors such as electricity generation and telecommunications. This type of application is consistent with a one-period model during which PBR replaces RBR and then, at the end of the period, full deregulation occurs. Second, PBR is touted as an evolutionary reform of traditional rate base regulation for industrial sub-sectors characterized by monopolistic economies of scale or density such as electricity and gas distribution. This application is more consistent with a multi-period model in which the PBR “game” is played over and over.

As we shall discuss below, utility managers in the two models face different types of incentives, with utility managers in the multi-period model facing a set of incentives that give rise to strategic behavior. An analysis of these differing incentives suggests that PBR is more likely to be effective in a one-period model.

### A. *The One-Period Model*

In a one-period framework, the PBR regulator sets a baseline, provides the utility with incentives to beat the baseline, and at the end of the period deregulates the utility. Under such conditions, regulated industries would have two unambiguous incentives to pursue the cost minimization point.

The first incentive is internal to PBR, and it is driven by the potential savings available from the sharing mechanism. *A priori*, there is no reason to expect utility managers *not* to respond appropriately to a well-designed sharing mechanism.

The second incentive is external and is driven by the competitive pressures of the market place. Utility managers now operating with the rate protection of the regulatory umbrella will generally find it in the interest of the firm to use the PBR period to “get into shape” for the rigors of competition waiting at the end of the experiment. These managers can generally be expected to respond fully to whatever incentives are offered by the PBR system.<sup>136</sup>

It follows from this observation that PBR may be best suited to industries which are candidates for deregulation such as telecommunications and electricity generation. In this regard, the question arises as to why such industries even need a transitional PBR period: *why not simply deregulate them*

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136. In industries facing increasing external competition and impending deregulation, PBR may not even be necessary to induce cost minimizing behavior on the part of utilities. Consider, for example, that many electric utilities now face a serious threat from customer direct access and economic bypass. In the face of higher rates, many municipalities are considering generating their own power. However, the loss of such large customers from a utility's grid can dramatically increase its fixed costs per kilowatt hour and put even more upward pressure on rates.

*and let the various firms compete?*

This is a point well-taken. One argument behind using PBR as a transitional bridge, however, is that firms that have been operating inefficiently under the regulatory umbrella need some time to make a successful adjustment to the competitive marketplace. In the absence of such a "grace period," they are likely to sustain heavy losses which would accrue to their shareholders. Such losses would not be "fair" to investors who originally made their investments based upon the assumption of a regulated marketplace.

It follows from this equity argument that PBR can be a useful tool to help the utility become sufficiently competitive to retain its customers. However, regulators should not ignore the option of immediate deregulation without a transitional bridge. The comparative merits of single-period PBRs leading to deregulation versus straight deregulation is an area which merits further study.

In this regard, a second argument for the use of PBR as a transitional tool addresses possible institutional constraints on immediate and complete deregulation. This argument may be highlighted by an example from the ongoing debate over restructuring in California.

On May 24, 1995, California's PUC issued Decision 95-05-045. It included a "Proposed Policy Decision Adopting a Preferred Industry Structure" ("Majority Proposal") voted for by a majority of the Commission and championed by California PUC chairman Daniel Fessler.<sup>137</sup> The Majority Proposal argues that neither nuclear nor hydro plants can realistically be privatized and deregulated because of "the difficulty that would be entailed in trying to transfer the ownership and operation of these plants to another party because of extensive and various licenses needed from federal and state authorities to operate these units."<sup>138</sup>

To address this issue, the Majority Proposal recommends that both hydro and nuclear assets be kept out of the spot market along with hydroelectric power and that both types of power be priced beneath the regulatory umbrella using a mechanism like PBR because: "There is a symmetry in bundling together the lower-priced hydroelectric resources with the higher-priced nuclear generating resources."<sup>139</sup>

## B. *The Multi-Period Model*

More complicated game-theoretic behavior may arise when PBR rates are determined in a recurring, multi-period framework. Such a framework is

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137. CAL. PUB. UTIL. COMM'N, *supra* note 30.

138. *Id.* at 55. The Majority Proposal may be overstating the licensing problems associated with hydro facilities. At least at FERC, transferring hydro licenses does not require a lengthy review in the same way that a new license does.

139. *Id.* at 55.

contemplated for industrial sectors such as electricity and gas distribution where, despite advances in technology, characteristics of a natural monopoly remain.

In a game-theoretic world, utility managers will weigh the benefits of achieving cost savings in any given period against the loss of utility and degrees of freedom in all future periods. To see this, suppose that in the initial period  $t$ , the utility behaves exactly like the PBR regulator wants. That is, utility managers respond to PBR incentives by undertaking the appropriate actions and investments, the firm's cost curve is shifted from the observed AC to the minimum AC, and the utility operates at point B rather than at point A in Figure Two. What have utility managers given up?

If we make the likely assumption that point B will be the new starting point or baseline for the next period in the PBR cycle, the utility will have nowhere further to go in reducing its costs. In exchange for the cost savings achieved in this first period, the utility and its managers must forego the perquisites associated with the "quiet life" of operating at the more comfortable observed cost structure in succeeding periods.<sup>140</sup> Moreover, from an agency theory point of view, the scope of this problem will be amplified the greater the separation between ownership of the firm and managerial control.

While the results of this calculus are theoretically indeterminate and no doubt specific to each firm and its regulatory environment,<sup>141</sup> at least one thing should be clear: *PBR is generally less likely to be successful at motivating cost minimization in a multi-period framework of continuing regulation than in the "one period and deregulate" model.*

It follows from this observation that the PBR regulator might also want to consider the use of a more innovative type of "managerial PBR" to help address the agency problem.<sup>142</sup> Such a form of PBR might incorporate the opportunity for management to share in some of the cost savings achieved under PBR. Such incentive plans are regularly used in the private sector under the rubric of "profit sharing" and "performance bonuses" and would provide managers with appropriate incentives to minimize costs.

It should be noted, however, that tying managerial compensation to utility performance may raise some difficult political issues with ratepayer advocacy groups who already frequently complain about the high salaries of executives in the industry. It should also be noted that what now passes for managerial

140. At the same time, with less of a cushion to rely on, the utility also increases the probability of rate suppression, i.e., that its next baseline will be set *below*  $AC_{\min}$ .

141. This area is a potentially rich topic for game theorists.

142. The kinds of managerial PBRs currently used do not generally allow managers to share in any of the bounty achieved through cost saving investments. Indeed, some of these PBRs include managerial salaries as a target for *reduction which would work in the opposite direction desired, at least from an agency theory point of view.* More generally, managerial PBRs target items such as debt ratios and the number of employees per customer for improvement.

PBRs only reward shareholders for good management practices and do not address the agency theory problem.

As stated earlier, the best antidote to the agency theory problem is increased competition in all sectors of the electricity market. In this regard, it is important to remember that in many cases PBR systems will be implemented as part of a broader restructuring of the electricity industry.

At present, there are two major competing paradigms for such restructuring: "Direct Access" and "Poolco." Direct Access is favored by free market proponents because it allows buyers and sellers to directly negotiate electricity prices and terms of service, a practice now largely forbidden. To facilitate Direct Access, electricity generators must be allowed to transmit or "wheel" their power directly to customers. This involves *wholesale* wheeling, or sending bulk power over the transmission grid. It also entails the critical step of *retail* wheeling, or transmitting electricity from the transmission grid over the distribution grid into homes, factories and businesses.

The Massachusetts Department of Utilities recently embraced Direct Access and ordered each utility in its jurisdiction to develop an individual restructuring plan consistent with expanded customer choice. Small-scale retail wheeling experiments are also under way in Michigan and Maine, while the New Hampshire state legislature has passed a bill calling for the PUC to begin a pilot retail wheeling program. Other experiments have been proposed by industrial consumers in Illinois and Indiana.<sup>143</sup>

The other restructuring approach is known as "Poolco." This approach was endorsed by the California PUC in its Majority Proposal,<sup>144</sup> and it is currently being used in Great Britain.<sup>145</sup> Under a pure Poolco, buyers and sellers cannot voluntarily negotiate price and terms of sale directly with one another.<sup>146</sup> Instead, they must buy and sell power at one transparent price. This price is set in a spot market based on bids received from buyers and sellers. All aspects of these transactions, from bidding to dispatch and billing, are administered by a centralized and mandatory power pool that critics have called "the monopolist's new clothes."<sup>147</sup>

While there is great debate over which approach is preferable, one thing

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143. For a state-by-state restructuring summary, see *Industrial Energy Bulletin*, *supra* note 31.

144. CAL. PUB. UTIL. COMM'N, *supra* note 30.

145. See Tim Woolf, *Retail Competition in the Electricity Industry: Lessons from the United Kingdom*, *ELECTRICITY J.*, May 1994, at 56-63.

146. One variant on Poolco allows buyers and sellers to enter into "contracts for differences" that allow them to negotiate price discounts and other terms of service. While Poolco supporters say such contracts allow "virtual direct access" and make Poolco equivalent to Direct Access, Direct Access proponents sharply disagree.

147. Robert Michaels, *Wholesale Pooling: The Monopolist's New Clothes*, *ELECTRICITY J.*, October 1994, at 64-76.

is clear: the Direct Access approach will inspire far more competition than Poolco. At least from the standpoint of addressing the agency problem, this Direct Access approach should be preferred to Poolco.<sup>148</sup>

C. *The California PBR Experience*

Beyond its current PBR experiment and as part of a broader reform, the California PUC has embarked on a comprehensive plan to restructure the state's electricity industry.<sup>149</sup> This ambitious restructuring plan includes: (1) the replacement of RBR with PBR in the distribution market; (2) fair and open access to the transmission grid; and (3) the deregulation of the electricity generation market.

The PUC is moving forward on full deregulation of electricity generation because it believes that rapid technological change has eliminated significant economies of scale in the generation market. Hence, this market is no longer a "natural monopoly" requiring the "visible foot" of rate regulation. On the other hand, the PUC also believes that significant economies of density, scope, and scale remain in the distribution market. Hence, rate regulation is necessary to control this natural monopoly, but the PUC favors a more market-oriented PBR to traditional RBR.

1. *The Multi-Period Model*

Within the context of the above theoretical discussion, the use of PBR as a substitute for RBR in the distribution market is consistent with the multi-period, recurring game model. Because the PUC has already adopted an arguably deeply-flawed, precedent-setting PBR mechanism in its experiment with SDG&E, it is unlikely that the PBR regulatory outcome will improve on the RBR status quo.

As we have outlined in this Article, the California PBR appears to violate each of the three major principles of effective PBR: (1) it uses a firm-specific methodology that runs the risk of setting the baseline revenue requirement too high; (2) it has embraced a regressive rather than a progressive sharing mechanism that typically will not maximize cost savings; and (3) its quality control mechanism contains unnecessary rewards as well as at least one parameter that is irrelevant.

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148. For further discussion, see Peter Navarro, *The Case for Radical Deregulation of Electric Utilities*, HARV. BUS. REV. (forthcoming Jan.-Feb., 1996).

149. For an in-depth discussion, see Navarro, *supra* note 8.

## 2. *The Single-Period Model*

Besides replacing RBR with PBR in the electricity distribution market, the Commission has also proposed using PBR in the generation market as a bridge to complete deregulation of that market. In particular the PUC has proposed that the utilities' existing nuclear and hydro plants be put under PBR for their remaining service life rather than be allowed to compete in the deregulated spot market.

The Commission may well have better success in this "one-period" application of PBR for the reasons articulated above, principally the need for utilities to compete. The fact remains, however, that the Commission has embraced a set of working principles contrary to the effective use of PBR. Unless the Commission embraces an SBM approach, adopts a progressive sharing mechanism, and streamlines its quality control mechanism, it is unlikely to achieve the best results.

### D. *Agency Theory and the PBR*

As discussed in Section II.A1 above, utility maximizing managers in a regulatory environment face strong incentives to bloat the average cost curve by using the firm's revenue stream to finance the consumption of "expense preferences" and perquisites such as larger and more plush offices, the use of corporate jets or company cars, excessive staff, etc.<sup>150</sup> Such consumption of "perks" may be traced back to the separation of ownership and control in the modern corporation. This separation in an imperfect capital market allows managers to pursue their own goals at the expense of shareholders.<sup>151</sup>

To date, the PBR experiment has not specifically acknowledged this "agency theory" problem except, perhaps, in the design and implementation of specific Managerial PBRs. The question arises as to what extent this is likely to defeat the goals of PBR. The answer depends on whether it is implemented in a single or multi-period model.

## 1. *The Single-Period Model*

There are several important factors at work that may help to mitigate the

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150. There is a rich literature on the topic of utility maximization and expense preferences that arguably begins with the path-breaking theory of managerial discretion set forth in OLIVER E. WILLIAMSON, *THE ECONOMICS OF DISCRETIONARY BEHAVIOR: MANAGERIAL OBJECTIVES IN A THEORY OF THE FIRM* (1964).

151. This issue is also often discussed in terms of the "principal-agent" problem. For discussion within the context of incentive regulation, see GLENN BLACKMON, *INCENTIVE REGULATION AND THE REGULATION OF INCENTIVES* (1994).

agency theory problem in the single-period model where PBR is used as a bridge to deregulation. In this single-period application, and as argued above, utility managers will face strong *external* competitive pressures to minimize their costs. As we know from agency theory, the greater the degree of market competition, the less likely utility managers will use corporate funds to consume “perks” and expense preferences. Competitive pressures in a single-period generation market framework come from two sources.

First, recent engineering and scientific advances have resulted in the emergence of highly efficient, natural gas-fired generation units.<sup>152</sup> At least at currently low natural gas prices, these plants can compete favorably with traditional central station powerplants characterized by large economies of scale, like those fueled by coal, one of the cheapest forms of baseload generation.<sup>153</sup> As Yeager has noted: “[T]he economic choice today is to quickly install these smaller, Brayton-cycle [gas-fired] combustion turbine units (25 to 250 MW) . . . . These can be installed at one-half to one-third the capital cost of conventional steam-electric stations[.]”<sup>154</sup>

The low capital costs associated with building gas-fired units have significantly lowered barriers to entry in the generation market, thereby increasing both the rate of entry into the market, as well as its potential contestability. Thus, as long as natural gas prices remain relatively low, both actual entry and the “contestable” threat of additional entry into the electricity generation market may help to inhibit managerial expense preference behavior.

This threat alone will not be sufficient to deter expense preference behavior. In fact, a PBR implemented for, say, a nuclear powerplant operating in an otherwise deregulated market essentially guarantees the utility a fixed price *regardless* of what the price in the deregulated spot market might be.

Having acknowledged this, utilities nationwide are also facing an increasing threat of bypass of their systems. Such bypass, a form of indirect contestability, can occur at the individual consumer level when customers like large industrial consumers choose to self-generate. Bypass can also occur at the local level when a city uses its powers to “municipalize” the distribution

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152. For an optimistic view of the impact of technological change, see Vinod Dar, *The Future of the U.S. Electric Utility Industry*, ELECTRICITY J., July 1995, at 17-18. Dar predicts that “The modern gas turbine . . . will profitably deliver power for less than 3.0 cents per kwh at the busbar, making both new stand-alone merchant and industrial and larger commercial on-site generation fiercely competitive.” *Id.* at 18. Dar also predicts that other technological developments such as electricity storage systems and next generation renewable technologies will make generation a highly competitive sector. *Id.*

153. See, e.g., Vikram Budhraj, *Generation as a Business—Facts, Fumbles, Fictions and the Future*, ELECTRICITY J., July 1995, at 36, 37 (“Our marginal generation cost for oil in the early 80s was six cents per kWh. Today it is two cents per kWh using natural gas. Generating electricity by burning natural gas . . . is cheaper than producing power in even the most efficient, new combined-cycle power plants[.]”).

154. Kurt Yeager, *Technology and Industry Structure*, ELECTRICITY J., July 1995, at 58.

grid. In either case, this indirect contestability of the market puts significant pressures on utility executives to minimize costs.

## 2. *The Multi-Period Model*

As we have argued above, in a multi-period model in which PBR is used as a substitute for traditional RBR, utility managers face significant incentives and opportunities to “game” the PBR system. Nonetheless, as was noted in Section IV.B, *it may be possible to improve the outcome if innovative managerial PBRs are developed and if PBR in general is implemented within the context of a more comprehensive restructuring framework that features direct customer access and competitive “retail wheeling.”*<sup>155</sup>

In this regard, it may be worth restating that, at least thus far, the California PUC has rejected the Direct Access-Retail Wheeling approach in favor of a more centralized restructuring approach. In contrast, on the East Coast, regulators seem more inclined to embrace the Direct Access-Retail Wheeling model.

## V. Summary and Policy Implications

Performance-Based Ratemaking is currently touted as an evolutionary reform of traditional rate base regulation and as a useful transitional step towards complete deregulation. It promises to be one of the most important forces shaping public utility regulation well into the next century. The PBR experiment is motivated not only by traditional concerns over ratepayer equity but also by a growing realization that inefficient regulation can play an important role in reducing competitive advantage in an increasingly global economy.

The basic premise motivating the PBR movement is that under traditional, cost-plus RBR, utility managers will not only fail to minimize costs but also strategically attempt to conceal the firm’s true minimum cost curve. The reason may be traced to a set of “perverse incentives” that encourages managers to inflate the firm’s operation and maintenance expenses, “goldplate” or over-invest in capital, avoid optimal risk-taking, and otherwise operate inefficiently.

This paper has presented an economic framework for designing, evaluating, and implementing Performance-Based Ratemaking systems to address this “cost minimization-cost revelation” problem. We have shown that PBR is neither good nor bad, but that application, design, and implementation make it so. We have also shown that PBR presents the regulator with three

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155. See generally Navarro, *supra* note 8 (discussing various issues involved in restructuring the regulation of the utilities industry).

basic paradoxes that must be resolved in order for PBR to succeed: (1) while the PBR regulator seeks to encourage the utility to operate at minimum cost, asymmetric information and strategic gaming by the utility prevents the regulator from knowing the firm's true cost structure; (2) while the best incentive to insure that the utility pursues maximum cost savings is to simply give all the savings to the utility, this defeats the basic goal of reducing the cost of service to utility customers and enhancing their economic competitiveness; and (3) while any effective PBR system requires a quality control mechanism to prevent utilities from cutting quality to achieve false "cost savings," such a mechanism is difficult to implement and entails significant transaction costs due to the fact that changes in quality are difficult to value given their status as non-marketed goods.

In light of these paradoxes, the policy question faced by the PBR regulator is whether PBR will be a positive force for change, or simply another failed variation on the traditional "regulatory game." The findings of this Article suggest that the PBR experiment may well fail for the same reason that traditional RBR has, namely, strategic behavior of regulated firms with an advantage in asymmetric information. It follows that would-be reformers should approach the PBR experiment with less zeal and more caution than currently exhibited in some quarters. Indeed, there is a significant risk that a poorly designed PBR system will exacerbate, rather than eliminate, regulatory inefficiencies. It may also destroy, rather than help to create, competitive trade advantage.

With these caveats in mind, it should be clear that once the decision is made to implement a PBR system, the mechanics and desired properties are relatively straightforward. First, the PBR regulator should be careful not to set the baseline revenue requirement too high or too low at the beginning of the period. In this regard, the use of Statistical Benchmark Modeling to determine the firm's true minimum cost structure should be encouraged. As with traditional RBR, the PBR regulator should also be careful not to incorporate excessive escalator and indexing factors or pass-through mechanisms that effectively remove any incentives for the utility to minimize its costs in specific areas. Second, the sharing mechanism should be progressive rather than regressive. It should also contain as many tiers as is administratively cost-effective. The exception to this progressive rule is the case where the regulated firm can clearly demonstrate that potential cost savings are small and difficult to achieve. In such a case, a better regulatory strategy might simply be to forego the PBR experiment because the potential gains are small relative to the risks involved. Third, the quality control mechanism should *include*, at a minimum, worker safety, system reliability, and customer service. It should *exclude* any parameters or indices not directly affected by the firm's strategic behavior. Fourth, the quality control mechanism

should directly link cost sharing benefits with the penalties for quality deterioration. Most important, any penalties should be of a similar magnitude to the cost savings benefits.

Within the context of these three basic PBR principles, it should be clear that PBR is unlikely to meet one of its major goals, namely, to significantly reduce administrative costs. The analytical problems associated with setting the baseline revenue requirement alone are formidable and resource intensive and will require proceedings similar to those now used in the general rate case format of traditional RBR. At the same time, the information requirements for designing an appropriate sharing mechanism are non-trivial, as are the resource requirements for adequately valuing non-marketed amenities such as customer service and employee safety when setting penalties in the quality control mechanism.

The bottom line is that PBR is unlikely to be a panacea for the ills of traditional RBR. As demonstrated above, this is particularly true when PBR is applied in a multi-period model of continuing regulation as opposed to the "one-period and deregulate" model. If the initial outcome of the California experiment with PBR has demonstrated anything, it is that PBR will be subject to exactly the same kind of strategic gaming and undesirable outcomes that have plagued traditional RBR since its inception.

Appendix

Figure 1 The Rationale for Rate Base Regulation

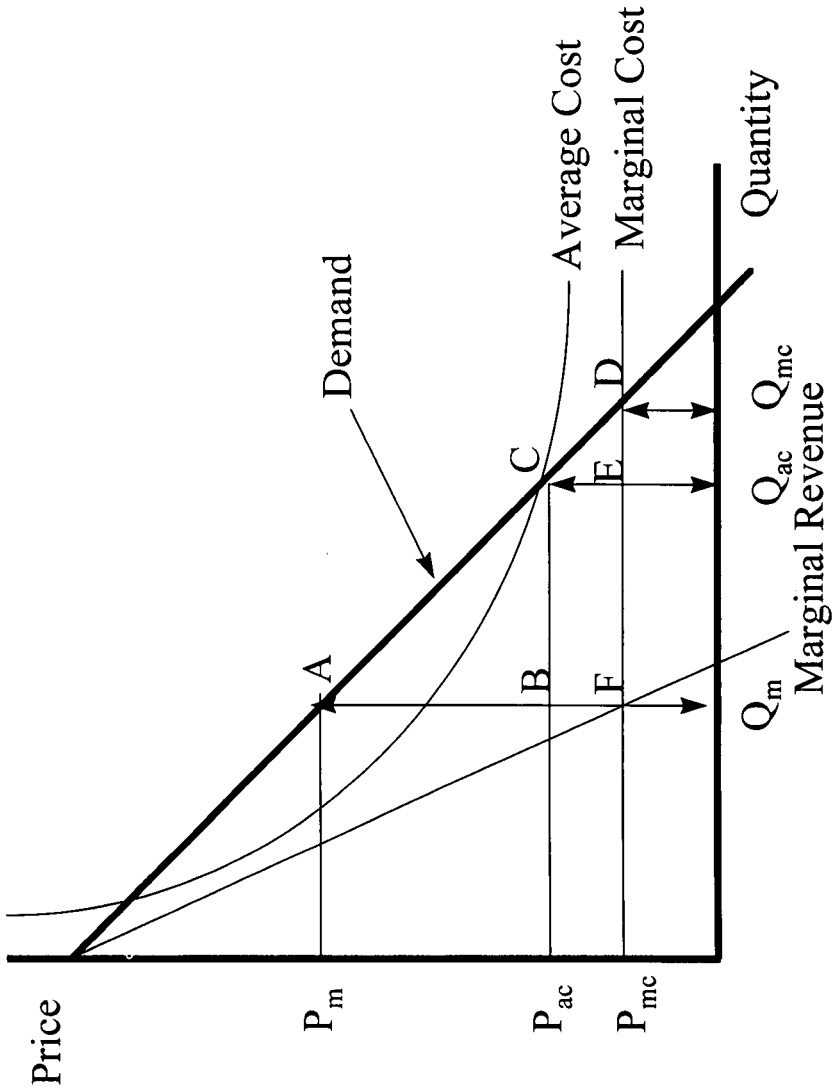
Figure 2 The PBR Promise

Figure 3 Five PBR Scenarios

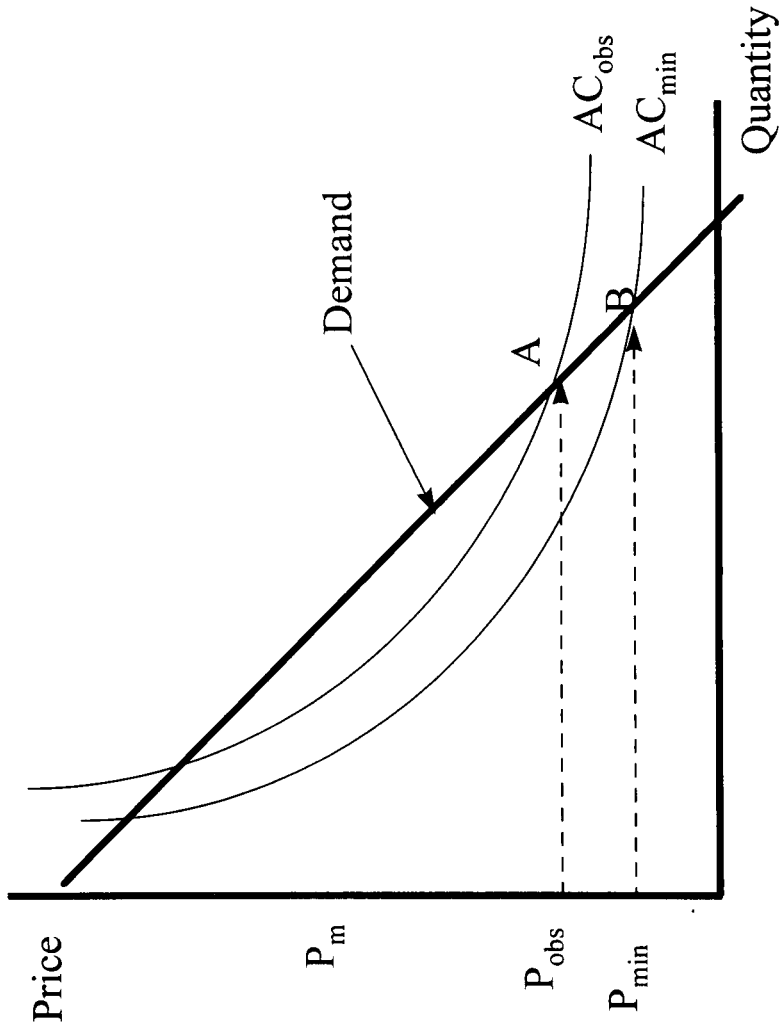
Figure 4 PBR Sharing Equilibria

Figure 6 A Regressive Sharing Mechanism

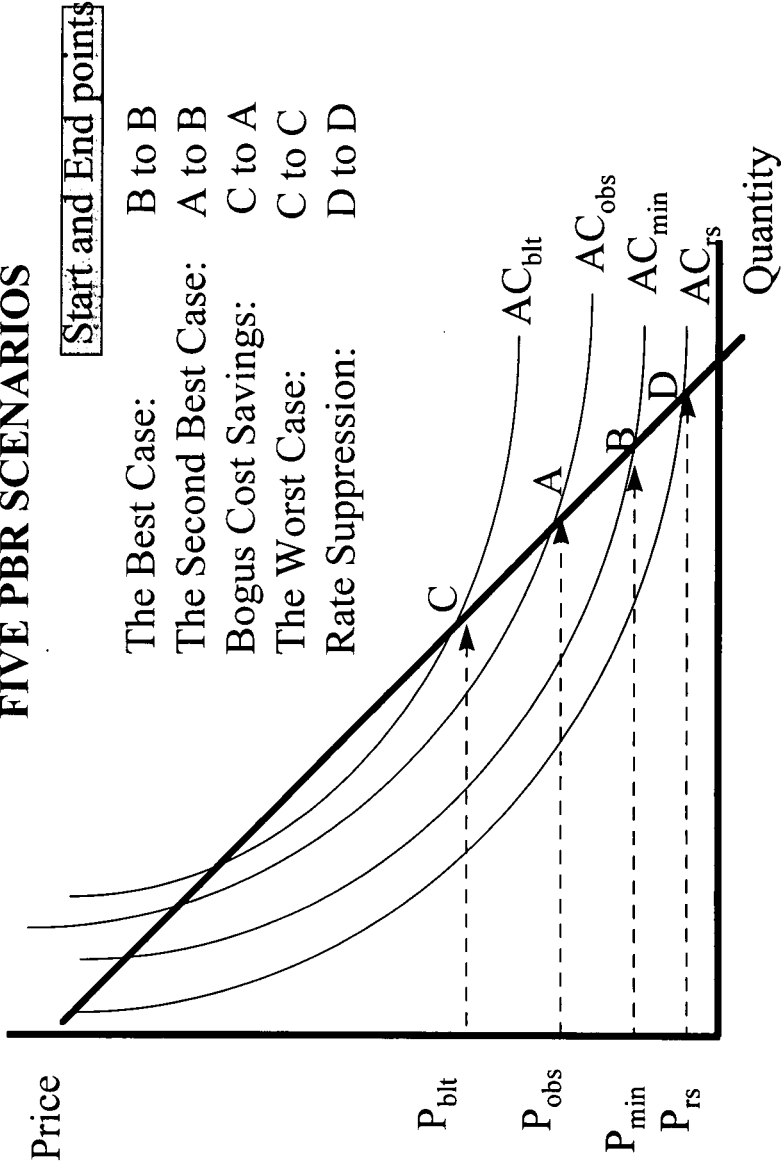
**FIGURE ONE:  
THE RATIONALE FOR RATE BASE REGULATION**



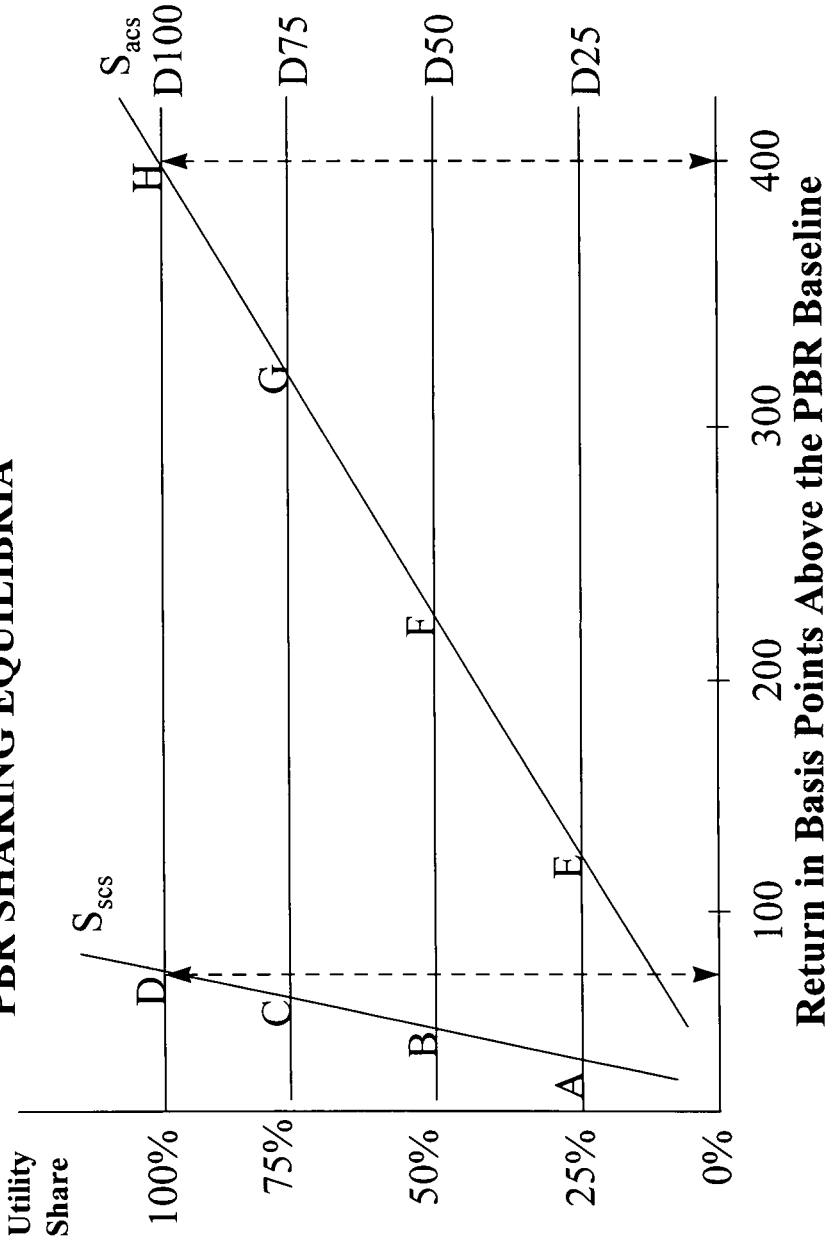
**FIGURE TWO:  
THE PBR PREMISE**



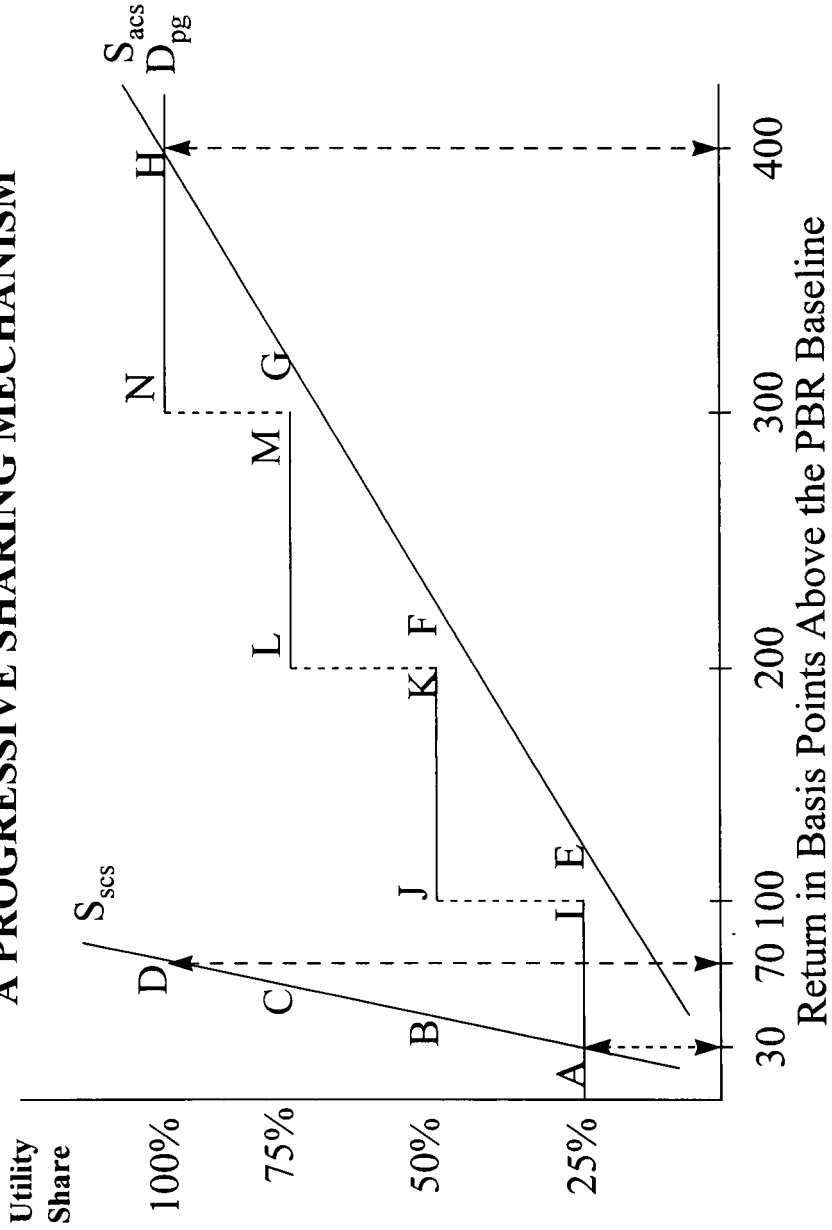
**FIGURE THREE:  
FIVE PBR SCENARIOS**



**FIGURE FOUR:  
PBR SHARING EQUILIBRIA**



**FIGURE FIVE  
A PROGRESSIVE SHARING MECHANISM**



**FIGURE SIX:  
A REGRESSIVE SHARING MECHANISM**

