PRICING AND THE INCENTIVE TO INVEST IN PIPELINES AFTER *GREAT LAKES*

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I. INTRODUCTION

Natural gas pipeline companies invest heavily in expansion of the United States pipeline system. System expansion projects totaled $5.7 billion in 1992. In 1993-94 there was more than $3.8 billion of construction projects completed or under construction, and an additional $5.2 billion proposed and pending, totaling over $9 billion.[1] Over 8,000 miles of new pipelines were installed or under construction in 1993.[2] Much of the new investment involves expanding capacity of existing pipelines by constructing parallel pipes that use existing compressors and follow the same right-of-way, a process also known as "looping." Under traditional regulation by the Federal Energy Regulatory Commission (Commission or FERC), the pipelines have been able to average or "roll in" the costs of expansion, generally raising costs to existing customers. The *Great Lakes Gas Transmission Ltd. Partnership* (*Great Lakes*)[3] decision reversed this long-standing policy by requiring new customers to bear the costs of expansion. This article will demonstrate that these alternative regulatory policies have significant consequences for pricing and the incentives to invest in new pipeline construction, and argues that the *Great Lakes* decision, which is currently under review, should be upheld and extended.

To understand the importance of the rolled-in versus incremental pricing debate, it is useful to observe that the existing transmission network with more than 284,000 miles of pipeline has a *book value* of $54 billion.[4] Therefore, expansion of existing facilities represents only a small fraction of total installed capacity in terms of pipeline miles but a much larger fraction of book value. For individual pipelines, expansion costs can far outweigh the book value of capacity. Regulated pricing provides pipelines with an incentive to expand since the costs of construction can be averaged with the existing rate base. The size of the installed base suggests that there are substantial opportunities available to average capacity expansions with existing facilities.

Substantial deregulation of the natural gas industry has taken place with the decontrol of wellhead prices of gas and the introduction of open

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1. American Gas Association, *New Pipeline Construction Status Report 1993-94*, May 1994, at 3.
2. *Id.*
3. Opinion No. 366, 57 F.E.R.C. ¶ 61,101, *aff'd in part and rev'd in part*, Opinion No. 368, 57 F.E.R.C. ¶ 61,141 (1991).
4. American Gas Association, *supra* note 1, at 5 (emphasis added).

access by FERC Order 636.[5] Open access resulted in the unbundling of the pipeline merchant function from transportation, which turned interstate pipelines into transporters of gas. This created a national spot market for wellhead gas.[6] Competitive wellhead markets for gas and open access transportation limit both the exercise of monopsony power in field markets and the exercise of market power at the transportation hubs or city gate. Most natural gas producing areas are served by multiple pipelines, with the potential for additional entry in many markets either by extension of existing pipelines or de novo construction.[7] The consuming areas receive delivery from multiple pipelines bringing gas from diverse sources within the United States and Canada.

Transportation rates on interstate pipelines remain subject to traditional cost-of-service regulation. In addition to static allocative inefficiencies, cost-of-service regulation entails serious dynamic inefficiencies, the most important of which is new pipeline construction. The traditional method of pricing new construction has been to "roll in" new capital expenditures with the existing rate base of pipelines and to increase rates accordingly. Under rolled-in pricing, also known as average-cost or embedded-cost pricing, all of the services provided by the firm are sold at a uniform price equal to the average cost of producing output. The capital portion of the expansion costs are added to the rate base, and additions to operating costs are included in total operating costs to obtain the regulated revenue requirement.[8] This article will establish that this practice creates inequities and cross-subsidization, and leads to excessive investment in new pipeline construction, which creates high costs for shippers of natural gas.

Incremental pricing of a service sets prices for new customers that reflect the incremental cost of facilities built expressly to serve them. Existing customers continue to pay rates that reflect the rate base before the expansion. Incremental-cost pricing avoids cross-subsidization and rate

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5. Order No. 636, III F.E.R.C. STATS. & REGS. Preambles ¶ 30,939, 57 Fed. Reg. 13,267 (1992).

6. Daniel F. Spulber & Michael Doane, *Open Access and the Evolution of the U.S. Spot Market for Natural Gas*, 37 J.L. & ECON. 477 (1994).

7. *See generally* EDWARD C. GALLICK, COMPETITION IN THE NATURAL GAS PIPELINE INDUSTRY: AN ECONOMIC POLICY ANALYSIS (1993). Over 70% of the 208 local markets were large enough to be served by potential suppliers within 140 miles of the market. In addition, he states:

> I find that for the majority of end-user markets in my sample, prices for natural gas might be set competitively by an unregulated market system. The data suggest that in many markets there would be several potential suppliers who could profitably enter if prices rose to noncompetitive levels. Thus, the number of incumbent firms and potential entrants make it unlikely that a firm or group of firms would be able to exercise market power and raise prices. If market power cannot be exercised in these major markets, then competition will serve as an effective regulatory mechanism.

Id. at xiii.

8. The regulated rate base usually refers to the book value of all past capital expenditures net of depreciation, and adjusted for prudency of purchase and used-and-useful criteria. The operating costs are calculated following standard regulatory accounting procedures and generally include taxes plus depreciation. The regulated "revenue requirement" equals operating costs plus the company's rate base times the rate of return allowed by the regulator. For further discussion of rate-of-return regulation see DANIEL F. SPULBER, REGULATION AND MARKETS (1989).

increases to existing customers that are not commensurate with benefits received. Moreover, it subjects new construction to a *market test*, thus creating incentives for efficient pipeline investment.

In *Great Lakes*,[9] the FERC reversed long-standing policy and introduced *incremental-cost pricing* of a capacity expansion designed to provide new services. On June 10, 1994, the D.C. Circuit Court of Appeals remanded to the Commission for further consideration its orders addressing the Great Lakes expansion. The FERC plans to rule on the general question of how transportation should be priced within the current regulatory framework.[10] This article makes the argument that a reversal of incremental pricing would be a mistake. Short of total deregulation, the Commission should reaffirm their *Great Lakes* decision and institute a general policy of incremental-cost pricing for large scale pipeline expansion.

This article addresses the choice of regulatory pricing policies. The organization of the article is as follows: (1) Part II examines regulatory policy and summarizes the *Great Lakes* case; (2) Part III discusses competitive market pricing and benchmarks for static and dynamic efficiency; (3) Part IV considers the effect of regulated pricing on the incentives for investment; (4) Part V examines the issue of cross-subsidization; (5) Part VI discusses the equity aspects of the pricing policies; and (6) Part VII concludes the article.

II. ROLLED-IN V. INCREMENTAL-COST PRICING

A. Background

The crucial problem confronting state and federal regulators is how to price pipeline expansions. When a new pipeline is built or expanded, the pipeline company must petition regulators for approval of the methodology to be used to collect revenues from customers using the new facilities. Any pricing method that is chosen will have consequences in terms of incentives for new pipeline construction and revenues generated from new and existing pipeline customers.

The Commission has traditionally favored rolled-in or average-cost pricing for new pipeline construction when (1) the new facilities provide benefits to the pipeline's existing customers; and (2) existing customers will not subsidize those customers that benefit from the new facilities. The Commission's position on pricing of pipeline expansion projects is summarized in *Northwest Pipeline*:

> The Commission's traditional policy is to permit pipelines to roll facility costs into existing system-wide rates when the pipeline demonstrates that the facilities benefit existing customers . . . . In order to roll the cost of new facilities into existing system-wide rates, the pipeline must show that the "existing cus-

9. Opinion No. 366, 57 F.E.R.C. ¶ 61,101, *aff'd in part and rev'd in part*, Opinion No. 368, 57 F.E.R.C. ¶ 61,141 (1991).

10. *FERC To Launch Generic Proceeding On Rolled-in vs. Incremental Rates*, INSIDE FERC, June 20, 1994.

> tomers will not subsidize the customers that benefit from these new facilities."[11]

Averaging costs has been justified by the view that when a pipeline operates an integrated system, the benefits from the expansion accrue to all customers in the form of increased capacity, flexibility, and reliability. If all customers benefit from the new facilities, then distributing the costs across all customers is seen as a "fair" way to allocate the incremental costs. The second condition requires the pipeline to show that rolled-in pricing will not result in a cross-subsidy from existing customers to the users of the new services. In the Commission's view, the pipeline must show the benefits that existing customers will receive from the expansion are equal to the increase in the rates paid by existing customers when the cost of the new facilities is added to the rate base. The rolled-in rate methodology has been the customary choice in rate-setting proceedings primarily because the cost of new facilities were generally small in comparison to the existing rate base.[12] Thus, rolling new facility costs into the rate base did not cause rates paid by existing customers to increase significantly. On an integrated system, this increase in rates was not seen as a cross-subsidy, but as a natural consequence of the increased reliability of the expanded system brought about by the new facilities, and was thus considered an equitable manner to allocate new facility costs.

Historically, the Commission has allowed the costs of almost all expansion facilities to be rolled into the rate base when the pipeline demonstrates that the facilities benefit existing customers.[13] Issues of "fairness" were paramount, and the rolled-in methodology was seen as the best way to fulfill this goal. As the Court of Appeals for the D.C. Circuit stated:

> Use of the rolled-in approach ensures that two otherwise similar customers will not pay radically different prices for commingled gas coming from the same pipe, merely because one happens to have been receiving the service longer than the other. Use of the rolled-in method thus serves the interest of equal treatment for customers receiving equal service.[14]

The Commission's agreement with this viewpoint is clear in *Algonquin Gas Transmission Co. (Algonquin)*,[15] where the Commission stated:

> It is often true that where capacity is expanded to meet additional needs of some customers, old customers could be said not to need the new facilities. Nevertheless, such costs should generally be rolled-in. Part of the concern underlying this position is the desire to avoid any possible undue discrimination .... It would be discriminatory to charge different rates based simply on the time when the customer signed up for the service.[16]

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11. *Northwest Pipeline Corp.*, 56 F.E.R.C. ¶ 61,006, at 61,045 (1991). *See also* Battle Creek Gas Co. v. FPC, 281 F.2d 42, 46 (D.C. Cir. 1960) (explaining application of rolled-in rates).

12. *Great Lakes*, 57 F.E.R.C. ¶ 61,141, at 61,539 (1991).

13. *See Battle Creek*, 281 F.2d 42 at 46; Opinion No. 93, *Otter Tail Power Co.*, 12 F.E.R.C. ¶ 61,169 (1980); Opinion No. 352, *Tennessee Gas Transmission Co.*, 27 F.P.C. 202, 209 (1962); Order No. 436, *Regulation of Natural Gas Pipelines After Partial Wellhead Decontrol*, III F.E.R.C. STATS. & REGS. Preambles ¶ 30,665, 50 Fed. Reg. 42,415, 42,478 (1985).

14. *Battle Creek*, 281 F.2d at 46.

15. 49 F.E.R.C. ¶ 61,029 (1989).

16. *Id.* at 61,111.

Questions concerning benefits to existing customers and cross-subsidies were also considered but received less attention.

The primacy of an integrated system as the rationale for averaging costs over measuring the magnitude of benefits received by existing customers from the new facilities was another tenet in the Commission doctrine of rolled-in rate methodology. This view is expressed in a Commission finding that "it is not necessary to have measurable benefits to justify rolling-in costs . . . [because] [i]t is sufficient that the quality of the system's services is enhanced by the presence of the facilities in question."[17] The Commission has reached similar conclusions in *Granite State Transmission, Inc. (Granite State),*[18] *Natural Gas Pipeline Co. of America (Natural),*[19] and *Algonquin.*[20] In *Granite State*, the Commission ruled:

> Where a system operates on an integrated basis to the benefit of all its customers, both this Commission and its predecessor, the Federal Power Commission, have followed a long-standing policy of rolling in costs. The facts in this proceeding demonstrate that the Granite State System operates as an integrated system and all its customers benefit from the integrated nature of the system.[21]

The *Natural* hearing approved rolled-in rates because the Commission felt that "[a]n incremental rate treatment is not proper for Natural's proposed interconnect, and [found] that a rolled-in [treatment] is the proper rate design where the facilities are intended for general system use."[22]

The *Algonquin* ruling also focused on the integrated nature of the pipeline's system, causing the Commission to state:

> Staff's witness testified, and Algonquin's own witness conceded at hearing, that Algonquin operates an integrated system, in which all its facilities are interdependent and required to support the system . . . . All the incremental facilities increase the capacity of Algonquin's mainline and thus are the type of facility benefitting all customers which the Commission traditionally has required to be rolled-in.[23]

Therefore, as shown by the above referenced Commission decisions, rolled-in rates were the preferred method of satisfactorily fulfilling the Commission's mandate equitably to assess the costs of new facilities to those who would benefit from them.

The cross-subsidy issue was addressed in a Court of Appeals for the D.C. Circuit remand of a 1989 FERC decision regarding the use of rolled-in rates on the Algonquin system. In an original rate hearing, cost for a specific group of services on the Algonquin system had been recovered on an incremental basis. The Commission subsequently ruled in April 1989 that these costs must be rolled into the pipeline's rate base because Algonquin operates an integrated system. However, in November 1991, the court

17. *Great Lakes*, 45 F.E.R.C. ¶ 61,237, at 61,701 (1988).
18. 45 F.E.R.C. ¶ 61,261 (1988).
19. 48 F.E.R.C. ¶ 61,311 (1989).
20. 49 F.E.R.C. ¶ 61,029 (1989).
21. 45 F.E.R.C. ¶ 61,261, at 61,820.
22. 48 F.E.R.C. ¶ 61,311, at 62,037.
23. 49 F.E.R.C. ¶ 61,029, at 61,110.

issued a remand after concluding that the Commission gave a "less than careful consideration of the benefits that actually flow to the customers who will bear the financial burden of the facilities cost roll in."[24] On remand, the FERC allowed Algonquin to reinstate its incremental rates.[25]

B. The Great Lakes Case

Great Lakes natural gas pipeline begins in Northern Canada near Emerson, Manitoba where it connects to its affiliate TransCanada Pipeline and runs southeast along the Canadian border through Minnesota and Wisconsin. The pipeline continues north of Lake Michigan whereupon it turns south, crosses near the Straits of Mackinac between Lake Michigan and Lake Huron, and traverses the state of Michigan, ending up at the United States and Canadian border near Sault Ste. Marie and St. Clair Michigan where it again connects with Transcanada. The Great Lakes expansion projects essentially consist of a parallel pipeline running almost the entire length of the original pipeline, sharing its right-of-way and compressor stations.[26] Great Lakes is a 1,960 mile pipeline of which 968 miles are 36-inch diameter pipeline, and 908 miles of 36-inch diameter pipeline loop. In addition, the pipeline has 14 compressor stations, and 37 compressor units.[27]

In May 1991, after completing three pipeline expansion projects, Great Lakes filed a general rate case seeking an annual $99 million increase in its rates.[28] The expansion projects involved a total capital expenditure of $557 million, adding to an initial rate base of $396 million, to reach a new rate base of $953 million.[29] On May 31, 1991, the Commission issued an order

24. Algonquin Gas Transmission Co. v. FERC, 948 F.2d 1305 (D.C. Cir. 1991).

25. *See* 60 F.E.R.C. ¶ 61,054 (1992); 63 F.E.R.C. ¶ 61,326 (1993). The FERC authorized refunds and surcharges to correct the rates issued under the rolled-in approach. In the 1993 order, the Commission states that "In sum, although there is the chance of a prospective rolling-in of the incremental rate schedules, incremental treatment of the rate schedules at issue is now fully reestablished . . . ." A settlement between Algonquin and the FERC, approved July 1994, resolved the remaining issues related to the remand and reached a compromise that will move slowly from incremental toward rolled-in rates. *See* 68 F.E.R.C. ¶ 61,039 (1994).

26. The three expansion projects include more than 17 separate mainline loop sections. *See FERC Orders Incremental Rates For Great Lakes System Expansion*, INSIDE FERC, Nov. 4, 1991.

27. Opinion No. 367, *Great Lakes Transmission Ltd. Partnership*, 57 F.E.R.C. ¶ 61,140 (1991) [hereinafter Opinion No. 367].

28. Great Lakes proposed that rates should be determined on a rolled-in basis for the firm transmission services authorized by the FERC in Docket Nos. CP88-541, CP89-892, and CP90-691 (hereinafter collectively referred to as the *expansion projects*).

29. In Docket No. CP89-892, Great Lakes was authorized by the Commission to construct 459.6 miles of 36-inch mainline loop at various points on its pipeline system, and to provide an additional 417,500 Mcf per day of firm transportation capacity to TransCanada Pipelines, Ltd. (TransCanada). This increase in contract capacity allows TransCanada to transport gas to areas of Eastern Canada and the Northeast U.S. The cost attributable to this expansion project is $548 million. In Docket No. CP88-541, the Commission authorized Great Lakes to provide 15,000 Mcf per day of firm transportation capacity for Southeastern Michigan Gas Company. To provide this service, Great Lakes was authorized to construct 2.9 miles of 36-inch mainline loop and the Muttonville I Meter Station, and to make modifications to three compressor stations. The cost attributable to this expansion project is $4.1 million. The third expansion project, authorized by the Commission in Docket No. CP90-691, involved

accepting and suspending Great Lakes' tariff, and scheduled a "paper hearing" to resolve the issue of whether Great Lakes should be permitted to "roll-in" the costs of the three expansion projects into its rate base.[30]

Great Lakes, supported by its affiliate TransCanada and other companies, argued that rolled-in rates should be applied because the expansion would benefit existing customers. It asserted that the benefits to existing customers follow because Great Lakes operates as an integrated system. Great Lakes further maintained that "because all customers jointly create the need for additional capacity on an integrated system, a higher rate paid by new customers under an incremental rate approach represents a subsidy to existing customers."[31] It also argued that the mainline loop improves service reliability and increases operating flexibility. Great Lakes contended that incremental rates would impose administrative burdens, while rolled-in rates would be easier to administer.[32] It noted that incremental treatment would result in an *undersupply* of capacity since "customers will only agree to expand if their incremental benefits are higher than the costs, or rates, they will have to bear."[33]

On October 31, 1991, with only one dissent by Commissioner Branko Terzic, the FERC voted in favor of incremental rates. The Commission rejected arguments that the pipeline operates as an integrated system and that the expansion projects would benefit all customers. Commissioner Charles Trabandt said that the expansion was "as incremental as it could possibly be," and that it did not reflect "any predictable benefits for other customers" on the system.[34] The Commission observed:

> Rolled-in pricing of Great Lakes' expansions will result in cross-subsidization because the benefits do not equal or exceed costs. The record shows that revenues attributable to the expansions will not cover their costs, and that rolling-in the costs of the new facilities will result in a cost shifting to Great Lakes' existing customers of approximately $50 million.[35]

The opinion stated:

> The incremental customers are primarily responsible for the cost of, and receive the most benefits from the expansion projects. Rolled-in treatment of the expansion facilities in this case does not reflect a sound relationship

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the construction of 2.9 miles of 36-inch mainline loop and two meter stations: Deer River and Floodwood, Minn. In CP90-691, Great Lakes was authorized to provide 5,000 Mcf per day of firm transportation for Northern Minnesota Utilities. The cost attributable to this expansion project is $5.3 million.

30. *Great Lakes*, 55 F.E.R.C. ¶ 61,336.

31. Opinion No. 367, 57 F.E.R.C. ¶ 61,140 at 61,515.

32. It also argued that rolled-in rates were consistent with, and incremental rates contravene, the Canada-United States Free Trade Agreement (27 I.C.M. 281 *et. seq.*) and the agreement concerning transit pipelines (T.I.A.S. No. 8720, 1977), by constituting discriminatory rates.

33. Opinion No. 367, 57 F.E.R.C. ¶ 61,140 at 61,516.

34. *FERC Orders Incremental Rates For Great Lakes System Expansion*, INSIDE FERC, Nov. 4, 1991.

35. Opinion No. 367, 57 F.E.R.C. ¶ 61,140 at 61,522. *See also* Opinion No. 368, 57 F.E.R.C. ¶ 61,141, at 61,541 (1991).

> between the costs and the benefits of incremental services, which is contradictory to a fundamental concern of rate design.[36]

Moreover, the Commission stated that, "Rolled-in treatment would contravene the Commission Policy Statement goal of encouraging only economic expansions because, in this case, rolled-in treatment entails cross-subsidizations . . . [and that] [w]here expansions are economically justified, the incremental rates produce net benefits to those receiving new service, while not increasing rates to existing shippers."[37]

The FERC also noted that the coexistence of different prices under an incremental approach does not constitute undue discrimination but "these price differentials merely reflect the costs to expand the pipeline's capacity at a different time and for different customers."[38] They acknowledged that incremental rates are "more complex and present a greater administrative burden than a single rolled-in rate" but concluded "that the administrative convenience cannot outweigh, by itself, the economic impact."[39]

The Commission mandate for incremental rates for the Great Lakes expansion was upheld in a 3 to 2 vote in a rehearing in January 1993.[40] The vote was the first time in over 6,000 occasions that then-Chairman Martin Allday was on the losing side. He was joined by Commissioner Branko Terzic in opposing the orders.[41]

On June 10, 1994, the D.C. Circuit Court of Appeals remanded the case stating that the FERC had "failed adequately to explain the adoption" of a new test measuring "commensurate benefits" of new construction.[42] The court cited *Battle Creek Gas Co. v. FPC*[43] saying that since then "the dominant theme of energy pricing policy has been to allow rolled-in rates whenever the expanding pipeline could show that the new facilities would be integrated into the mainline system and would confer some positive benefit on all the customers of the system."[44] The court stated that the commensurate-benefits test that was applied "represents a departure from precedent that cannot be said to have been compelled" by a change in policy or legal precedent, and that "the novelty of the Commission's test required a reasoned explanation for the change."[45] Furthermore, the court found that the Commission did not respond carefully to arguments that incremental-cost pricing produces differences in rates that are not based on

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36. Order No. 367, *supra* note 27, at 61,524.

37. *Id.* at 61,524-25.

38. *Id.*

39. The Commission also rejected the arguments of Great Lakes regarding the Free Trade Agreement and the Transit Treaty, stating that it "does not believe that they require the Commission to approve rates that create cross-subsidies, encourage uneconomic investment, and are unduly discriminatory to Great Lakes' existing customers." *Id.* at 61,525.

40. *See* RP91-143, 57 F.E.R.C. ¶ 61,140 (1991); RP89-186, 47 F.E.R.C. ¶ 61,285 (1989).

41. *FERC Test For Rolled In vs. Incremental Rates Remanded by D.C. Circuit*, INSIDE FERC, June 13, 1994, at 1.

42. TransCanada Pipelines Ltd., v. FERC, 24 F.3d 305, 307 (D.C. Cir. 1994).

43. 281 F.2d 42 (D.C. Cir. 1960).

44. TransCanada, 24 F.3d at 308.

45. *Id.* at 309.

cost causation.[46] Moreover, the court told the FERC to consider "the rate differentials and administrative costs" that would be produced by incremental-cost pricing.[47]

In a post-*Great Lakes* decision in March 1994, the FERC rejected a proposal of Pacific Gas Transmission Co. (PGT) to allow rolled-in rates on its system expansion.[48] The expansion adds $835 million to an existing rate base of $129 million creating a capacity of 900,000 MMBtu/day.[49] PGT argued that its pipeline will be operated on a fully integrated basis with benefits for both new and existing customers. Earlier, the California Public Utilities Commission had ruled that existing customers of Pacific Gas and Electric Company (PG&E) do not have to pay for the instate portion of the PGT expansion, requiring PG&E to use incremental rates.[50]

The following sections present economic arguments in support of incremental-cost pricing of large scale capacity expansions. The discussion suggests that the FERC's *Great Lakes* decision was based on sound economic principles and that the decision should be upheld in subsequent proceedings.

III. Competitive Market Pricing and Efficiency

Competitive market pricing provides a benchmark against which regulated rate structures can be evaluated. Short of deregulating transportation rates, it is desirable to choose between alternative pricing policies that approximate market incentives. The issue that needs to be addressed is whether average-cost or incremental-cost pricing is closest to the competitive market benchmark.

There are many reasons why regulated prices cannot be expected to create the same incentives as competitive prices. Market prices are set based on the competitive alternatives available to customers while regulated prices are established based on the company's cost of service. The cost of service is estimated following regulatory accounting rules that generally correspond to the economic costs of service. In particular, regulatory accounting rules estimate the cost of capacity using book value rather than replacement costs. The resulting revenue requirement is established through rate-hearing procedures, rather than on the basis of customer willingness to pay. The relative prices established by regulated rate structures often are based on cost allocation rules rather than differences in the markets served by the company.

Most significantly, a regulated price structure differs from pricing in competitive markets in that it must satisfy the revenue requirement of the regulated firm at the same time that it is used to allocate scarce capacity

46. *Id.* at 311.

47. *Id.*

48. *Pacific Gas Transmission Co.*, 67 F.E.R.C. ¶ 61,071 (1994).

49. *FERC to Launch Generic Proceeding on Rolled in vs Incremental Rates*, Inside FERC, June 20, 1994, at 1.

50. *CPUC Adopts Incremental Rates for Calif. Leg. of PGT/PG&E Expansion*, Inside FERC, Oct. 26, 1992, at 1.

across the firm's customers. These requirements may be inconsistent depending on the company's operating and capital costs, capacity level, and customer demand. Regulated rates need not "clear the market" for capacity or allocate capacity to those customers with the highest willingness to pay.

In competitive markets, the price increases that occur in response to increased demand are paid by all customers. This is desirable because price increases in competitive markets yield positive profits for existing firms and efficiently allocate scarce resources or productive capacity in the short run. Moreover, in the long run, price increases in competitive markets encourage capacity expansion by existing firms and market entry by new producers. These capacity expansions result in a lowering of prices to all consumers.

If increased demand drives up the unit costs for a regulated utility, then costs will necessarily be reflected in increased rates. If costs increase as a result of the addition of distinct services, the necessity of adhering to cost-of-service principles in regulated markets makes it undesirable for the incremental costs of expansion to be passed on to all customers. The regulated firm's revenue requirements will not be met, and either over collection or under collection of costs could result. In regulated pricing systems, then, the incremental costs of expansion should not be passed on to all customers, but rather, should be borne by users of the new services that are provided by the capacity expansion.

A. Static Efficiency

In an economic textbook representation of a market equilibrium, the supply curve represents the marginal costs of competitive firms and the demand curve represents the marginal willingness of consumers to pay. Assuming that firms take the market price as given and set output to maximize profits, they choose an output level allowing their marginal cost to equal the market price. Thus, the equilibrium market price in this model of the competitive market represents the marginal cost of production for individual firms.

A standard benchmark is *marginal cost pricing*, which refers to a price that equals marginal cost. Marginal cost is the additional cost of producing one unit of output efficiently given a particular technology. Economists generally speak of a marginal cost function or schedule that represents the additional cost of producing one more unit of output evaluated at various levels of output. In industries like natural gas pipelines, the presence of cost economies can imply that the marginal costs of production will decline at low levels of output and increase at higher levels of output.

Marginal cost pricing is generally understood to represent a price at which marginal benefits of a product equal its marginal cost of production. The efficient output level that maximizes the net benefits equates marginal benefit to marginal cost. This definition of efficient output-level applies if marginal benefits diminish as output increases and marginal cost increases as output increases. A higher output would result in marginal benefits that

are less than marginal costs, thus lowering net benefits. Conversely, a lower output would result in marginal benefits greater than marginal cost. So, if output is below the efficient level, additional benefits may be obtained by increasing output.

Reasoning by analogy, many recommend marginal cost pricing for regulated firms. For example, Alfred Kahn refers to marginal cost pricing as "the central policy prescription of microeconomics." The idea is that regulated firms should estimate market demand as well as their marginal cost. Then, they should calculate the marginal cost price that is consistent with their market demand. This is the price that equates the marginal willingness to pay of their customers to the company's marginal cost. Unfortunately, this policy prescription is not often applicable in regulated industries and is no longer central.

A number of caveats are in order. First, marginal cost pricing by a regulated monopoly is difficult to compare to a competitive market with many firms making pricing and production decisions. The regulated firm chooses its price subject to regulatory constraints. In the competitive market model, companies choose output levels such that marginal costs equal price. Second, the costs of competitive firms are measured in terms of the opportunity costs of the capital, labor, and resources employed. The regulated firm's costs are estimated using complex regulatory accounting rules that can depart significantly from opportunity costs. Moreover, competitive market prices emerge through a process of competition and entry leading to adjustments in industry capacity that reflect consumer demand and production costs. In contrast, regulated firms choose their prices and capacity in accordance with a process of regulatory hearings and negotiation.

Even without these caveats, marginal cost pricing may not be a feasible policy recommendation. It is important to note that the revenues obtained from marginal cost pricing can be either greater or less than the total cost of service. If the firm's marginal cost is above its average cost, the firm will earn revenues in excess of cost. If marginal cost is below its average cost, the firm will not break even. For example, a firm may have fixed costs due to overhead and capital equipment. These will generally cause marginal costs to depart from average costs. This is not consistent with regulated prices which are meant to equal the costs of service.

When marginal cost is greater than average cost at some level of service, then an increase in output will raise average cost.[51] A firm with average costs that are increased by increases in output is said to have diseconomies of scale. Conversely, when marginal cost is less than average cost at some level of service, an increment in output will lower average

51. The reasoning behind this statement is as follows. Consider the average height of a group of people in a room. Suppose that an individual enters the room who is taller than that average height. Then, if a new average is calculated including the additional (or marginal) person, it is evident that the average height will rise.

cost. A firm with average costs that are reduced by increases in output is said to have economies of scale.[52]

Suppose that the firm has economies of scale at some level of output. Then, a marginal cost price would result in losses. Conversely, if the firm has diseconomies of scale at some level of output, then a marginal cost price would yield potential revenues in excess of costs.

There are several principal ways to resolve this dilemma, all of which involve abandoning strict reliance on marginal cost pricing. The first is average cost or "rolled-in" pricing, which charges all customers the same price equal to the firm's per-unit cost. The second is multipart pricing. The simplest form of multipart pricing is a two part tariff that sets a per unit price that may be equal to marginal cost and recovers the shortfall in revenues using a fixed fee per consumer. More complicated forms include declining block tariffs and quantity dependent pricing such as discounts for consumers purchasing higher quantities. Still another approach is to segment customers into classes and recover different revenues from each customer class depending on their willingness to pay or other demand and service characteristics. All of these approaches are used in some form in the utilities sector, including electricity, natural gas, telephone, and water services.

The average-cost price is sometimes referred to as the "second-best" price since the firm breaks even. Yet, it is easy to demonstrate that multipart prices can be designed to increase consumer well being relative to average-cost pricing. For example, consumers are made better off by offering a choice between a unit price and a two-part tariff consisting of a fixed fee and a lower per unit price equal to marginal cost.[53] Lower-demand consumers will select the unit price option while higher-demand consumers will select the two-part tariff option. The revenues raised cover costs but consumers are better off than at the average-cost price. This type of multipart pricing allows customers to "self select" into service classes depending upon usage.

B. Dynamic Efficiency

The consequences of average-cost prices for new investment can be illustrated using a simple example. Suppose that there are two consumers and one of them is willing to pay up to $100 to obtain a given service. The other consumer is willing to pay up to $50. The service can be provided to one customer at a cost of $110 and to two customers at a total cost of $120. Clearly, since the total of the willingness to pay levels ($150) exceeds the

52. It is generally the case that pipelines have costs that exhibit economies of scale over some range of capacity. This is due primarily to the technology of pipeline facilities. It is well known that since the capacity of a pipe is proportional to the square of its diameter while the surface of the pipeline is proportional to its diameter, average construction costs per mcf are lower for a 36-inch diameter pipeline than say for a 16-inch diameter pipeline. *See* PAUL W. MACAVOY, PRICE FORMATION IN NATURAL GAS FIELDS 39-41 (1962).

53. Robert D. Willig, *Pareto-Superior Nonlinear Outlay Schedules*, 9 BELL J. OF ECON. 56, 56-69 (1978).

total cost of providing the two consumers with the service, the investment should be undertaken. What will be the outcome under average-cost pricing? The average-cost price for the service is an even split of the total cost, at a price of $60 each. While this is affordable for the high-value customer, it is not affordable for the low-value customer, who will not purchase the service. Yet, the cost of providing the service to one consumer exceeds the willingness to pay of either consumer. Therefore, if average-cost pricing is used, neither consumer will be served since it would not be worthwhile to invest in the service.

This example illustrates that there can also be advantages to segmenting customers of a regulated firm on the basis of demand and service characteristics. By setting different prices for market segments with higher and lower elasticities of demand, it is possible to improve customer welfare relative to uniform average-cost price. In the example, total costs can be recovered by offering a price of $80 to the high-value consumer and $40 to the low-value consumer.

A desirable pricing policy must lead to both allocative and dynamic efficiency. The dynamic efficiency criterion for an investment project is that the present discounted value of benefits from the project must exceed the present discounted cost of the project. A company will not contemplate an expansion of its capacity unless it expects that incremental revenues cover the incremental costs of the project. This means that incremental consumer benefits exceed the revenues the project is expected to generate, and since the revenues must exceed the incremental costs of the project, it follows that consumer benefits are greater than the incremental costs. This is the definition of a market test for new investment.

It should be noted that if the existing rate base were to be valued at replacement costs, many of the problems associated with rolled-in pricing would not be observed. The pipeline company would no longer have an incentive to roll-in new capacity with old as a means of passing on the cost of expansion to existing customers. Customers would see the full incremental cost of the expansion.[54]

A natural question to ask is why not charge all customers for the replacement cost of current facilities? This has long been advocated by economists who emphasize that the book value of capacity net of depreciation usually fails to provide an accurate measure of its market value. Of course, to do so would depart from the standard regulatory accounting practices for measurement of capacity. In many states, the rate base can be adjusted upward to reflect replacement costs, using a weighted average

54. For example, Great Lakes' initial pipeline construction in 1966 cost $240.2 million. That initial construction cost would be valued in current dollars at over 3.5 times its original cost, based on inflation as measured by the GNP inflation factor. The initial rate base of $396 million reflects capital of different vintages purchased between 1966 and 1979, with all but $6.8 million purchased before or during 1974. Substantial inflation has occurred in the period preceding the Great Lakes Expansion Projects. Rolling-in $557 million of capital of the most recent vintage with the existing rate base will not transmit accurate information to Great Lakes' new customers about the additional cost of the new service. This can lead to unwarranted expansion of existing facilities.

referred to as "fair value."[55] In what follows, standard regulatory practices are taken as given, since the question of choosing between average and incremental costs only applies within the context of regulation.

III. INCENTIVES FOR INVESTMENT

An efficient pricing policy must allow efficient investment projects to be carried out and also must not allow inefficient investment projects to be undertaken. Ideally, regulated pricing should subject large scale investment by pipelines to a market test. In other words, the willingness to pay of new customers should exceed the costs of the new service.

The effect of price regulation on the incentives for investment is a recurring theme in the economic regulation literature. Rate-of-return regulation has been shown to distort the incentives for investment.[56] The inability of regulators to credibly commit to future rate adjustments, and the fact that rates are generally more flexible than capital investment, implies that regulated companies can strategically underinvest.[57] The presence of asymmetric information about the regulated firm's costs can alleviate the underinvestment problem.[58] Another approach to offsetting underinvestment is for the regulated firm to take on debt as a means of inducing regulators to increase rates to reduce the likelihood of bankruptcy. This can lead to a higher debt-equity ratio than in the absence of regulation.[59]

The application of average-cost pricing to investment yields another source of distorted incentives. This effect has not yet been identified in the literature. It may be conjectured that in some cases, where the existing rate base is large and substantially undervalued, rolled-in pricing provides suffi-

55. SPULBER, *supra* note 8, at 276.

56. The classic analysis of Averch and Johnson and voluminous subsequent literature shows that the imposition of a maximum allowed rate of return constraint causes distortions in the capital-labor ratio of regulated firms. Under some conditions, the profit-maximizing regulated firm employs more capital than the competitive firms as it tries to increase its rate base and correspondingly lower its rate of return to meet the constraint. H. Averch & L.L. Johnson, *Behavior of the Firm Under Regulatory Constraint*, 52 AM. ECON. REV. 1053, 1053-1069 (1962). A dynamic analysis if given in D. F. Spulber and R. A. Becker, *Regulatory Lag and Deregulation with Imperfectly Adjustable Capital*, 6 J. OF ECON. DYNAMICS AND CONTROL 137, 137-151 (1983). They show that with adjustment costs and irreversible investment, the regulated firm can choose a capital bias in anticipation of regulation but not necessarily afterwards. Conversely, there may be either a capital or labor bias in anticipation of deregulation. *See* SPULBER, *supra* note 8, at 617-624.

57. *See* SPULBER, *supra* note 6, at 603-632. Underinvestment as a consequence of limited commitment and renegotiation has been discussed in the economic literature on contracts beginning with P. Grout, *Investment and Wages in the Absence of Binding Contracts: A Nash Bargaining Approach*, 52 ECONOMETRICA 449, 449-460 (1984).

58. *See* D. Besanko & D.F. Spulber, *Sequential Equilibrium Investment by Regulated Firms*, 23 RAND J. OF ECON. 153, 153-170 (1992). When investment lowers operating costs, regulated firms have an incentive to signal that their costs are high by investing more thus offsetting the disincentive to invest resulting from the regulator's limited commitment ability.

59. *See* Y. Spiegel & D.F. Spulber, *The Capital Structure of a Regulated Firm*, 25 RAND J. OF ECON. 424 (1994). This is confirmed by empirical work of R. Taggart, *Rate of Return Regulation and Utility Capital Structure Decisions*, 36 J. OF FIN. 383, 388 (1981); R. Taggart, *Effects of Regulation on Utility Financing: Theory and Evidence*, 33 J. OF INDUS. ECON. 257 (1985).

ciently strong economic incentives to overinvest that other effects may be overshadowed. In this section, it is emphasized that, *ceteris paribus*, average or rolled-in pricing creates incentives for overinvestment while incremental-cost pricing leads to efficient investment decisions.

A. Rolled-in Pricing

Rolled-in pricing can lead to inefficient decisions regarding investment since users of the new capacity do not pay the full cost of the additional benefits they receive from the new capacity. Pipelines contemplating expansion projects have an existing rate base. The "rate base" is the sum of the pipelines capital expenditures evaluated at their original purchase price, taken net of depreciation. The rate base generally is less than the market value of the facilities for a number of reasons. As a consequence of inflation, the rate base would have a higher value in constant dollars in a current year than it does in book value. Moreover, as real costs have risen, the replacement value rises as well. Finally, to the extent that regulatory depreciation schedules reflect arbitrary deductions that proceed at an accelerated rate in comparison with the economic life of the asset, the rate base is correspondingly undervalued.

The rate base treatment of capital costs affects the investment decisions of regulated firms. A pipeline with capacity that is not of recent vintage has a "cushion" of very low cost capacity. Rolled-in pricing of capacity gives the pipeline an incentive to purchase a higher level of higher cost capacity than a pipeline whose capacity "cushion" is of more recent vintage. The pipeline with a "capacity-cushion" of older vintage has no incentive to take into account the full additional cost of investing in new capacity. Instead, such a pipeline only considers the effect of the additional investment on the average cost of its total capacity. Thus, a pipeline with substantial low-cost capacity will have a lower average cost of capacity for any given investment level. The lower the book value of existing capacity, the greater the willingness to pay for new capacity.

In the case of large scale expansion projects by pipelines with a cushion of low-cost capacity, it is possible that the benefits of the new project are above the new customer payments under rolled-in pricing but are *below* the construction cost of the new project. Rolled-in pricing involves a subsidy from existing customers to new customers, as discussed above. Therefore, given the use of rolled-in pricing, the project has not been subjected to a market test; it is not evident that the benefits from the expansion to users of the new capacity exceed the cost of the expansion. At a rolled-in price, users of the expansion facilities will pay less than the full incremental cost of the new service, and existing system-wide customers will share in the cost of the new service. If customers served by the new project do not receive benefits that exceed the cost of the expansion, then the project does not yield positive net benefits. If there are no positive net benefits for the users of the expansion capacity, the expansion projects should not have been undertaken according to the criterion for efficient investment.

An additional problem may arise. A large expansion project that is rolled-in with the existing rate base can result in a large price increase to existing customers. Some of those customers may no longer find that purchasing the service is economically feasible. Thus, rolled-in pricing can exclude some initial customers from the service, although contracts can mitigate this effect. The loss of these customers will cause further price increases to other customers and result in further welfare losses, as utilities spread their revenue requirements over a smaller customer base.

B. The Fallacy of Sunk Costs

The economic viability of an expansion project cannot be accurately determined if rolled-in prices that are charged to both new and existing customers are used in the analysis. This is true because the use of rolled-in pricing to evaluate an expansion will suggest that a new project should be approved if the benefits of the service provided to all customers *by both new and existing capacity* exceed the cost of the combined new and existing capacity. This implicitly counts the costs and benefits of past expenditures in evaluating future investment decisions. This approach is based on a conceptual error known in economics as the "fallacy of sunk costs."[60]

The proper standard of comparison is whether *incremental* benefits exceed *incremental* costs. The decision to commit additional funds should not be based on past expenditures that are irreversible. Rather, only the net benefits resulting from future investment are relevant to the investment decision. The fact that initial customers have positive net benefits from existing service that can be "tapped" to subsidize new investment should not be a part of an efficient investment decision.

Incremental pricing avoids this problem by providing a test of incremental benefits that is independent of the cost of existing facilities. Customers of the pipeline that are receiving the new service must be willing to pay more than the incremental cost of the new facilities that are constructed to serve them. Thus, incremental cost pricing properly requires that the additional benefits of the expansion exceed the additional costs. Benefits derived from existing facilities are not counted with incremental pricing and, thus, the "fallacy of sunk costs" is avoided.

C. Comparison with Vintages of Natural Gas

The rolling-in of investment costs has a number of similarities with rolled-in purchased gas costs. Indeed, the problems that can arise as a consequence of rolled-in pricing are best illustrated by reviewing the effects of rolling in purchased gas costs after the passage of the Natural Gas Policy Act (NGPA)[61] in 1978. The NGPA created pricing categories for natural gas that were based on production methods, the presence or absence of

60. The "fallacy of sunk costs" refers to the error of basing decisions on irreversible expenditures that have already been incurred. Decisions should only be based on the costs and benefits of alternative actions that are being contemplated.

61. 15 U.S.C. §§ 3301-3442 (1988).

prior interstate or intrastate contracts, and other factors. Gas was broadly classified into "old", "new", and "high-cost" categories, with a large number of subcategories. The multiple pricing categories and the purchasing policies of many pipelines created distortions in wellhead prices under long term contracts. Some pipelines bid up the cost of new and deregulated deep gas to levels substantially above the resale market prices. "Favored nation" clauses in many of these contracts caused the cost of gas to rise substantially for many pipelines as price increases were transmitted across producing regions. Due to take-or-pay provisions in many contracts, pipelines faced significant payment obligations which in some cases threatened the financial viability of the pipelines.

It is generally recognized that rolled-in pricing played an important role in the contractual problems faced by pipelines. Pipelines averaged existing low-cost supplies with both existing and new high-cost supplies. Those pipelines with large "cushions" of low cost supplies were able to pay more for high cost gas. This contributed to the "bidding-up" of the prices of high-cost gas supplies to above-market levels. Pipelines with relatively small "cushions" of low-cost gas were adversely affected. Those pipelines often faced delivery obligations and, at the same time, experienced increased purchase costs of gas under existing contracts. It is clear that many pipelines chose to purchase too much high-cost gas, and many other pipelines were harmed by these purchasing decisions through their contractual obligations.

D. Incremental-cost Pricing

Incremental-cost pricing avoids these problems by charging prices to recipients of the new service that reflect the current cost of capital. Incremental-cost pricing leads to efficient investment decisions for capacity expansion projects. The project is approved if new customers obtain benefits from the service that exceed the payments for the service. The pipeline receives payments that cover the cost of the expansion. Incremental-cost pricing guarantees that the benefits from the expansion exceed the costs of the expansion. Therefore, under incremental-cost pricing the investment efficiency criterion is satisfied. Moreover, initial customers are not excluded since the benefits from the service that they receive continue to exceed their payments.

Incremental-cost pricing avoids the problems associated with rolling-in capital of different vintages. Under an incremental methodology, customers receiving the new service are charged prices that reflect the additional cost of purchasing new transmission facilities. Thus, prices to those customers accurately reveal the incremental cost of purchasing new capital. This eliminates the incentives for over-investment that can result from rolling-in new investment with a rate base of an earlier vintage. Customers receiving incremental services should pay prices based on the costs of expansion in current dollars. This pricing structure will allow an accurate determination of whether the capacity expansion is economically efficient or the investment is unwarranted. Additionally, incremental-cost pricing

reflects marginal cost pricing more closely than rolled-in pricing. New customers are charged for the marginal cost of adding the new service.[62] A rolled-in price would not signal marginal cost to new customers particularly when the rolled-in price is well below the incremental cost. Therefore, new customers will pay less at the margin than the additional cost caused by their added demand.

IV. CROSS-SUBSIDIZATION

It is generally recognized that cross-subsidization should be avoided in regulated rate structures since it is inefficient and inequitable for one group of customers to pay for the services provided to another group.[63] The group of customers providing the cross-subsidy would be made better off if the service they received was provided independently of the other service. The group receiving the cross-subsidy is not paying the cost of providing the additional service. The Commission has recognized this point and in recent dockets has stated that pipelines proposing rolled-in pricing "must demonstrate that the existing facilities will not subsidize the customers that benefit from these new facilities."[64]

This section defines cross-subsidies for regulated rate structure and shows that when average costs rise with capacity expansions, rolled-in pricing involves cross-subsidies from new to existing customers. Incremental-cost pricing does not create cross-subsidies.

A. Cross-subsidies

There are two tests that determine whether a regulated rate structure is to be free of cross-subsidies: the stand-alone cost test and the incremental-cost test.[65] These tests are equivalent as a consequence of the equality of revenues and costs for a regulated firm. The "costs" or "cost function" of a firm refers to a list that associates with various levels of output the total expenditures required by the firm to produce each level of output.[66]

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62. It is not possible to charge all customers, initial and new, a price equal to incremental cost. This would violate the firm's revenue requirement, raising revenues in excess of costs.

63. The term "regulated rate structure" refers to the relative prices for the services of the regulated firm that cover the total costs of service. The total costs of service for a regulated firm are defined to equal its revenue requirement. Recall that the "revenue requirement" is the sum of operating cost and the rate base multiplied by the allowed rate of return. *See generally* SPULBER, *supra* note 8 (discussion of rate-of-return regulation).

64. *Great Lakes*, 55 F.E.R.C. ¶ 61,336 at 61,991, *reh'g granted in part and procedural schedule modified*, 55 F.E.R.C. ¶ 61,426 (1991).

65. The definitions of the two tests for cross subsidies are given in terms of two services. In the case of more than two services, the tests require that no group of services subsidizes any other group of services. *See* SPULBER, *supra* note 8.

66. For a pipeline, the cost list associates total costs with levels of throughput. Costs have two components. One component is the operating cost of the pipeline. The other component is capacity cost, including the pipeline itself, pumping stations and other plant and equipment. Pipelines are subject to cost-of-service regulation so that broadly speaking, capacity costs are measured in terms of the rate base multiplied by the allowed regulated rate of return. In general terms, the rate base equals the book value of the pipeline's capital net of depreciation.

Consider first the *stand-alone cost test.*[67] The *stand-alone cost* of service refers to the long-run total cost of providing that service independently from other services. The stand-alone cost test requires that the revenues generated from either of two services not exceed the stand-alone cost of providing that service. If the revenues from one service do exceed its stand-alone cost, then that service is providing a cross-subsidy and the other is receiving it. Clearly, the service customers providing the cross-subsidy would be better off if that service could be obtained independent of the other service. This is the principal motivation behind the stand-alone cost test.

According to the *incremental-cost test*, a regulated rate structure is free of cross-subsidies if and only if the revenues generated by each service cover the incremental cost of providing that service.[68] The rationale for the incremental cost test is the requirement that each service must generate revenues that at least cover the additional cost of producing that service. If not, the other service is providing a cross-subsidy, and the customers of the other service would be better off receiving their service independently, at its stand-alone cost.[69]

The presence of inflation and the changing costs of construction and operation add some complexity to the analysis of stand alone and incremental costs. Economic costs are generally measured as the market value or opportunity costs of all of the inputs, capital, labor, resources and so on. The costs of the firm are presumed to be derived from cost minimization at market prices given efficient use of the firm's technology. Analysis of cross-subsidization for a regulated firm departs from this ideal setting.

It is important to distinguish between short-run costs and long-run costs. Short-run costs are calculated for a fixed level of capacity and depend on the pipeline's actual level of throughput. The long-run cost schedule is calculated based on the presumption that the pipeline's capacity is selected efficiently to accommodate each level of throughput. Therefore, the long-run cost of a level of throughput is based on a capacity level that achieves the lowest operating and capacity costs required to deliver that throughput reliably. Long-run costs are the most appropriate definition of costs when examining the choice of the pipeline capacity. This is because the most efficient choice of pipeline capacity must be made taking into account the total cost associated with each level of capacity. Accordingly, the discussion of costs in this section refers to long-run costs unless otherwise indicated. The comparisons of cost levels associated with different output levels are made in terms of current dollars. The effects of inflation are considered subsequently.

67. The stand-alone cost test is a widely applied criterion. *See* WILLIAM J. BAUMOL ET AL., CONTESTABLE MARKETS AND THE THEORY OF INDUSTRY STRUCTURE (1982).

68. The incremental cost test is a widely applied criterion that has been known for over a century. *See generally* WILLIAM J. BAUMOL, SUPERFAIRNESS (1986).

69. The two tests can be shown to be equivalent in the following way. Let SAC_1 and SAC_2 be the stand-alone costs of the two services and let R_1 and R_2 be the revenues from the two services. The stand-alone cost test requires that the revenue from each service does not exceed its stand-alone cost, that is, $R_1 \leq SAC_1$ and $R_2 \leq SAC_2$. The regulated rate structure breaks even, so that $R_1 + R_2 = C$. Therefore, the revenue from service number 1 equals the total cost of service net of the revenue from service number 2, $R_1 = C - R_2$, and similarly for the other service. Then, the stand-alone cost test requires that the total cost of service net of the revenue from service number 2 not exceed the stand alone cost of service number 1, $C - R_2 \leq SAC_1$. Rearranging the terms in this last expression yields the equivalent statement that the incremental cost of service 2 is less than or equal to the revenue from that service, $C - SAC_1 \leq R_2$. Similar reasoning applies to service 1. This is the incremental cost test. *See generally* BAUMOL, *supra* note 68.

First, costs refer to *regulated costs*, that is, the costs as defined by regulatory accounting rules. Thus, the costs of the regulated firm are defined to be the operating costs plus the rate base times the regulated rate of return. The rate base, as noted previously, is the sum of the book values of capital expenditures net of depreciation. As a consequence of inflation, changes in relative prices, and technical change, the purchased price of capacity need not correspond to its replacement costs, as many have observed.[70] Moreover, since the depreciation schedule is an accounting convenience, the depreciation of the rate base need not correspond to the economic life of the asset.

To analyze cross-subsidization for a regulated firm, it is standard to use the break-even rates. Thus, the total cost measure is the regulated firm's revenue requirement with the caveats just noted. Table 1 summarizes stand alone and incremental costs. The stand-alone costs for existing customers are the costs of serving those customers before the expansion takes place. This is based on the pre-expansion operating cost and rate base, and equals the original revenue requirement.

Customer Group	Stand-Alone Cost	Incremental Cost
Existing Customers	Pre-expansion total cost of service using the original cost of the rate base net of depreciation	Post-expansion total cost of service minus the current cost of constructing a stand-alone pipeline to serve expansion customers
Expansion Customers	Current cost of constructing a stand-alone pipeline to serve expansion customers	Post-expansion total cost of service minus pre-expansion total cost of service

TABLE 1 Stand-alone and incremental costs.

The incremental cost of service for existing customers is the difference between the total cost of service post expansion and the stand-alone cost of serving the expansion customers. The stand-alone cost of serving the expansion customers is not known with precision and must be estimated. However, the incremental cost of serving the existing customers must be less than the stand-alone cost of serving the existing customers. The reasoning is as follows. If it is economically desirable to build the facilities from the cost efficiency point of view, it must be the case that the total cost of post-expansion is less than the stand alone costs of the pre-expansion facilities and the stand-alone cost of the new service. Otherwise, it would have been better to build a separate facility rather than to combine the two

70. *See generally* SPULBER, *supra* note 8.

projects.[71] This implies that the incremental cost of the existing facility is less than the stand-alone cost of the existing facility.[72]

The stand-alone cost of the expansion customers equals the total cost of constructing and operating a dedicated pipeline to meet these customers demands. This total cost includes the operating cost and capacity construction cost that would be incurred to provide stand-alone capacity to serve the expansion customers. Again, this must be estimated. However, since the cost of serving the expansion customers by adding capacity to the existing system must be less than the cost of constructing a new stand alone facility, the stand-alone cost of serving the expansion customers must be more than the incremental cost of serving those customers.

The incremental cost of serving the expansion customers is easily determined in practice since it equals the difference between the total cost of service post-expansion and the stand-alone cost of serving the existing customers. This corresponds to market cost since it is the current market value of the expansion facilities.

B. Rolled-in Pricing

Rolled-in cost refers to the average cost of producing a given level of throughput. By definition, the total revenues raised exactly equal the total costs of service. *Rolled-in pricing* charges all customers a price equal to total cost per unit of throughput. Here total cost refers to the costs across all of the services that are treated on a rolled-in basis by the regulator. For example, when rolled-in pricing is applied to a capacity expansion, all customers pay a rolled-in price equal to the total cost at the expanded level of throughput per unit of total throughput.

Rolled-in pricing involves a cross-subsidy when the addition of a second service raises the average cost of all services above the average cost of the initial service.[73] This means that with the addition of the second service, the rolled-in price exceeds the price originally charged for the initial service. In this situation, the initial customers will pay more than before for the same level of service. Therefore, the revenues generated from the

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71. This seems to be a reasonable assumption. This rules out the possibility that the utility has a perverse incentive to add to an existing pipeline rather than to build a facility at a lower cost, so as to reap the benefits of rolling in the new investment. Generally, one would not expect this to be the case, in part as a result of regulatory oversight. Moreover, the fact that expansion through looping usues the existing pipeline's right of way and compressor stations, one would expect that the resulting incremental cost of the expansion facilities to be lower than the stand alone cost.

72. Let SAC_1 and SAC_2 be the stand alone cost of the existing and expansion facilities respectively. Let C be the post-expansion costs. Then, the combined facility is worthwhile in terms of cost minimization if and only if $SAC_1 + SAC_2 \leq C$. Rearranging these terms implies that the stand-alone cost of each service is less than its incremental cost, that is $SAC_1 \leq C - SAC_2$ as well as $SAC_2 \leq C - SAC_1$. Note that the terms $C - SAC_2$ and $C - SAC_1$ represent the incremental costs of the existing and expanison facilities respectively.

73. *See* Daniel F. Spulber, *Second Best Pricing and Cooperation*, 17 RAND J. OF ECON. 239 (1986). *See also* Paul W. MacAvoy et al., *Is Competitive Entry Free? Bypass and Partial Deregulation in Natural Gas Markets*, 6 YALE J. ON REG. 209 (1989). Note that average cost pricing of a single product does not entail cross-subsidies if average costs are decreasing over all output levels in the relevant range.

initial customers exceed the stand-alone cost of serving those initial customers. Thus, the initial customers are providing a cross-subsidy to the new customers. Rolled-in pricing thus causes cross-subsidies when average costs rise.[74]

The same argument can be made in terms of the equivalent incremental cost test. As previously noted, for rolled-in pricing to satisfy the incremental-cost test, revenues generated by the new service must cover the incremental cost of the new service. Since the payments of the existing customers increase, it must be the case that they are paying part of the incremental cost of the new service. Therefore, since the regulated revenues cover total cost, the new customers are paying less than the incremental cost of the new service.

C. *Incremental-cost Pricing*

Incremental cost refers to the increase in total cost associated with adding a new service. Incremental cost is very useful in identifying the cost of a large scale expansion in the capacity of a pipeline. Incremental cost is calculated as the difference between total cost at the expanded capacity level and total cost at the original capacity level. *Incremental-cost pricing* involves charging a price for the increment in output that is equal to the incremental cost per unit of incremental output. Furthermore, under incremental-cost pricing, the initial service is priced at the initial cost per unit of initial output. This incremental-cost method raises revenues exactly equal to total cost.

When capacity is added to serve new customers, incremental-cost pricing charges the new customer a per unit price equal to the addition to total cost after the capacity expansion per unit of added output. Initial customers would continue to pay a price equal to initial cost per unit of initial capacity. Again, total revenues raised would equal the total cost of service.

Incremental-cost pricing is free of cross-subsidies. This can be established using either the stand-alone cost test or the equivalent incremental-cost test. Consider, first, the stand-alone cost test. Certainly, the initial customer's payment does not exceed stand-alone costs since such a payment exactly equals the stand-alone cost of their service. The new customer's payment of incremental cost is less than the stand-alone cost of providing service to the new customers. The reason for this is as follows. If it were less expensive to provide stand-alone service for the new customers rather than adding an increment to the existing system the pipeline would surely have done so. The fact that the pipeline chose to expand the existing system and the regulators approved the expansion means that the increment was less costly than a new stand-alone system to serve the new customers.

74. This is exactly what occurred in *Great Lakes*. The increase in the total cost of service outweighed the increase in output whether measured in terms of annual system volume or in gas times distance transported. Therefore, average costs per Mcf (thousand cubic feet of gas) or per MMcf-miles (billions of cubic feet of gas transported one mile) rose substantially.

Each group of customers pays for the incremental cost of service under incremental-cost pricing. Under incremental-cost pricing, the new customers' payments cover incremental costs of serving the new customers since the payments are exactly equal to that incremental cost. Also, the initial customer's payment, equal to the stand-alone cost of the initial service, covers the incremental cost of serving the initial customers. This is true because the initial cost of serving the initial customers covers the incremental cost of serving the initial customers.[75] Therefore, incremental pricing is free of cross-subsidies.

If average costs rise as a consequence of an expansion, new customers should be charged a price where revenues cover the incremental cost of the expansion project. This will serve to guarantee that initial customers are not providing a subsidy to the new customers. If new customers were to pay less than the total cost of the expansion, (as occurs with rolled-in pricing), then it would be possible to conclude that the initial customers are providing a cross-subsidy.

The stand-alone cost test can be applied as follows. New customers pay the incremental cost of their service which must be below the stand-alone cost of providing that service (both adjusted for inflation). Again, this is true since the incremental project must be more efficient than a stand-alone project. Initial customers are paying for capacity at its book value under cost of service regulation. This is certainly below the stand-alone cost of service adjusted for inflation. Therefore, under incremental pricing, both services yield revenues that are below their respective stand-alone costs of service. Therefore, incremental-cost pricing in the presence of different vintages of capital is free of cross-subsidies.

In addition, since new customers make use of existing facilities like compressor stations, they could be charged a price that yields revenues above incremental costs without creating any cross-subsidies. New customers would bear some portion of joint and common costs, such as the cost of compressor stations. Incremental-cost pricing is in this sense the minimum price to new customers for the incremental service since initial customers are assigned all of the joint and common costs of service arising from facilities in existence before the new project.

V. EQUITABLE PRICING

Ideally, a regulated pricing system should be equitable as well as efficient, however, this is more the exception than the rule. The regulatory perceptions of equity are often in conflict with economic efficiency. Moreover, regulatory authorities should not be presumed to act in the public

75. As established above, the incremental cost of serving the new customers must be less than the stand-alone cost of serving the new customers since the project would otherwise be inefficient compared to a separate project. Since the incremental cost of the new project is just the total cost of the expanded system minus the cost of the initial system, this implies that the total cost of the expanded system is less than the sum of the stand-alone costs of the initial service and of the new service. This implies that the incremental costs of the initial service must be less than the stand-alone cost of the initial service.

interest.[76] Nonetheless, taking regulatory institutions as a given, it is useful to compare the distributive effects of the two pricing policies. In this section, this author defines an equity criterion and shows that rolled-in pricing fails to satisfy its requirements, while incremental-cost pricing meets the criterion.

A. Equity

Equitable pricing is achieved when the cost of improving a product or service is allocated such that some individuals are made better off, and no individuals are made worse off. This essentially requires customers unanimously to approve a new allocation of cost resulting from an improvement. This principle is generally referred to as the "Pareto Improvement Criterion."[77] This criterion is consistent with FERC statements.

In its Rate Design Policy Statement of May 30, 1989, the Commission asserted: "A price or rate is inefficient if a different pricing scheme can be developed which would make all ratepayers and the company better off."[78] The FERC further explained its understanding of the efficiency produced by equitable pricing by noting, "[A]n efficient pricing scheme is one where no one can be made better off without making someone else worse off."[79]

Average-cost pricing of a capacity expansion satisfies the Pareto Improvement Criterion if average costs of service fall as a result of the expansion. However, as often occurs for pipeline companies undertaking a large scale expansion given low cost, existing capacity average costs rise, and rolled-in pricing for the expansion facilities fails to satisfy the Pareto Improvement Criterion. Instead, average-cost pricing will raise rates for existing customers making them worse off. Generally, the increased costs outweigh any potential increase benefits from the capacity expansion such as increased system reliability. New customers are made better off than without the expansion since by subscribing to the new service they demonstrate that they are receiving net benefits. The equity criterion is not satisfied since initial customers are made worse off.

In contrast, incremental-cost pricing does satisfy the Pareto Improvement Criterion. Under an incremental methodology, existing customers are not made worse off, and users of the new capacity are made better off. With incremental-cost pricing, the lot of the existing customers is not worsened; instead, they continue to pay prices for their existing level of service that are based on pre-expansion capacity. If some improvement in reliability were to occur as a result of the expansion, then initial customers would be made strictly better off.

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76. The administrative regulatory process has been characterized as bargaining between market participants intermediated by regulatory authorities. *See generally* SPULBER, *supra* note 8. Moreover, the executive, legislature and judiciary branches exercise various forms of oversight. As George J. Stigler and Sam Peltzman have argued, the political process greatly influences regulatory decisions. SPULBER, *supra* note 8, at 93-99.

77. *See* BAUMOL, SUPERFAIRNESS (1986) (defining Pareto Improvement Criterion).

78. *Interstate Natural Gas Pipeline Rate Design*, 47 F.E.R.C. ¶ 61,295, at 62,053 (1989).

79. *Id.* at 62,053, n.20.

Users of the new capacity are also made better off by the presence of the new service priced at its incremental cost, so long as the value of new service to its users exceeds the price of the new service. Indeed, new customers must obtain benefits in excess of incremental costs if the new service is to be economically viable. If this is not the case, then investment in the new service is inefficient, as will be established below. In this case, pricing at incremental cost must yield positive benefits for new customers. Accordingly, since incremental-cost pricing of the expansion facilities makes users of the new facilities better off without making the existing customers worse off, incremental pricing of the expanded capacity satisfies the Pareto Improvement Criterion.

B. Price Differentials

Regulated firms generally provide an array of services to their customers. Services may be distinguished from each other on the basis of many characteristics. Services are often distinguished by customer classes (i.e., residential, commercial, and industrial service), even though the physical properties of the services may be very similar. Services may be distinguished on the basis of time of year using seasonal pricing. Services may also be distinguished by location or by reliability (i.e., firm and interruptible service). One should not conclude that two services are identical for the purposes of rate-setting simply on the basis that the costs of providing the services are interdependent. For example, the firm's costs may depend on the total throughput of gas. Distinct services can be identified, however, on the basis of the demand characteristics of the services provided, such as firm and interruptible rates or pricing by customer class. In natural gas distribution, customers are classified on the basis of residential, commercial, and industrial classes as a means of distinguishing value of service. Similar pricing provisions are employed in electric power distribution. In railroad regulation, prices are set on the basis of the value of service to shippers.[80]

It has been argued that incremental-cost pricing constitutes unfair rate discrimination between initial and new customers for the same service.[81] In some cases, the expansion involves the creation of distinct capacity, or the establishment of additional services for new customers that differ from the services previously available to the pipeline's existing customers. The new service is not analogous to simply adding on a few small customers to an existing system. The customers for the new service represent a signifi-

80. The calculation of value of service prices is sometimes referred to as Ramsey Pricing. Economically efficient prices that cover total cost allocate costs across customer classes on the basis of value of service as measured by willingness to pay for service.

81. In the *Great Lakes* hearing, Dr. Colin Blaydon stated that "If the timing of a new customer coming onto the system can result in a rate for that customer, for the same service at the same time, that is very different from the rates for customers coming before or after, then that is unfair rate discrimination." *Great Lakes Gas Transmission Ltd. Partnership*, Docket No. RP91-143000, at 3 (on file with author). *See also Great Lakes Gas Transmission Ltd. Partnership*, 55 F.E.R.C. ¶ 63,037, at 65,213 (restating Dr. Blaydon's testimony).

cant expansion of demand and require a large-scale expansion of system capacity to serve them. The new service is provided by an expanded system. It is the system expansion itself, not the timing of customer arrivals, that requires a change in the regulated rates. The issue, therefore, is how to allocate the costs of the expansion across customer classes.

The capacity expansion may involve facilities designed expressly to provide service to the new customers. In this case, cost of service regulation and the need to avoid cross-subsidization requires that customers of the new service bear the full cost of the expansion, plus some share of joint and common costs if the new service also uses existing facilities. For example, a pipeline system with looping involves the routing of parallel sections of pipeline through the same compressor station. The capacity costs of the compressor are joint costs for service on the two parallel sections of pipeline. Suppose transportation of gas on the two pipelines were distinguishable services. While operating costs of the compressor station may be attributable to the two services on a volumetric basis, the allocation of the fixed level of capacity costs across the two services is necessarily arbitrary. Economic efficiency requires allocation of attributable cost to the service that causes the cost to be incurred.[82] In this case, it is apparent that incremental pricing is not "unfair discrimination," but simply reflects different prices for different services provided at different costs.

Another possibility that bears upon proper allocation of expansion costs is whether the capacity expansion involves an increase in total capacity that is then used to serve both new and initial customers. However, even that situation still allows separate services to be distinguished. For example, services are often distinguished on the basis of customer classes as noted above. The "commingling" of molecules of gas in a pipeline does not change the fact that gas deliveries are being made to different markets or to distinct customer classes. Incremental-cost pricing provides a means of assessing customers for the costs of service. This is not a matter of "timing". Rather, it is a matter of determining what portion of costs are attributable to the service being provided to a given class of customers.

Finally, it should be emphasized that charging all customers the same price, as is the case with rolled-in pricing, need not be equitable. To the contrary, if two customers receive distinct services at the same price, then *uniform* pricing can be viewed as discriminatory. Two well-known examples are postal rates and uniform delivered pricing for products requiring transportation. Generally, services may be distinct if different facilities are being used to provide the service or if the costs of service differ. If the costs of service are the same, it may nonetheless be desirable to charge different prices that reflect customer willingness to pay.

82. The economically efficient allocation of common costs is achieved by prices that reflect the customer willingness to pay for each of the two services.

C. *Contracts and Administrative Costs*

Proponents of rolled-in pricing have pointed out its advantage over incremental pricing in terms of administrative simplicity, since all customers are charged the same price. In its remand of *Great Lakes*, the D.C. Circuit Court asked the FERC to consider the rate differentials and administrative costs of incremental pricing.

There are potential administrative costs in distinguishing between existing and incremental service. This suggests incremental pricing should be used only for large-scale expansions that clearly create new services, as occurs when an expansion project doubles a pipeline's capacity. Incremental-cost pricing is not desirable for small improvements that represent minor adjustments in pipeline capacity.[83] Administrative costs should be balanced against the costs of overinvestment in pipeline capacity.

Another difficult issue concerns the contractual aspects of incremental pricing. Since the span of customer contracts do not correspond to the economic life of the transmission facilities, it is necessary to determine how costs will be assigned once contracts expire. What happens when the contracts of existing customers expire? Do the customers become incremental customers, paying incremental rates, or are the customers merely incumbent? These questions demonstrate that there is additional complexity in administering incremental rates. In the wake of the remand of *Great Lakes*, the FERC announced a conference on pricing pipeline construction. In their notice, the Commission asked whether "as lower-priced contracts for existing shippers expire, their capacity would be rolled into the expansion capacity, thus reducing the incremental rate."[84] The contractual issues can be addressed in part by requiring the customers of the expansion facilities to enter into contracts that correspond to the economic life of the pipeline. These customers would further be permitted to resell their capacity rights on the pipeline. In addition, existing customers should be able to resell their contractual capacity rights.

The administrative costs and contractual issues can be addressed by deregulation of pipeline transportation rates. This would eliminate the costs of regulatory hearings. Moreover, pipeline capacity would be priced at market rates with contract terms determined by private negotiation.

VI. CONCLUSIONS

Rolled-in pricing leads to cross-subsidies when an expansion raises the average cost of service. By comparison, incremental-cost pricing involves

83. This need not imply a threshold for capacity expansions below which rolled-in pricing is applied since this would provide an incentive for pipelines to carry out an expansion through a series of small investments that stay just under the threshold. In its notice of a public conference on pricing, the FERC recognized that "piecemeal" expansions might result from determining pricing methods based on thresholds. *Pricing Policy for New and Existing Facilities Constructed by Interstate Natural Gas Pipelines: Notice of Public Conference and Opportunity to File Written Comments*, 59 Fed. Reg. 39,553 (1994).

84. *Id.* at 39,554.

no cross-subsidies because it passes the stand-alone cost test and the incremental-cost test for regulated rate structures to be subsidy-free.

Rolled-in pricing does not satisfy the Pareto Improvement Criterion. Users of the expansion capacity are made better off by obtaining the new service at a rolled-in price, while customers of the existing capacity are made worse off by a rolled-in pricing structure. Incremental-cost pricing, on the other hand, does satisfy the criterion since new customers are made better off if their value of service exceeds the incremental cost of service and existing customers are not made worse off since their payments for service are not increased.

Rolled-in pricing often will lead to inefficient investment decisions since under this pricing policy, existing customers subsidize the customers of the new service. This subsidization implies that the incremental benefits of the new projects could be less than the cost of the new projects and lead to an unnecessary expansion of transmission facilities. By contrast, incremental-cost pricing guaranties efficient investment decisions because it requires that the incremental benefits to the new customers served by the additional capacity exceed the costs of the expansion.

Rolled-in pricing can lead to inefficient capital investment decisions when the expansion projects involve capital of a different vintage than the initial rate base. Rolled-in pricing provides inefficient prices signal to new customers. Rolling the expansion costs in with the existing capacity, which is evaluated at original costs, can lead to over-investment in new capacity. A lower book value of capacity in comparison to the cost of new capacity exacerbates this problem. On the other hand, incremental-cost pricing avoids the problems of rolling in capital of different vintages and results in the cost of expansion being properly evaluated at its current cost. New customers receive an efficient price signal equal to the incremental cost of the expansion required to serve the new customers.

In a competitive market the prices charged to all customers reflect the current or replacement cost of capital. This is, of course, not feasible in a regulated industry since the regulated rates must not exceed the total costs of service. In the regulated context, customers receiving distinct incremental service should pay the incremental costs of providing that service. This is the principle established in *Great Lakes*.