Final Report On

THE ALLOCATION OF INCREASING GAS SUPPLIES IN OHIO

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EXECUTIVE SUMMARY

The study reported on in the enclosed three volumes was requested by the Public Utilities Commission of Ohio (PUCO) to assist it in the formation of policies concerning the allocation of increasing gas supplies in Ohio.

There is a great number of potential new service policies that could have been subjected to evaluation in this study. Generally potential new service policies can be defined in terms of (a) the type of customer to receive new service, (b) the location of the customer in relation to the existing distribution system, and (c) the contractual arrangement under which the new service is to be provided. The potential of introducing combined policies in terms of the above categories and the differentiation of policies in terms of time of implementation increases vastly the number of policies that need to be analyzed.

Due to time and budget limitations only representative new service policies were studied under alternative assumptions concerning future conditions, especially those related to the availability of various types of energy and associated prices. In particular, four policies were analyzed under seven energy scenarios. The four policies are:

1. No New Service Policy - the present ban is continued;

2. Company Initiative Policy - this policy permits the company to provide new service within the supply limits and in a particular order of customer classes. Residential, commercial, and industrial customers within the currently served areas are hooked-up in sequence, followed by residential customers outside the currently served areas;

3. Selected Residential Service - only residential customers within the currently served areas are hooked-up;

4. Industrial Service - only industrial customers within the currently served areas are connected.

The mere existence of a multitude of possible new service policies suggests that the choice of the preferred policy be based on the capacity of the policy to satisfy regulatory objectives. Among the traditional objectives of regulatory policies are concerns for financial stability of the regulated utility and adequacy of the quantity and quality of the supplied services. More recently, due to the newly revealed energy scarcity and the associated growth in utility bills, regulatory policies have been increasingly subjected to evaluations in terms of changes in production and end-use efficiency and in terms of fairness and the redistribution of income that they induce.

The analysis of these policies was carried out with the regulatory simulation model that was developed for this purpose. The results were obtained by applying the model to the East Ohio Gas Company (EOGC). It is important to note that the extent to which the results indicate differences in achievement of the various regulatory objectives is a function of differences in policies and scenarios only. No other exogenous forces were permitted to influence the results. Differences in the achievement of objectives by policies cannot be attributed to changes in the behavior of the EOGC or the PUCO.

Table 1 contains a summary of policies ranked in terms of the desirability of their impacts on utility finances, on customers, and on net aggregate economic efficiency as calculated for the EOGC's service area. These results are based on averages of annual impacts only. No reference is made to the time incidence of the impacts.

Table 1 Policy Rankings by Type of Impact Based on Simulations for the Period 1978-2000

Policy	Rankings in Terms of		
	Impact on Utility Finances	Impact on Customers	Impact on Net Aggregate Efficency
No New Service Policy	3	1	4
Company Initiative Policy	2	4	1
Selected Residential Policy	1	2	2
Industrial Only Policy	3	3	3

The choice of the preferred policy is made difficult by a number of factors. Above all, the extent to which some of the regulatory objectives are attained and the repercussions of several policies in terms of the various criteria cannot be measured accurately. In addition, the comparison of policies in terms of their achievement of all the objectives is not possible because of the non-existence of an aggregate measure. The lack of such a measure is due to the fact that the standards by which the attainment of the objectives is measured are not equivalent.

Yet, even the limited information contained in Table 1 is too rich to yield an objective and unambiguous choice of the preferred policy. All policies, except the industrial only policy, emerge as the preferred policy in terms of at least one of the impact criteria used in this study. Two of the policies considered emerge as second best policies. Thus, concern for the company finances alone would lead the decision-maker to choose the selected residential policy as a guide for new service offering by Ohio's gas distribution companies. Concern for customers alone would lead the same decision-maker to prefer the current ban as the preferred policy. Concern for economic efficiency, on the other hand, would lead the decision-maker to select the selected residential policy. The choice of the preferred policy depends on the relative importance, in the form of weights, that decision-makers attach to the decision criteria.

No full-scale attempt has been made to select the preferred policy under various assumptions concerning the relative importance of the decision criteria. An examination of the results reveals, however, that in some cases the selected residential policy is clearly preferred. In other cases, where the policy is not ranked as the preferred policy, it is almost indistinguishable from the preferred policy. Overall, it is ranked as the best policy in terms of impacts on utility finances and second best in terms of impacts on customers and on economic efficiency.

Finally, these results are valid for the EOGC only. Generalizations based on these results may be subject to errors due to circumstances that could be unique to the EOGC service area. The determination of precise new service policies for other companies could benefit from a similar analysis with the regulatory simulation model.

ACKNOWLEDGEMENTS

Many individuals contributed to the completion of this study. During various stages of research the project benefited from the able assistance of Mr. Robert Indian, Mr. Ali Rabbani, and Ms. Janet Ruggles. Mr. James Detwiler provided his drafting expertise. Professors Oscar Fisch, Steven Gordon, Wilpen Gorr, Kenneth Pearlman, and Burkhard von Rabenau were kind enough to provide us with monthly gas consumption data. We have gained many insights through discussions with Mr. James Balthaser and Ms. Hollie Mion of the Public Utilities Commission of Ohio (PUCO), Mr. Robert Koblenzer and Mr. Michael Bartels of the East Ohio Gas Company, and Dr. Kevin Kelly, Associate Director of the National Regulatory Research Institute (NRRI). Mr. Dennis Yun and Mr. Thomas Flockens helped to adapt the computerized model to facilities at the disposal of the PUCO. Finally, the project staff would like to thank the secretaries at NRRI who patiently endured with us the final execution of the report.

PREFACE

The study reported on in the enclosed three volumes was requested by the Public Utilities Commission of Ohio (PUCO) to assist it in the formation of policies concerning the allocation of increasing gas supplies in Ohio. In the early research stages the National Regulatory Research Institute (NRRI) team proposed an economic-engineering model for analyzing the repercussions of new service policies in the case of one gas distribution company. The results of such analysis were to serve as a basis for generic recommendations. At the same time it was recognized that the computerized model would be useful for the analysis of new service policies on a company by company basis.

In light of those research objectives the report is divided into two major parts. An overview of the analysis together with a complete statement of findings is presented in Volume I. Volume I is intended for those readers interested in general policy issues and in the basis for choosing preferred policies from the many alternatives. Volume II is intended for those readers who will use the computerized model. In this volume the means of constructing the model and the meaning of its results are explained in the context of an application. Since each volume is intended to be self-contained, there is some repetition of information. Volume III is composed of appendixes to the information contained in Volume II.

Volume I:

ALLOCATION POLICIES OF INCREASING GAS SUPPLIES IN OHIO

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CHAPTER 1

INTRODUCTION

This volume is first in a series of three volumes that represent the final report on the allocation of increasing gas supplies in Ohio submitted to the Public Utilities Commission of Ohio (PUCO) by the National Regulatory Research Institute (NRRI). The purpose of this Volume is to provide a brief overview of the analysis and a complete statement of finding.

The content of this volume is organized according to the logical structure of the analysis performed with the help of the regulatory simulation model. Thus, Chapter 2 contains description of the policy issues and policy alternatives that are faced by the PUCO with respect to the gas utilities' requests to provide new service. The criteria by reference to which the various policies were evaluated in this study are described in Chapter 3. Chapter 4 contains a brief overview of the regulatory simulation model that was constructed to analyze new service policies, while Chapter 5 presents selected results of the analysis. Finally, Chapter 6 contains the preliminary conclusions that can be drawn from this preliminary analysis.

CHAPTER 2

POLICY ISSUES AND POLICY ALTERNATIVES

In the early 1970's Ohio's gas distribution companies were unable to supply the demand for natural gas within their service areas. As a result the Public Utilities Commission of Ohio (PUCO) gave its consent for the companies to impose restrictions on new service. Today Ohio's gas utilities are projecting increasing supplies of gas. Some companies have already asked the PUCO to approve relief orders from the currently-enforced bans on new customer hook-ups.

The new situation raises a number of policy issues the resolution of which will have repercussions in the coming decades. The purpose of this chapter is to present these policy issues in light of the history of gas distribution in Ohio and in light of potential PUCO policies. The following sections of this chapter contain discussions of: (a) the history of gas distribution, (b) the current conditions, (c) the relevant policy issues that are consequently raised, and (d) potential PUCO policies.

The History of Gas Distribution Utilities

The gas distribution industry, as it is known today in the United States, dates some 100 years. The original product of this industry was manufactured gas that was used to produce light. The gas was manufactured by various methods at local utility installations at relatively high costs. The use of such gas for industrial purposes, or for heating, was not economically feasible.

More recently, discoveries of natural gas, as a by-product of oil production in the southwest U.S., and the development of a technology for piping natural gas over long distances of the country, have led to a steady supply of relatively inexpensive premium fuel. Natural gas production increased steadily after World War II, growing from 13.7 percent of the total energy produced in the United States in 1945 to a high of over 40 percent of total energy produced in 1971. (See Table 2-1).

Table 2-1 Natural Gas Production in the U.S.

Year	Natural Gas Production in U.S. (trillions Btu's)	Percent Change from Previous Year	Percent of All Energy Produced
1945	4,423	--	13.7
1950	6,841	54.6	19.8
1955	10,204	49.1	26.2
1956	10,930	7.1	26.3
1957	11,571	5.8	27.7
1958	11,943	3.2	30.5
1959	13,036	9.1	31.8
1960	13,822	6.0	33.2
1961	14,691	6.2	34.7
1962	15,365	4.5	34.8
1963	16,271	5.8	35.1
1964	16,989	4.4	35.2
1965	17,628	3.7	35.2
1966	18,984	7.6	36.6
1967	20,087	5.8	36.6
1968	21,548	7.2	38.1
1969	22,838	5.9	38.9
1970	24,154	5.7	39.0
1971	24,805	2.6	40.6
1972	24,792	-0.1	39.9
1973	24,764	-0.0	39.7
1974	23,689	-4.5	38.7
1975	22,022	-7.5	36.9
1976	21,752	-1.2	36.3

Source: American Gas Association, Gas Facts, 1977.

Associated with the production of large quantities of natural gas were certain marketing strategies, the effects of which are felt to this day. During the years immediately after World War II, gas pipeline companies contracted with distribution utilities for the sale of natural gas under two different types of contracts. Relatively small loads of natural gas were sold to distributors under firm connected load contracts. Much larger quantities were sold under "take or pay" contracts covering excess amounts that were made available to low priority users for boiler fuel or electricity generation. These quantities of gas were then marketed under interruptible tariffs permitting gas distributors to seek additions to their firm loads, which when connected would displace the interruptible gas contracts.

Additional characteristics of these early marketing techniques relate to the pricing of gas under interruptible contracts. Almost invariably, gas marketed under these contracts was sold at prices that were close to the incremental cost of the gas to the gas distributors. The higher price, that was charged to firm customers, was rationalized on the basis of an assured year round supply. (See for example Table 2-2) This type of marketing technique was in place from early post World War II. It had major implications for the profit position of gas distribution firms. Because higher prices were charged to new firm customers, as the volume of gas sold to these customers increased over time, the revenues of the utilities and therefore their profits increased.

These conditions came to a rather abrupt end in the late 1960's. The reversal was mainly due to changing supply conditions of natural gas. Since additional volumes of gas from the interstate pipeline companies generally were not available, distributors could not expand their firm sales by first contracting on an interruptible basis. It is noteworthy that some analysts attribute the lobbying efforts of the natural gas industry before the Federal Power Commission to these

Table 2-2 Gas Industry Revenues, Gas Use, and Average Price For Selected Customers and Years

Year	Revenues From ($000's)		Sales To (Trillions of Btu's)		Average Price ($/Millions Btu's)	
	Electric Generation (Interruptible Contracts)	Residentials (Firm Contracts)	Electric Generation (Interruptible Contracts)	Residentials (Firm Contracts)	Electric Generation (Interruptible Contracts)	Residentials (Firm Contracts)
1971	335,539	5,635,395	1,083.6	5,040.1	.309	1.118
1972	294,885	6,094,171	858.4	5,141.8	.343	1.185
1973	309,653	6,246,988	871.6	4,993.6	.355	1.251
1974	395,889	6,899,395	812.5	4,864.8	.487	1.418
1975	473,951	8,445,484	623.4	4,991.0	.760	1.692
1976	1,015,066	9,941,013	804.5	5,014.2	1.261	1.982

Source: American Gas Association, Gas Facts, 1977 changing conditions. The major aim of the lobbying efforts was to maintain a price advantage for natural gas over alternative fuels, typically oil.[1]

In retrospect, these actions are particularly puzzling. They seem to have been shortsighted. The relative price advantage of natural gas over other fuels was contributing to the growth in pent-up demand during a period of continuously declining supply. Indeed, the regulated price was a major cause of lack of adequate supplies of natural gas to non-producing states. It is not surprising that during the early 1970's the lobbying efforts of the natural gas industry, and especially gas pipeline and gas distribution companies, were reversed in favor of gas deregulation.

The situation was further complicated by the Federal Power Commission's policy of allowing some new gas in the interstate market to be sold without "dedication". Spot, and other undedicated sales, at prices below the intrastate market price led to a growing reluctance by natural gas producers to sell in the interstate market, especially to sell their long-lived reserves.[2]

By the early 1970's the demand for interstate gas clearly exceeded its supply. The Federal Power Commission began to approve transmission company curtailment plans in 1973. These curtailments were technically based on "end use." By 1974 Columbia Transmission Corporation, the major supplier of the biggest gas distribution company in Ohio, had its first gas supply shortfall of some 66 million mcf, measured against amounts supplied in the base periods, 1970 - 1971. This shortfall increased to 344 million mcf in 1975.[3]

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[1]Russell Fleming, Jr., "The Problems of Gas Utilities and Their Solutions," Public Utilities Fortnightly, May 12, 1977.

[2]See Russell Fleming, Jr., "The Dilema of Gas Supply", Public Utilities Fortnightly, November 24, 1977.

[3]See M. Audeen Walters, Kevin A. Kelly, and James Bydolek, The Emergency Purchase, Transfer, and Self-help Programs, Columbus: Public Utilities Commission of Ohio, Policy Analysis Series, July 8, 1977. p.10.

At this time, many natural gas distribution companies throughout the non-producing states were attempting to deal with the supply problem by developing additional gas storage facilities. These facilities were designed to assure a continued supply to the utilities' firm customers during periods of peak load. Although winters during these years were atypically warm, there was a general increase in the cost of providing natural gas to the firm customers. In addition to the increased cost due to the operation of gas storage facilities, the regular purchases of gas through spot contracts and self-help gas contributed as well. These cost increases made it necessary for gas distribution utilities to seek general rate relief and to increase rates via their adjustment clauses due to the purchase of higher priced gas. Frequent rate cases, resulting in higher natural gas prices, resulted in efforts to initiate "lifeline" rates by some customers.

The major initiative of the Public Utilities Commission of Ohio (PUCO) was to impose restrictions on new service, in order to limit the growth in demand and in order to protect supplies for old customers. In the winter of 1972 the PUCO gave its consent to Columbia Gas of Ohio to stop new hook-ups of industrial and commercial customers, and by the summer of that year new residential hook-ups were stopped as well.

Although the PUCO had no ability to increase the normal supply of gas available to the distribution companies from transmission companies, it had some power to secure supplies from non-historic sources and some power over the reallocation of both normal and non-historic supplies among customers. Therefore, in addition to the curtailment plans, three programs were established to provide an efficient allocation of gas to curtailed customers. The three programs were the emergency gas purchase program, the natural gas transfer program, and the self-help program. A full description of these programs is contained in a previous report to the PUCO by the Ohio State University Policy Development Program.[4]

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[4] Walters, et. al., Ibid.

The Current Condition of the Gas Distribution Industry in Ohio

The moratorium on new customer hook-ups in Ohio spread when other gas distributors followed Columbia Gas of Ohio, and received permission from the PUCO to cease taking on new customers. In January 1979 the East Ohio Gas Company will become the first major gas distribution utility to begin new hook-ups after obtaining a relief order from this moratorium. In May 1978 Columbia Gas of Ohio announced that it intends to ask the PUCO for a similar relief order in the spring of 1979.[5]

The sudden reawakening of interest among Ohio's gas distributors in service expansion is due to reduced growth in gas consumption by the existing customers so that market requirements are below their minimum annual contract obligations with gas transmission companies. Furthermore, under "take or pay" contracts if the gas purchaser (gas distribution company) cannot accept delivery of quantities of gas equal to the minimum quantity provided for in the contract they must pay for that quantity of gas which represents the difference between the minimum called for under the contract and the amount of gas actually delivered. They are, therefore, advancing money for gas which will be delivered later. Since there are no deductions for royalty or operating costs, the net amount of money received by a gas producer or pipeline is great than if the gas had been taken. When the gas is actually delivered in the future, it will be delivered at the price then in effect, which will be higher than the current price.

It should also be pointed out that the purchaser must take delivery of the gas, for which prepayments have been made, within the specified period, failing which the right to recover the gas

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5 "Gas Sales May Be Resumed," Columbus Dispatch, May 28, 1978, p. B-3.

terminates. The recovery of this gas can only be accomplished by the purchaser after meeting its minimum quantity commitment in any contract year. Obviously these circumstances create a strong incentive for the purchaser to expand its markets and increase deliveries. Otherwise the prepayment is left with the producer without the delivery of the gas, and it should be self-evident that the purchaser try to avoid that happening.

Furthermore, the apparent over-supply problem has been caused in large part by the activities of producers many years ago when gas prices were very low and there was no incentive by the industry to develop reserves, particularly shallow gas. Large areas were assigned under contract to the industry participants, even though only relatively little acreage could at that time be considered as proven. As gas prices have increased to levels of $1.25 - 1.50 per/mcf, more development drilling has resulted in increases in gas reserves. Adding to the current over-supply has been the lower than forecast increased usage of natural gas in the U.S.

In particular, the supply position of Consolidated Natural Gas Company, a major supplier of the East Ohio Gas Company, has improved substantially during the past year as the result of the start-up of the El Paso Algeria LNG program, rising production rates, and improvement in the supply positions of the company over pipeline suppliers. Gas sales are expect to rise by 7.3% in 1978, primarily because no deliveries were curtailed and because the weather was extremely cold during the first quarter.

Similarly, the supply position of the Columbia System is enhanced by deliveries (which began in March 1978) of LNG from Algeria to the Cove Point, Md. terminal, ownership of which is shared with Consolidated Natural Gas. When full deliveries from the Algerian trade are reached in late 1978, Cove Point will contribute 110 million mcf annually to CG's gas supply over a 25-year period. The average cost of the revaporized LNG delivered into the transmission system is estimated to be $1.66 per mcf. Negotiations continue for securing additional LNG supplies for delivery to Cove Point. To meet future market requirements, the company also plans to construct a new storage field in Fairfield County, Ohio, which eventually will increase the total present storage capacity of 590 million mcf by 19%.

A subsidiary is engaged in a joint venture to build two mines to develop some 42% of CG's 475 million tons of low sulphur coal reserves in West Virginia. Initial coal production is slated for early 1979, with 2.2 million tons annually to be reached in 1982. This coal will be used in the production of synthetic natural gas.

The Policy Issues

In light of the emerging new conditions in which gas distribution companies must operate, it is increasingly likely that the PUCO will be soon facing numerous and frequent applications for relief from the "no new customer connections" policy. At the time that these new service restrictions were extablished it was generally believed, and reflected in the orders authorizing restrictions, that in the event supplies increased the full needs of existing customers would be satisfied first. This policy would be relaxed by a relief order removing the "no new customers" restrictions, first to the residential class, then to the small commercial, and upward to the large industrial classes as supply permits.

The major implication of such a program is that gas would be provided to industrial boilers which were curtailed prior to any permission to connect new customer. Once the needs of industrial boilers are satisfied the policy would result in the connection of customers with a very high reliance upon continued gas supply, such as residential heating customers. This policy might not be appropriate if the increased supply turns out to be temporary. If customers' curtailments have to be reapplied, it may be more desirable to utilize the gas now available for customers who can most easily withstand a future withdrawal of their supply.

An additional consideration is the future price of gas. If the presumption is made that ultimately gas will be priced at the market clearing price, then allowing new hook-up of those who ultimately will not be willing to pay market price, may leave the utility in a position of being unable to sell gas at an appropriate price in the future. That is, if customers willing to pay a future market clearing price, marginally above oil equivalent price, are precluded from the market and other customers not willing to pay that price are permitted in the market, then the revenue stability of the gas company could be undermined to the ultimate disadvantage of all customers.

Based on considerations such as these a number of policy questions arise, the answers to which will contribute to the development of a new service policy. Such a policy would be arrived at by the following steps:

1. The identification of possible alternate new service policies;
2. The identification of goals that could be pursued in allocation of increasing gas supply;
3. The identification of the constraints imposed by outside agencies;
4. The evaluation of the implications of alternate new service policies in terms of impacts on Ohio; and
5. An analysis of probable future gas supplies.

Potential New Service Policies

In general, potential PUCO policies concerning new service can be defined in terms of (a) the type of customer to receive new service, (b) the location of the customers to receive new service, and (c) the contractual arrangement under which new service is to be provided. This typology of policies is helpful in an attempt to evaluate the alternative courses of action that are open to the PUCO in terms of the regulatory objectives to be discussed in Chapter 3.

For example, the provision of excess gas supply to residential customers, at the expense of industrial customers, will have a major impact on end-use efficiency. The provision of new service to customers who are located within the current service regions of the company's legal service area will result in a smaller change in the company's rate base than provisions of a similar quantity of gas to similar customers located elsewhere. At the same time, provision of the excess gas supply under interruptable contracts will cause smaller economic dislocations during unusually high demand heating months.

Out of the above crude typology of policies emerge 19 potential PUCO policies, including a policy of no new service. For further details see Figure 2-1, in which each of the 19 policies is listed. Each box in the figure represents an alternative policy. The possible introduction of mixed policies, e.g. in terms of Figure 2-1 policies #5, #7, and #15 together, increases the number of potential policies and complicates the analysis of potential impacts.

Potential PUCO policies can be further differentiated in terms of the specified time of their implementation. For example, policy #2 in Figure 2-1 can become two different policies if implemented in 1978 or implemented in 1985. Furthermore, the date of implementation of policies may be prespecified, or may depend upon some set of events that become known as an output of the simulation exercise. In such case, the implementation date of a policy is unknown *ex ante*.

It is noteworthy that new policies can be construed as a means for the definition of new legal service boundaries for Ohio's power utilities. In the absence of franchises, the boundaries of utilities' territories are not firmly set. Adjustment of these boundaries by permitting one utility to expand while holding another utility to its present service area, or the extension of one utility service area at the expense of another, has the potential of becoming a major source of

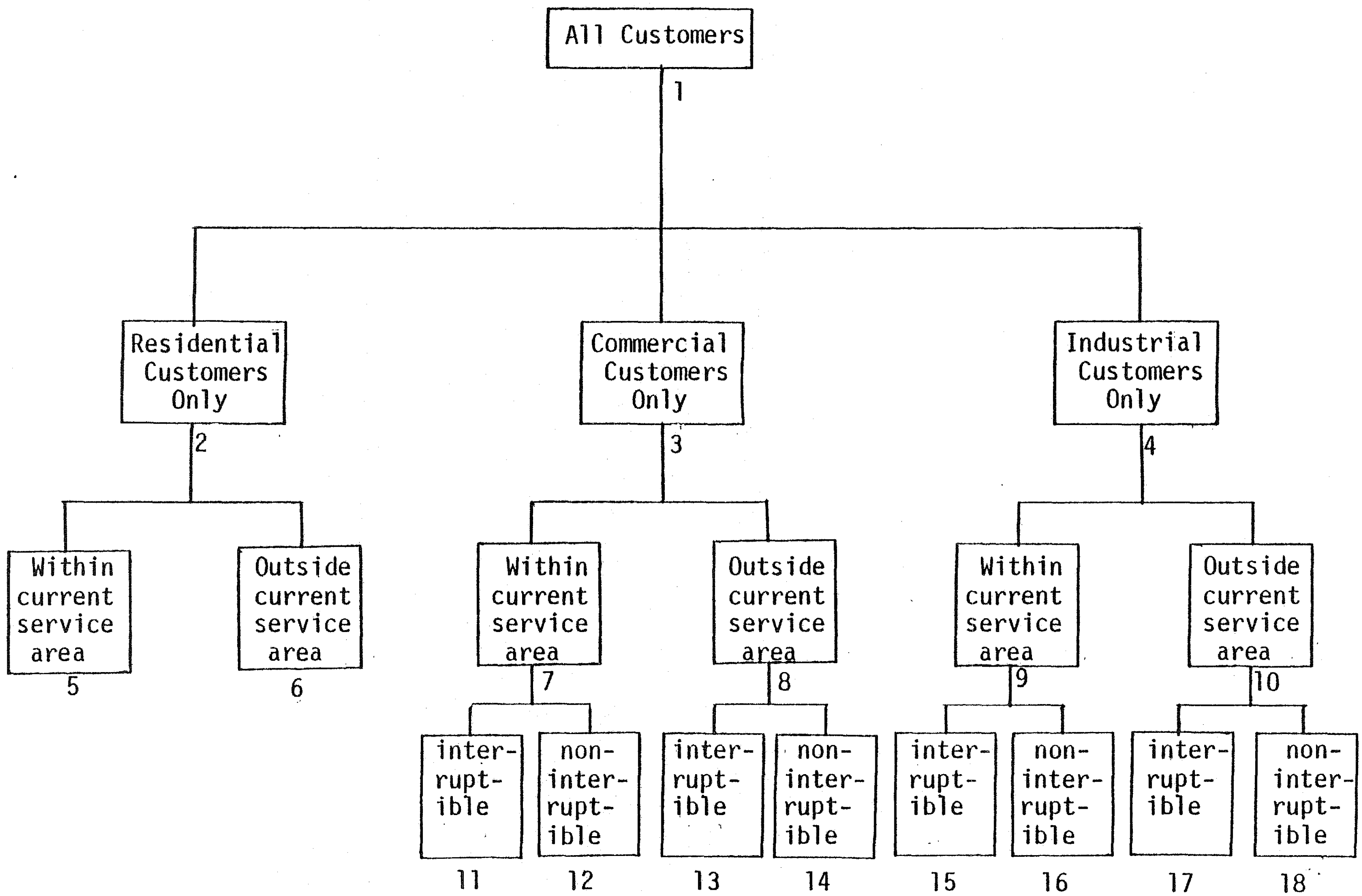

Figure 2-1 Potential PUCO Policies in Terms of Customer Type and Location and Type of Contract

competition among utilities of the type that can lead to an overall increase in efficiency with which resources are allocated. In the least, this type of competition would lead to the elimination of differences in the price of gas which are due to differences in the efficiency with which utilities operate. The only price differences permitted would be those based on "true" cost of service differentials.

Policies Selected for Simulation

Of all the potential policies that the PUCO may adopt only a small selected number was subjected to evaluation through the simulation model. The choice of policies was guided by the need for certain types of information necessary for general evaluation of very broad policies. In other words, this study seeks to point out the repercussions of very general policies that the PUCO might adopt. It did not evaluate in detail very specific policies. Such an evaluation can be carried out by PUCO staff in the context of specific hearings. It is for this purpose that the analytical model was developed.

Among the policies that were analyzed are two extreme courses of action. The intention is to point out the consequences of a limited involvement by the PUCO in the whole issue of new service. These policies range from a "do nothing" policy to a policy of "laissez faire":

Policy 1: No reflief order is issued.
Policy 2: A complete relief order is granted.

Policy 2 permits the gas company to make decisions that are in its own best interest. It is not at all clear that such a policy will lead to the achievement of regulatory objectives such as adequacy of service and use efficiency. Nevertheless, it is important to examine this policy in terms of the policy evaluation criteria selected. Similarly, Policy 1 may result in an adverse financial position for the company, as well as inadequate service and inefficiency of end-use.

While Policy 1 and 2 were used to analyze the repercussions of extreme courses of action by the PUCO, other policies were used to examine the least adverse impact point of alternative policies. Two additional policies were analyzed:

Policy 3: A partial relief order is granted, covering residential customers within the currently serviced areas of the company's legal service area.

Policy 4: A partial relief order is granted, covering the industrial customers located anywhere within the legal service area.

The aim of testing Policies 3 and 4 is to examine the extent to which the effects of Policy 1 and 2 can be localized. Policies 3 and 4 increase the rate base of the utility, but without endangering it to price competition from other fuels. In light of possible deregulation of natural gas wellhead price the policies can lead the company to capture part of the energy market. Policy 4 has the added advantage that it can be implemented on an interruptible contract basis, thus avoiding the possibility of an adverse future impact on adequacy of service.

CHAPTER 3

POLICY EVALUATION CRITERIA

The mere existence of a multitude of possible new service policies, as described in Chapter 2, suggests that the choice of the preferred policy be based on the capacity of the policy to satisfy regulatory objectives. Such choice is made difficult, however, by a number of factors. Above all, the extent to which some of the regulatory objectives are attained and the repercussions of serveral policies in terms of the various criteria cannot be measured accurately. In addition, the comparison of policies in terms of their achievement of all the objectives is not possible because of the non-existence of an aggregate measure. The lack of such a measure is due to the fact that the standards by which the attainment of the objectives is measured are not equivalent. The purpose of this chapter is to describe the various criteria that should be used to analyze new service policies.

Among the traditional objectives of regulatory policies are concerns for financial stability of the regulated utility and adequacy of the quantity and quality of the supplied services. More recently, due to the newly revealed energy scarcity and the associated growth in utility bills, regulatory policies have been increasingly subjected to evaluations in terms of changes in production and end-use efficiency and in terms of fairness and the redistribution of income that they induce. As the recognition grows that public utilities' services can serve as stimuli and constraints for regional development there is increasing speculation about the potential for the evaluation of regulatory policies on the basis of their regional development repercussions. The following sections of this chapter contain descriptions of possible criteria for policy evaluation based on concerns for (1) utilities' finances, (2) adequacy of service, (3) end-use efficiency, (4) aggregate economic efficiency, (5) fairness, (6) regional development.

The Impact of Hook-up Policies on Utilities' Finances

Ultimately, the concern for utilities' finances is a concern for its stock-holders and customers. An aggravated financial position for a regulated company can lead to the necessity of internal financing of projects needed to assure an adequate level of service. Inevitably such financing leads to higher rates. In the end lack of a financing source can lead to service curtailments and losses for the stockholders. In particular, the expansion of a gas distribution system, or the lack of such an expansion, may affect the gas company's financial position in two ways. Changes in its rate base can affect its allowed profits, while changes in its realized expenses and its revenues can affect the actual profits. Such changes inevitably lead to further repercussions in terms of changes in gas rates, in the relative prices of all fuel, and further changes in the potential demand for gas. In an extreme situation failure of the company to grow may lead to the eventual disappearance of the utility, while indiscriminate growth may lead to inadequate service and associated economic costs, causing eventaul cut-backs brought about by customers who switch to other fuels.

There are at least three general aspects of company finances that can be affected by such changes. First, expansion policies have a major impact on the company's ability to generate revenues. Second, they alter the company's financial structure. Finally, they change the company's ability and willingness to control expenses associated with doing business. Inasmuch as regulated monopolies have a limited set of built-in incentives to control expenditures strictly, expense control is a particularly important aspect of gas companies' finances.

A number of financial indicators can be used to analyze the repercussions of new service policies on all three aspects of gas companies' finances.[1] The total asset turnover ratio can be used as an overall measure of the use of total assets employed by such companies. Essentially, the ratio measures dollars of sales generated by a gas company per dollar of

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[1]The precise mathematical specifications of the various measures are fully described in Chapter 9 of Volume II.

investment. Typically, in the case of non-regulated industries it is measured as the value of net sales divided by total company assets.

Net profit margin ratio is the most commonly used index to evaluate a firm's performance from the common shareholders' point of view. It is defined as profits after taxes per dollar of sales. The gross profit margin ratio is used with a similar intent. It is simpler to calculate, however, since it is defined as profits before taxes per dollar of sales and thus does not involve tax rate calculations. The return on total assets ratio is similar in that profits after taxes are calculated per dollar of total assets.

A much more general indicator, one that encompasses all three crucial financial analysis elements, is the return on common equity index. It is the product of the net profit margin ratio, the total asset turnover ratio, and the equity multiplier, which is indicative of the relationship of change in net profits for common shareholders given a change in the level of operating profit.

Two additional indicators can be used to analyze the impact of new service policies. The percentage change in the value of net plant in service can be used as an indicator of changes in the company's size. The number of rate increases made necessary by the various policies can be used as an indicator of the extent of adjustments needed to keep the company's revenues in line with the revenue requirement. In this case since no gas price adjustment mechanism is employed in the financial analysis, fully described in Chapter 8 of Volume II, only rate increases that exceed the annual change in wholesale fuel price are counted.

The Impact of Hook-Up Policies on the Adequacy of Service

The notion of adequate utility service has been interpreted in the past as its availability upon demand. Thus, for example, electricity brown-outs and black-outs and natural gas curtailments are deemed to be symptoms of inadequate service. The need to consider the impact of hook-up policies on the adequacy of service arises out of a concern for the availability of adequate gas supply to serve the expanded demand associated with the new service. In the face of given gas supply forecasts and unusually severe heating seasons the granting of a relief order concerning the ban on new service may lead to an increased risk of forced curtailments. The need for such curtailments is traditionally viewed as a symptom of inadequate utility service.

In the present effort adequacy of service is evaluated with the help of two types of indicators: annual curtailments indexes and monthly curtailments indexes. The purpose of the annual indicators is to analyze the extent to which a new service policy that calls for an increase in committed requirement[2] in one year leads to potential unfilled demand in other years. One indicator is used to assess the average annual excess demand. A second index indicates the number of years during which such excess demand occurs.

The purpose of the monthly curtailments indicators is to analyze the extent to which unpredictable winter weather together with changes in the number of customers leads to short-term curtailments in winter. Another index is used to compute the frequency of the monthly curtailments.

No attempt is made in the present effort to estimate the economic costs associated with both types of curtailments. The Ohio Department of Energy is conducting research with the aim of estimating such economic costs. Should these results become public they can be incorporated in a future stage of this research.

The Impact of Hook-Up Policies on End-Use Efficiency

Use of "end-use efficiency" as a criterion for the evaluation of regulatory policies has a relatively short history. It is increasingly linked to the notions of "wasteful" or "unjustified" consumption of natural gas, or to the need for conservation. A direct implication of the notion of end-use efficiency is that natural gas entitlements should be redistributed from the "wasteful" consumers to those who are "justified" in their consumption.

"The idea of justified consumption, when coupled with the notion of consumer sovereignty, takes on a very precise meaning. In a free economy,

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[2] For a full discussion of the concept "committed requirements" see Chapter 6 of Volume II.

it is convenient to assume that the individual gas consumer knows best the extent to which natural gas benefits him and he expresses its usefulness to him by his willingness to pay for it. The more useful an mcf of natural gas is to the individual the more he is willing to pay for it. Thus, if gas is sold to individuals with a low willingness-to-pay, while individuals willing to pay more find gas unavailable, some "wasteful" or "unjustified" consumption has occurred. For example, it is considered wasteful for an industry to receive summer gas at $1.60 for firing boilers that could burn $2.00 coal, while other customers who require a clean source of energy turn to $5.00 propane or $7.00 electricity.[3] On the other hand, a gas allocation policy that would redirect the flow of gas from the low willingness-to-pay to the high willingness-to-pay individual is a gas conservation policy. It leads to greater end-use efficiency and an improved allocation of resources in general."[4]

Instead of being determined through the interaction and bargaining of very many suppliers and demanders, the price of natural gas is determined by government regulation. Because this government set price is below a freely operating market price, there is a constantly prevailing excess demand for gas over supply. In order to use the efficiency standard of willingness-to-pay to evaluate gas hook-up policies it is necessary to estimate excess demand.

Regulatory agencies have resorted to natural gas curtailment to reduce the excess demand to meet available supply, so that today it is still not possible to know individuals' willingness-to-pay for natural gas by directly observing their consumption patterns. The actual quantities of gas that individuals consume are not the quantities that they would buy without a curtailment policy. Besides the directly-ordered curtailment, excess demand exists because of hidden "curtailments" due to the prohibition of new gas hook-ups for all customer classes. The quantity of excess demand can be inferred from what economists call a demand curve. A typical demand curve is illustrated in Figure 9-1. At the

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[3]It should be noted that these figures mean $2.00, $5.00, $7.00 per equivalent energy unit depending on the particular energy source.

[4]This discussion is from a previous report to the PUCO, Benefits and Costs by Gas Storage Development in Ohio, August 1977, pp. 32-34

regulated price P* a customer would demand the quantity of gas, Q. Because of existing curtailments, however, he can obtain only the quantity, D.

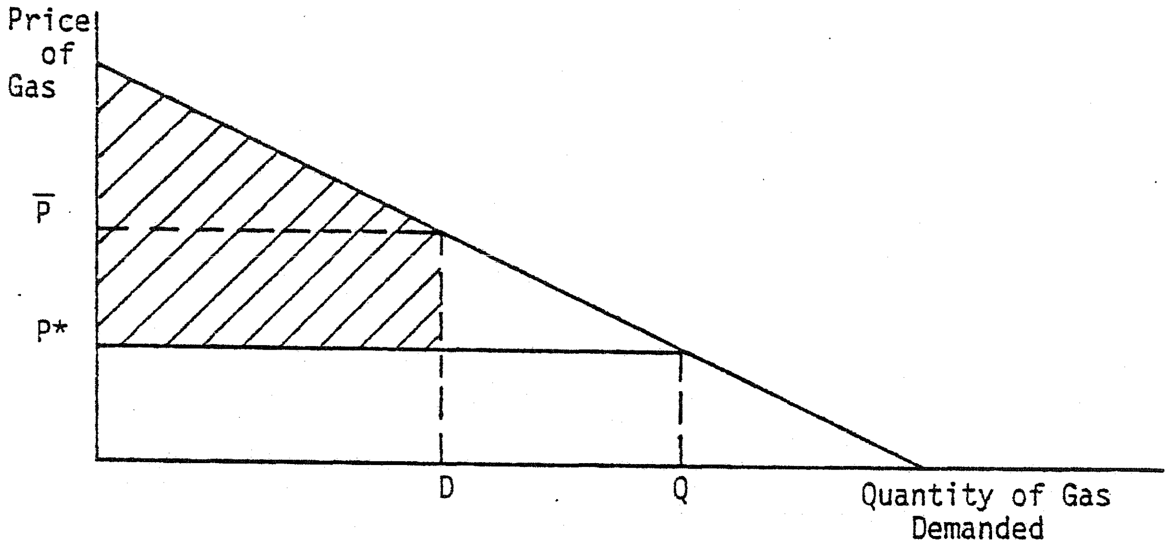

Figure 3-1 Typical Demand Curve for Natural Gas by a Single Customer. (Shaded Area Shows Consumer's Surplus)

"Note that for the last unit that a hypothetical customer is able to obtain is willing to pay $\overline{P}$ but actually pays only P*. The difference between the price he is willing to pay and the price that he actually pays is a benefit to the customer that is not captured and expressed by the commodity's price. Thus, for all the previous units there is an excess of benefits over price. The dollar value of these benefits, given by the shaded area in Figure 3-1 is called consumer's surplus."[5]

Each consumer has a consumer's surplus. The higher the individual's willingness-to-pay the greater will be his consumer's surplus associated with any given quantity of natural gas. If the object of a gas allocation policy is to distribute the gas to the individuals with the highest willingness-to-pay (i.e. to promote end-use efficiency), it should aim

[5]The concept of consumer's surplus is a fundamental concept in economic theory, explained in any basic economic text. It is an essential ingredient in cost benefit analyses. The concept was explained and applied in a previous report at the PUCO. Alternative Policies for Pricing Non-Historic Gas, October 1975.

at attaining the highest sum of all consumers' surplus. The reallocation of gas from some consumers to others, causes some consumers' surplus to shrink while others' to grow. A well-designed policy can reallocate gas so that the net change is positive and as large as possible.

The Net Aggregate Consumers' Surplus

The removal of a ban on new hook-ups has the potential of affecting the consumer's surplus of many individuals. In order to assess the desirability of various new hook-ups policies it is necessary to estimate the change in net aggregate consumers' surplus less the cost of policy implementation.

A typical policy will specify

(a) the allocation of the gas supply for each year to existing customers of the gas company, and

(b) the allocation of excess gas supply for each year to new customers by customer class.

Accordingly, within the supply constraint a new group of customers will be supplied with gas up to its potential demand at the current level of price.

The net aggregate consumers' surplus is calculated under six different situations. These are defined in terms of the amount of gas received by the three major consumer groups. The need to distinguish the six different situations is necessitated by the requirement that the opportunity cost of each gas allocation be considered along with the direct benefits of that allocation. For the three hypothetical consumer groups, denoted by i, j, and k, the following cases will be considered:

CASE 1: Group i receives some of the gas that it demands. There is not enough gas for groups j and k.

CASE 2: Group i receives all the gas that it demands. There is not enough gas for groups j and k.

CASE 3: Group i receives all the gas that it demands. Group j receives some of the gas that it demands. Group k receives no gas.

CASE 4: Groups i and j receive all the gas that they demand while group k receives no gas.

CASE 5: Groups i and j receive all the gas that they demand, while group k receives some the gas that it demands.

CASE 6: All three groups receive all the gas that they demand.

It is noteworthy that based on the net aggregate consumers' surplus, calculations based on the above cases are made for one time period only. In fact, however, once an allocation is made during any given year the benefits and costs of that allocation will continue to be felt by the individuals affected, as long as relative price changes, changing technology, and changes in preferences do not change the individuals' willingness-to-pay for gas and other fuels. Furthermore, the allocation of gas is not performed once for all time. As new excess gas supply appears concern for maximum achievement of net aggregate consumers' surplus dictates that gas be allocated repeatedly to new customers as long as there exists potential demand.

The Impact of Hook-Up Policies on the Allocation of Resources

The end-use efficiency index represents a partial description of the efficiency with which resources are allocated as a result of new service policies. In fact, it is descriptive of the efficiency with which resources are consumed only. An equally important determinant of the overall efficiency of resource allocation is the efficiency with which resources are transformed into consumables. It is typically termed production efficiency.

In a perfectly competitive environment, an environment in which producers are subjected to rivalry from each other, highest production efficiency is assured by the survival of those who combine resources most efficiently. It is generally claimed that within a regulated environment the absence of rivalry has led to the partial decline in the extent to which production efficiency is sought and achieved. In the economic literature the lack of incentives and the resulting misallocations have become known as the "Averch-Johnson effects."

In the absence of a perfectly competitive environment the only means for measuring the extent to which production efficiency has been achieved is to compare an idealized production process to the actual. In the present effort the lack of time and budget prohibits such an exercise. Instead, information from the Financial Analysis described in Chapter 8 of Volume II is used to assess the extent to which maximum "producer's surplus" has been attained.

The motion of producer's surplus is symmetric to the notion of consumer's surplus. The extent to which a producer is willing to sell his products depends upon his marginal cost. The supply curve, illustrated in Figure 3-2 depicts the quantity of a good that a producer is willing to sell at various prices of the good. Thus, at price P_i the producer would be willing to sell if Q_i of the commodity and yet, because the price is regulated at $\overline{P}$, if he were to sell only Q_i, on the last unit sold he would have realized an unusual profit of $(\overline{P} - P_i)$. The shaded area in Figure 3-2 depicts all such unusual profits, termed producer's surplus.

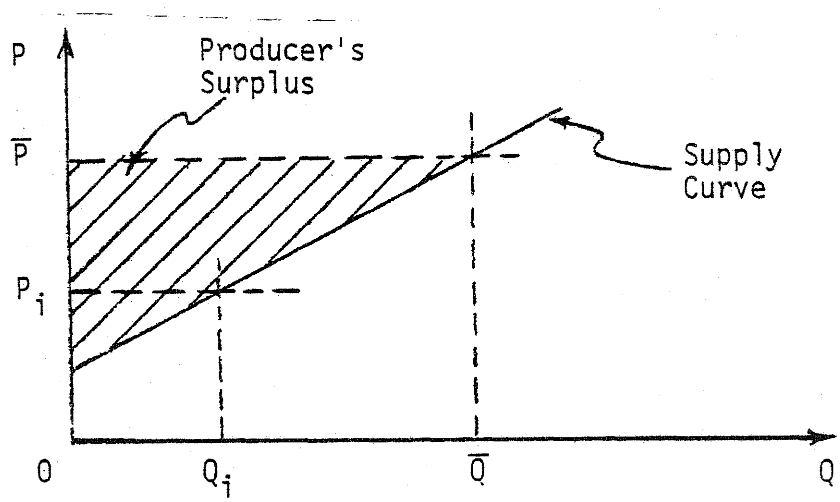

Figure 3-2 Illustration of Producer's Surplus

In the present research an indirect measure of the aggregate value of producer's surplus is given by the total revenues of a gas distribution company less its total cost of providing its service. On the basis of this calculation and the previous estimate of end-use efficiency, aggregate efficiency is defined as their sum.

Fairness and New Hook-up Policies

In a previous report to the PUCO[6] it was argued that the concept of fairness is at once both difficult and vague. Consequently, this evaluation criterion has received a variety of interpretations, each of which suits a particular interest group. Bonbright delineated four standards of fairness that are often applied in practice; these are good faith or reasonable expectations, ability to pay, notional equality, and the compensation principle. These are further described as follows:[7]

1. Good faith or reasonable expectation standards refer to what may be called a moral obligation to live up to previous commitments. Such standards are typically held by customers who wish to maintain the low rates to which they have become accustomed. Suppose, for example, that customers were led to buy electric appliances on the basis of low electric rates. They might argue that since they made these purchases on the expectation of low rates, those rates should be maintained, even though conditions have changed. Bonbright points out, however, that, "As a matter of legal doctrine, such an argument has dubious standing in view of the generally accepted principle that public utility rates are subject to revision if and when they become 'unreasonable.'"

2. Ability-to-pay standards are based on egalitarian ideas of social justice and are used to "support whatever deviations from cost can feasibly be applied in order to minimize burdens falling on those customers with lower income." Use of this standard essentially results in redistributing income and consequently represents what Bonbright refers to as a "quasi-tax." Bonbright further points out that, "The ability-to-pay principle cannot be carried beyond severe limits, since any attempt to do so would lead to a breakdown in the other functions of utility rates."

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[6] Daniel Z. Czamanski, et al., Electricity Pricing Policies for Ohio, PUCO, Policy Analysis Series Number 7, October 1977, pp. 20-22.

[7] The following discussion is based on J. C. Bonbright, Principles of Public Utility Rates, Columbia University Press, New York, 1961, especially Chapter VIII and repeats a summary contained in a previous OSU report to PUCO entitled, Alternative Policies for Pricing Non-Historic Gas, 1975, pp. 26-27.

3. Notional equality standards are based on the popular impression that uniform rates for the same kind of service are fair despite differences in the costs of delivery. In the context of natural gas, for example, the temptation to apply this standard may be great because even though the costs of historic and non-historic gas are quite different the service provided is the same. Bonbright, however, argues that, "This tendency is really a distored reflection of an income-distributive standard," (i.e., ability to pay). "It certainly fails to accord with any of the more general theories of proper income distribution. Instead, it accepts a specious egalitarianism."

4. The compensation standard is based on the idea that the payment of the consumer to the producer should offset or counterbalance the cost incurred by the producer in delivering the service. Under this standard, rates are not designed to reflect egalitarian principles to any degree.

In terms of new gas hook-ups and the allocation of excess gas supply there are at least three implications of the above. First, based on the "good faith" definition of fairness alone those already consuming gas should not be curtailed in the future in order to supply the gas needs of newly connected customers. Secondly, the capacity and other costs associated with the connection of new customers should be borne by these new customers and should not be spread equally over all mcf's of gas sold by the company. And thirdly, there is an unclear implication associated with the fairness objective concerning who should be connected to the system. As long as natural gas prices remain regulated by the Federal Energy Regulatory Commission (FERC) there is an economic gain associated with the priviledge of being able to consume it. Allocation of excess gas supply on the basis of end-use efficiency considerations alone may result in an undesirable distribution of these economic gains.

In order to assess the desirability of hook-up policies in terms of the distribution of such gains, however, there is a need for information concerning customers' income. No such data is currently available and no such assessment is possible within this model. In this analysis partial information concerning potential impact was gained from the consideration of average relative energy prices.

Regional Development Impact of Hook-up Policies

The regulatory policies of the Federal Energy Regulatory Commission with respect to natural gas prices have resulted in a perpetual imbalance between gas prices in non-producing states and the prices of other fuels per equivalent Btu. Because of the competitive advantage that natural gas possesses the spatial distribution of gas consumption privileges may be viewed as a tool of growth management policies. For example, a gas hook-up policy that removes the ban on inner city hook-ups while maintaining such a ban elsewhere would lead to a possible increase in housing starts and potential growth if either population, jobs, or both migrate into the inner city. Since examination of regional development impacts would constitute a major study on its own, no such impacts are evaluated within this study.

CHAPTER 4

POLICY ANALYSIS

It is increasingly recognized that regulatory decisions, whether they are taken in the context of daily rate case proceedings or as part of long-term policy decisions, bear major repercussions that are felt in the years and even decades following such decisions. Until very recently little attention was devoted to the analysis of such repercussions and little effort was exerted to incorporate anticipated consequences into decision-making processes. Indeed, it is recognized that until very recently most regulatory decisions were made by reference to precedents rather than desired changes.

Recent growth in the interest of state regulatory agencies in rigorous analyses of utilities corporate operations, energy consumption patterns, and the manner in which these are affected by regulatory decisions parallels closely the rapid rise in energy costs, the deteriorating financial condition of utilities, and the consequent need for frequent rate cases. The development of simulation models for the analysis of electric utilities' operations and the adoption of such models by several regulatory agencies have created a demand for a similar model of gas distribution utilities.

The major purpose of this chapter is to present an overview of the gas distribution company model that was developed to study new service policies in Ohio.[1] Because the model is perfectly flexible in its adaptability to a variety of analyses prompted by general regulatory issues it has been named a Regulatory Simulation Model (RSM) for a Gas Distribution Utility.

Regulatory Simulation Model for a Gas Distribution Utility

Simulation models are most frequently used as forecasting tools.

[1] It is the purpose of Volume II to present a complete description of this model and the means by which it was used to study new service policies.

With their help decision makers can anticipate the repercussions of alternative assumptions concerning uncertain future events that they cannot control and alternative policies that they can adopt. By reference to regulatory objectives, the comparison of forecasted repercussions associated with alternative assumptions enables a choice of the preferred policy. (See Figure 4-1).

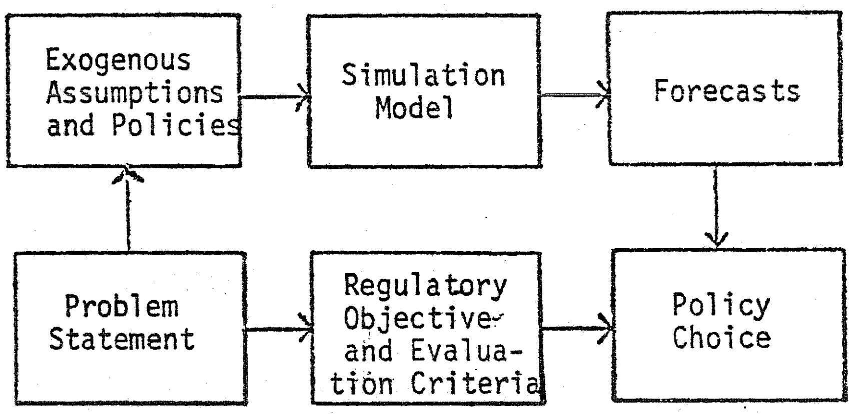

Figure 4-1 The Role of Simulation Models of Policy Choice

But, while the role of simulation models in policy analysis is well defined, their structures are extremely varied. The model at hand is comprised of several parts, each of which can be easily adapted for the analysis of different problems. (See Figure 4-2.) Calculations made with the help of each part present either intermediate or final forecasts calculated on a monthly, seasonal and annual basis one period at a time.

The driving force behind these forecasts is a set of exogenously supplied data and policies. These are enclosed by the heavy rectangle in the upper left of Figure 4-2. The data are indicative of events that are outiside the sphere of influence of state regulatory bodies. The set is made up of four data types: (1) forecasts of socio-economic changes, (2) technological forecasts, (3) forecasts of energy supply in terms of quantities and prices, and (4) weather forecasts. This information is the basis on which patterns of gas requirements and sales are forecasted. Socio-economic forecasts including demographic characteristics, such as household size, and economic characteristics,

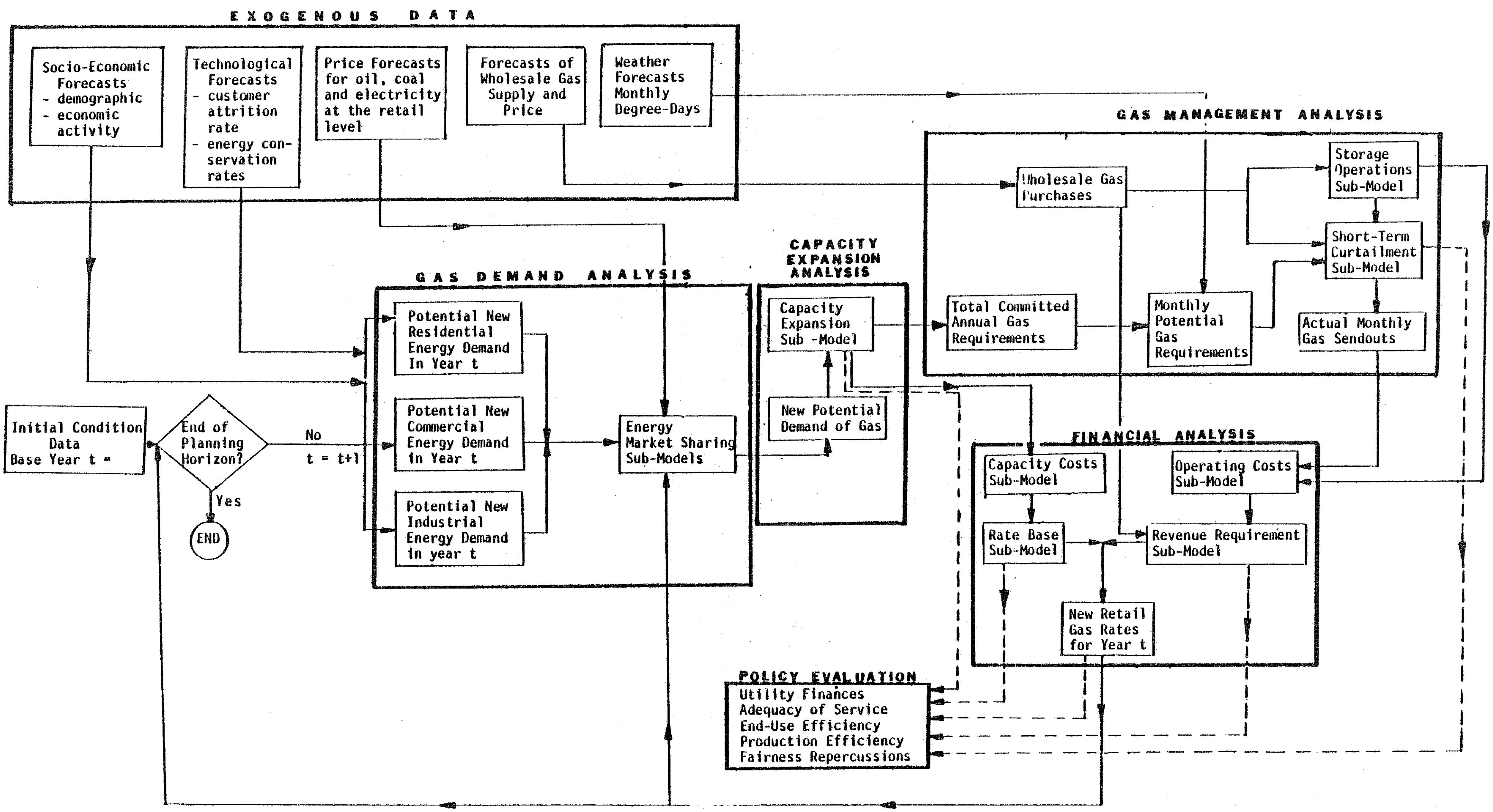

Figure 4-2 Regulatory Simulation Model (RSM) for a Gas Distribution Utility

such as industrial employment and commercial floor area, are used to determine numbers and types of potential gas customers. Energy supply data, which include quantities and prices of various energy forms, are used to examine the utility's ability to serve and the willingness of customers to buy gas, as opposed to other forms of energy. Weather data are used to forecast potential monthly heating loads.

The alternative regulatory policies, the repercussions of which are to be analyzed through the model, can be considered occasionally as exogenous data as well. It is possible, however, that while the menu of policies is exogenous, their introductions into the simulation analysis is triggered by a specific set of forecasts generated within the model.

The above-mentioned socio-economic forecasts are inputs into the Gas Demand Analysis enclosed in the heavy rectangle under the exogenous data rectangle in Figure 4-2. Through this analysis the annual increments in the number of potential energy consumers by spatial divisions of the service area are calculated. These forecasts together with exogenously supplied forecasts of relative prices of various energy forms are the basis for calculating the potential demand for natural gas by class of customers through appropriate "market sharing" models. The sharing is based on statistically estimated functions that relate gas consumption to an index of relative gas prices. (see Figure 4-3.)

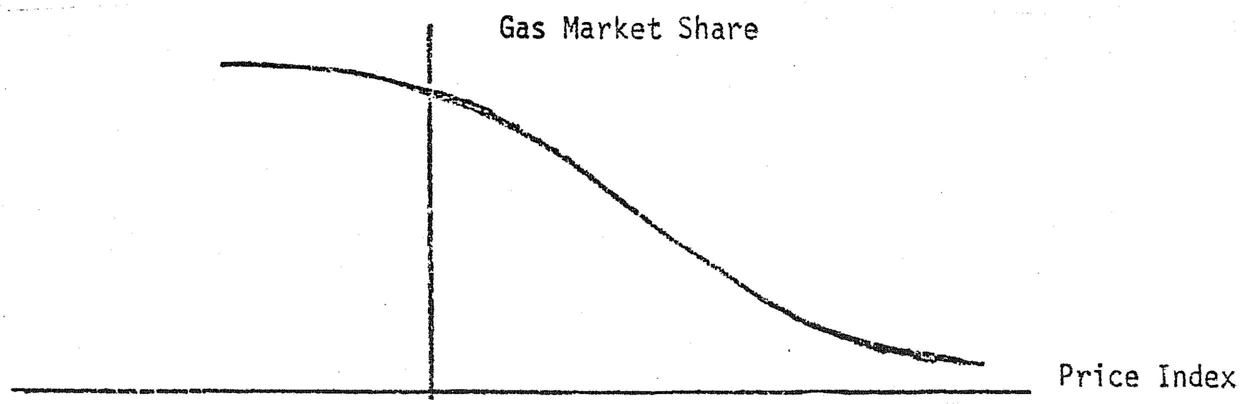

Figure 4-3 A Typical Energy Sharing Function

Output of the Gas Demand Analysis serves as input to the Capacity Expansion Analysis enclosed in the heavy rectangle to the right of the gas analysis in Figure 4-2. Through this analysis decisions are made concerning the extent of new customer hook-ups. Inasmuch as the supply forecasts indicate that no excess demand exists, natural gas is committed to satisfy the forecasted growth in potential demand. It is noteworthy however that the extent to which customers' demands are satisfied and new customers hooked-up to system is circumscribed by regulatory policies. Existing and new customers' demands constitute the basic service commitment of the company.

The company's committed requirements together with randomly selected weather scenarios serve as inputs into the Gas Management Analysis enclosed in the heavy rectangle in the upper right corner of Figure 4-2. These requirements, together with data on gas availability to the company from its transmission companies and storage, are the basis for the calculation of monthly gas send-outs, curtailments by class, and inputs to and withdrawals from storage. Through an engineering-economic analysis the capacity cost sub-model calculates the capacity costs associated with system growth.

The next set of calculations comprises the Financial Analysis, which is enclosed in the heavy rectangle in the lower right corner of Figure 4-2. The purpose of this analysis is to simulate calculations that are typically made in the context of rate cases. Information from Gas Management Analysis is used to calculate forecasts of operations and maintenance costs in the corresponding sub-model. Based on data obtained from these calculations and on exogenuosly supplied data on such variables as allowed rate of return, depreciation rates, and tax rates, this analysis leads to calculations of the gas company's rate base, as illustrated in Figure 4-4. Using these calculations the model proceeds to calculate the company's income deficit and new gas rates for each class of customers. These calculations are illustrated in Figure 4-5. The new gas rates, which should enable the company to earn its allowed rate of return, are used to augment the exogenously obtained energy supply data used in the consumption sub-model during the next period.

The last set of calculations are the Policy Evaluation. The precise nature of the calculations performed depends on the policy issues being analyzed. In each case, however, the calculations are based on evaluation criteria derived from accepted regulatory objectives, such as the financial stability of regulated utilities and adequacy of the quantity and quality

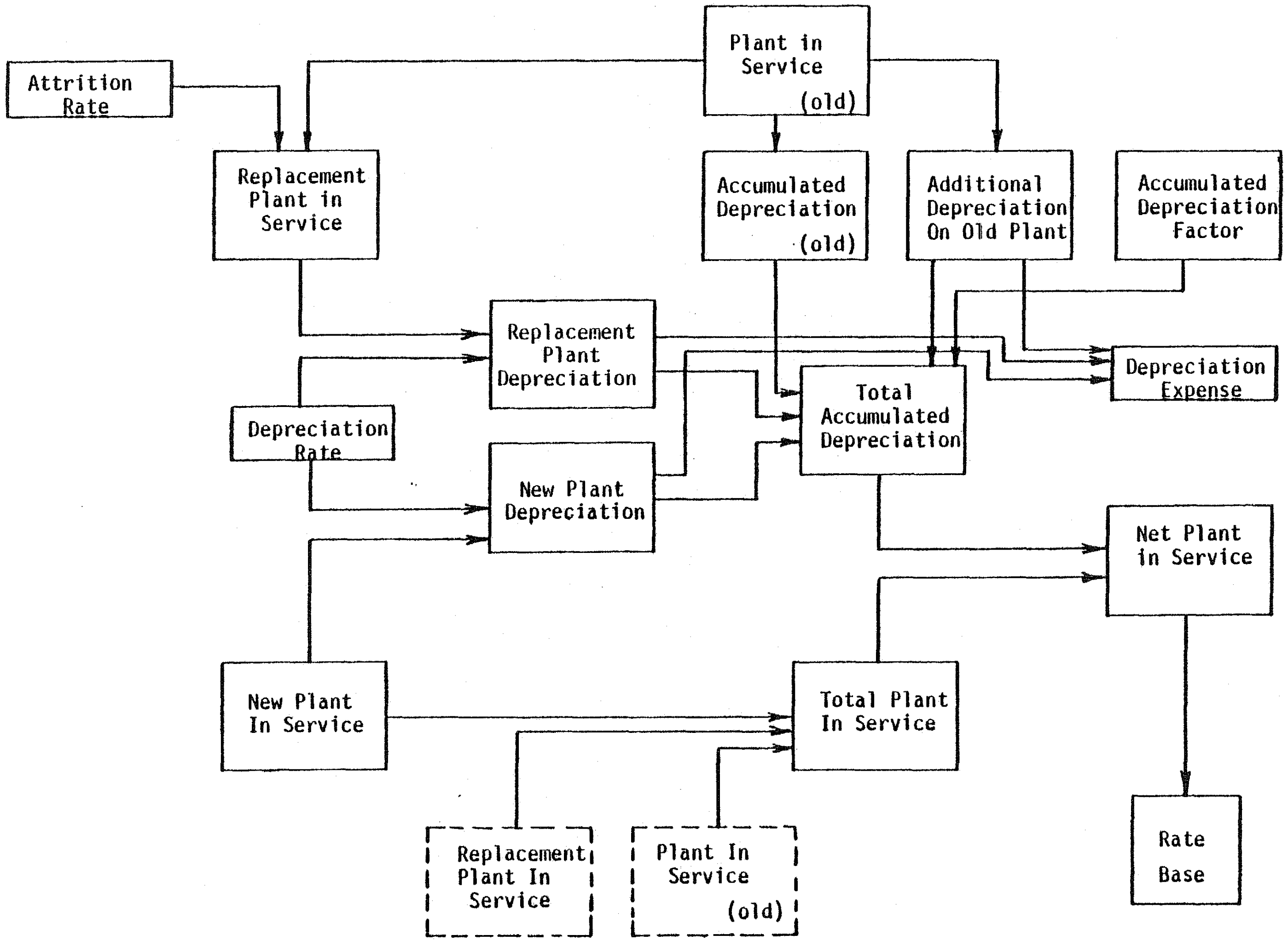

Figure 4-4 The Rate Base Sub-Model of the Financial Analysis in Figure 4-2

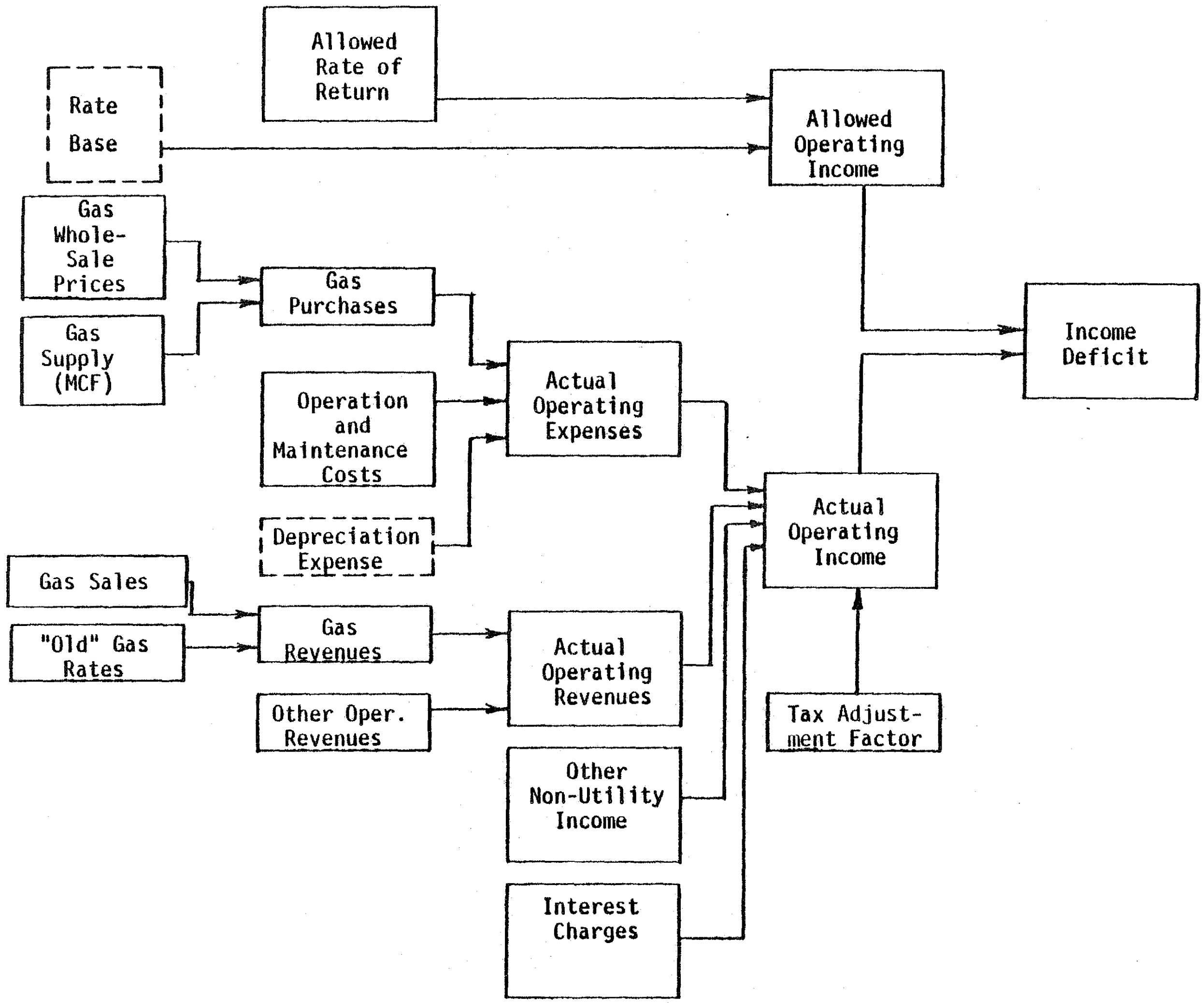

Figure 4-5 The Revenue Requirement Sub-Model of the Financial Analysis in Figure 4-2

of the supplied services. More recently, due to the newly revealed energy scarcity and the associated growth in utility bills, regulatory policies have often consisted of evaluations in terms of changes in production and end-use efficiency and in terms of fairness and the redistribution of income that they induce. All these criteria are accounted for in this sub-model and are fully described in Chapter 9 of Volume II.

Finally, the model will continue to be updated and refined. In the coming year the model will be augmented by the introduction of a jurisdictional cost-of-service sub-model and the refinement of the industrial consumption sub-model to account for inter-industry differences at the two-digit SIC level.

CHAPTER 5
SELECTED RESULTS

The basic premise upon which potential PUCO new service policies were evaluated in this research is that the choice of the preferred policy be based on the capacity of the policy to satisfy regulatory objectives. The variety of potential policies was introduced in Chapter 2 of this volume. Chapter 3 of this volume contains descriptions of the means by which a selected number of these policies was evaluated. The purpose of this chapter is to present results of such evaluations by means of the regulatory simulation model.

An Application of the Model to the East Ohio Gas Company

The model was used to study new service policies with respect to the East Ohio Gas Company (EOGC). This particular company was chosen because it was the first company in Ohio to request a relief order from the ban on new service. Since the company has several potential gas suppliers, a diversified service area, and its own gas storage facilities, basing the modeling effort on the EOGC meant that all aspects of the gas distribution business were accounted for.

Some of the major modeling problems encountered in this effort are related to the estimation of capacity expansion costs and the representation of the company's monthly gas management practices. The cost of expanding capacity is definable only on the basis of a particular gas distribution network. Given the lay-out of a company's system, the addition of customers at one end of the network may not require additional capacity while a similar capacity expansion at another point of the network may lead to additional capacity costs. In this effort capacity costs were expressed in terms of historic averages.[1] Similarly, the representation of monthly gas management practices depends crucially on the company's objectives and the supply

[1] Under a new contract with the PUCO the capacity cost calculation will be redefined as part of a "jurisdictional (spatial) cost of service" model.

and system constraints within which the company operates. Such circumstances determine the amount of gas that the utility buys each month and the amount that it injects into or withdraws from storage. In the EOGC case, a simplified model was developed on the basis of the engineering characteristics of the company's storage plant. The choice of the modeling approach was at least in part dictated by the fact that the company's pipeline suppliers do not impose limits on seasonal entitlement.

Representative new service policies were studied under alternative assumptions concerning future conditions, especially those related to the availability of various types of energy and associated prices. In particular, four policies were analyzed under seven energy scenarios. The four policies are:

1. No New Service Policy - the present ban is continued;
2. Company Initiative Policy - this policy permits the company to provide new service within the supply limits and in a particular order of customer classes. Residential, commercial, and industrial customers within the currently served areas are hooked-up in sequence, followed by residential customers outside the currently served areas;
3. Selected Residential Service - only residential customers within the currently served areas are hooked-up;
4. Industrial Service - only industrial customers within the currently served areas are connected.

Six of the seven energy scenarios were based on U.S. Department of Energy Project Independence Evaluation System (PIES), 1977.[2] Table 5-1 contains the definitions of these scenarios in terms of the assumptions upon which they were built. The seventh energy scenario (EOGCS), almost radically different from the others, is an amalgam of forecasts supplied by the EOGC and price data obtained from Project Independence forecast. It is characterized by a 26 percent increase in wholesale gas supply between 1977 and 2000.[3]

The evaluation was carried out separately for each potential policy in terms of each evaluation criterion and each alternative future energy scenario. It is important to note that the extent to which the results

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[2] Project Independence Evaluation System Documentation, Vol. 14, Federal Energy Administration, Washington, D.C., 1977.

[3] Full description of the energy scenarios is presented in Chapter 3 of Volume II.

Table 5-1 Definitions of Project Independence Energy Scenarios

Scenario	Macroeconomic Forecast*	Energy Demand	Energy Supply	World Oil Price
MRTSF	TRENDLONG	MEDIUM	MEDIUM	INCREASING
MRTSC	TRENDLONG	MEDIUM	MEDIUM	CONSTANT
HRCSA	CEASPIRIT	HIGH	HIGH	CONSTANT
HRCSD	CYCLELONG	LOW	HIGH	CONSTANT
LRCSE	CYCLELONG	LOW	LOW	CONSTANT
LRCSB	CEASPIRIT	HIGH	LOW	CONSTANT

* The macroeconomic trends named below refer to forecasts made on the basis of Data Resources, Inc., forecasting model of the U.S. economy.

indicate differences in achievement of the various regulatory objectives is a function of differences in policies and scenarios only. No other exogenous forces were permitted to influence the results. Differences in the achievement of objectives by policies cannot be attributed to changes in the behavior of the EOGC or the PUCO. For example, the model assumes that the cost of doing business will expand at an average historic rate as new services are offered by the EOGC. Should new hook-ups lead the company to incur reduced or increased operating costs, the model does not take such possibility into account. Similarly, the model does not take into account changes in the decision-making process of the PUCO.

New Service Policies and Utility Finances

Two extreme arguments are typically made concerning the impact of new service policies on utility finances. The utilities argue that lack of new hook-ups coupled with rising costs, leads to incessant income deficits, rising prices to consumers, and losses to investors. Consumers argue that indiscriminate hook-ups lead to company overexpansion that results in a need for financing through higher rates. Both groups agree that the choice of a wrong policy may lead to noncompetitive gas prices. It is the purpose of this section to describe the potential impacts of new service policies on various aspects of utility finances.

Perhaps the most telling indicator of the overall impact of hook-up policies on utility finances is the return on total assets ratio. It is indicative of the effects of new service policies on all the major aspects of managing a gas distribution utility - i.e., profit margin, and asset and financial management. Since the simulation model did not explicitly investigate the capital structure of the utility, several approximations have been used to evaluate the impact of new service policies on profit margins, asset and financial management (see Chapter 8, Vol. II). Profit margins and asset turnover ratios were estimated based on actual simulation results. As an indicator of the latter two the average return on total assets was calculated for each policy and each scenario. Generally, the ratio is used to measure dollars of company's sales per dollar of investment. In the EOGC analysis sales were defined as gas revenues and other operating revenues. While average net plant in service served as a proxy for total company assets throughout the financial analysis, resulting in inflated estimates of return on total assets and return on common equity.

Table 5-2 contains the results for this indicator. It is important to note that this general indicator does not yield unequivocal results.

Table 5 - 2 Average Annual Return on Total Asset Ratio, by Policy and Energy Scenario, Based on Simulations for the Period 1978-2000.*

Energy Scenario	New Service Policies			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	0.10949	0.11116	0.11050	0.10929
MRTSC	0.17535	0.17312	0.17596	0.17545
HRCSA	0.17168	0.17215	0.17330	0.17249
HRCSD	0.16815	0.16882	0.16959	0.16895
LRCSE	0.17758	0.17758	0.17758	0.17758
LRCSB	0.17883	0.17883	0.17883	0.17883
EOGCS	0.11103	0.11787	0.11603	0.11180

* The various energy scenarios and new service policies were described above. Fuller descriptions are to be found in Volume II.

Examination of Table 5-2 reveals that the choice of the preferred policy based on this index depends crucially on the choice of energy scenario. If the assumption is made that the EOGC forecast is the most likely, than the "company initiative" policy yields the best results in terms of this index. If, on the other hand, it is assumed that one of the other energy scenarios is more likely, then other policies emerge with better scores in terms of this ratio. This is because the larger the score in terms of this ratio the more productive is each dollar of investment in generating revenues.

The reasons for these results are not difficult to identify. First, alternate energy scenarios imply different constraints on doing business and the associated costs. Lack of adequate supply limits sales in general and new hook-ups in particular. In terms of a particular new service policy, however, investments remain by-and-large unchanged. In general, gas availability characteristics determine the cost of doing business such as that associated with gas storage operations. At the same time higher gas prices affect both the cost of providing gas and gas revenues. Second, the alternate policies imply different investments and profit margins and thus affect the return on total assets ratio.

Similar reasoning can be used to understand the much more general indicator, the return on common equity index. As can be seen from Table 5-3 various policies emerge as superior depending on the energy scenario considered.[4] In order to better understand the financial implications of the various energy scenarios and new service policies it is necessary to examine other financial indicators that will permit a more focused view of the different aspects of a utility's finances.

From the common shareholder's point of view the most telling indicators are the gross and net profit margin ratios. The ratios measure profits before and after taxes per dollar of sales, respectively.

[4] It is important to note that the return on common equity ratio includes other operating revenues as part of utilities' returns and that net plant in service is used as a proxy for common equity. As a result the figures contained in Table 5-2 seem inflated. They are useful, nevertheless, for cross-policy comparisons.

Table 5-3 Average Annual Return on Common Equity Ratio, by Policy and Energy Scenario, Based on Simulations for the Period 1978-2000.*

Energy Scenario	New Service Policies			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	0.23487	0.22639	0.23277	0.23131
MRTSC	0.40582	0.39683	0.40657	0.40549
HRCSA	0.40167	0.39460	0.40187	0.40055
HRCSD	0.39359	0.38572	0.39435	0.39260
LRCSE	0.40862	0.40862	0.40862	0.40862
LRCSB	0.41198	0.41198	0.41198	0.41198
EOGCS	0.23727	0.66498	0.22920	0.21653

* The various energy scenarios and new service policies were described above. Fuller descriptions are to be found in Volume II.

Tables 5-4 and 5-5 present estimates of these ratios. A striking fact that emerges from examination of these tables is that the choice of the preferred policy from the shareholder's point of view is made very easy. No matter which energy scenario is considered, the company initiative policy yields the highest estimates for both ratios. Comparison of results generated by this policy under alternate energy scenarios leads to the conclusion that the success of this policy does not depend upon the extent to which there exists an excess gas supply. The choice of company intiative policy as a means to the achievement of shareholders' interest is supported further by consideration of the impact of the various policies on the interest coverage ratio. As is evidenced by Table 5-6, the highest estimates of this ratio are associated with the company initiative policy.

A different conclusion emerges from the consideration of total asset turnover ratio. It is considered the best indicator of the use of total assets employed by the company. Table 5-7 reveals that no matter which energy scenario is considered the policy that fovors the continuation of the present ban on new service leads to the highest estimates of this ratio. This is not difficult to explain in light of the fact the ratio measures

Table 5-4 Average Annual Gross Profit Margin Ratio, by Policy and Energy Scenario, Based on Simulations for the Period 1978-2000.*

Energy Scenario	New Service Policies			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	0.11260	0.11620	0.11503	0.11329
MRTSC	0.12966	0.13337	0.13177	0.13080
HRCSA	0.12861	0.13630	0.13311	0.13047
HRCSD	0.12865	0.13628	0.13320	0.13051
LRCSE	0.12877	0.12877	0.12877	0.12877
LRCSB	0.12823	0.12823	0.12823	0.12823
EOGCS	0.11223	0.12344	0.11995	0.11418

Table 5-5. Average Annual Net Profit Margin Ratio, by Policy and Energy Scenario, Based on Simulations for the Period 1978-2000.*

Energy Scenario	New Service Policies			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	0.04422	0.04539	0.04506	0.04439
MRTSC	0.07741	0.07828	0.07811	0.07769
HRCSA	0.07521	0.07822	0.07718	0.07586
HRCSD	0.07378	0.07683	0.07558	0.07438
LRCSE	0.08763	0.08763	0.08763	0.08763
LRCSB	0.08660	0.08660	0.08660	0.08660
EOGCS	0.04352	0.04917	0.04749	0.04433

* The various energy scenarios and new service policies were described above. Fuller descriptions are to be found in Volume II.

Table 5-6 Average Annual Interest Coverage Ratio, by Policy and Energy Scenario, Based on Simulations for the Period 1978-2000.*

Energy Scenario	New Service Policies			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	8.74862	9.07031	8.96305	8.81314
MRTSC	8.83214	9.11128	8.99123	8.92315
HRCSA	8.82573	9.37464	0.15276	8.97799
HRCSD	8.82890	9.37035	9.15674	8.98209
LRCSE	8.00984	8.00984	8.00984	8.00984
LRCSB	8.06929	8.06929	8.06924	8.06929
EOGCS	8.74250	9.55425	9.30200	8.90231

Table 5-7 Average Annual Total Asset Turnover Ratio, and Energy Scenario, Based on Simulations for the Period 1978-2000.

Energy Scenario*	New Service Policies**			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	2.72499	2.68352	2.69627	2.71712
MRTSC	2.27919	2.24940	2.26324	2.27200
HRCSA	2.30403	2.22764	2.25996	2.28922
HRCSD	2.31069	2.23039	2.26554	2.29551
LRCSE	2.04647	2.04647	2.04647	2.04647
LRCSB	2.07183	2.07183	2.07183	2.07183
EOGCS	2.73682	2.57757	2.62630	2.71048

* The various energy scenarios and new service policies were described above. Fuller descriptions are to be found in Volume II.

value of sales per dollar of net plant in service. The results indicate that the growth in sales that is associated with all policies, except the no new service policy, is not sufficient. The resulting sales do not grow sufficiently to improve the ratio of sales to net plant in service. Although no detailed study has been conducted to ascertain the reason for this finding, it is reasonable to assume that the resulting gap in the value of sales is due to the non-competitive price at which gas would have to be offered. As rate base increases are translated into higher prices the model's forecasts indicate that gas consumption will not grow sufficiently to generate high total asset turnover ratio.

Table 5-8 contains estimates of the average annual percentage changes in the company's rate base that are necessitated by the various policies under alternate energy scenarios. Although the highest increases are associated with the company initiative policy and the lowest with the no new service policy, the striking feature of the results is the small range of values between the highest and lowest increase. While the highest increase is estimated to be 2.85 percent the lowest increase is only 2.04 percent.[5] In light of the discussion of total asset turnover ratio estimates this is an interesting finding. The most likely explanation of this result is that no matter which energy scenario is considered the extent of the excess supply of gas that emerges does not permit vast numbers of customers to be hooked-up. Furthermore, because of the prescribed order in which customers are to be connected the limited excess supply of gas meant that the majority of the newly connected customers would be located within the currently served areas requiring only small additions to the company's plant.

It is noteworthy, however, that no consideration was given in this model to the possible need for additions to the company's gas storage plant. Such plant additions would have resulted in different estimates of percentage changes in plant, as well as different estimates of curtailments associated with the various policies and energy scenarios.

The results in terms of the impact of new service policies on company finances seem to be somewhat contradictory. In the absense of a reliable estimate of the probability with which each energy scenario can be expected to occur, this probability is considered to be the same for

[5]The implications of this for ratepayers are analyzed below.

Table 5-8 Average Annual Percentage Change in Rate Base, by Policy and Energy Scenario Based on Simulations for the Period 1978-2000.*

Energy Scenario	New Service Policies			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	0.02039	0.02350	0.02247	0.02098
MRTSC	0.02039	0.02355	0.02219	0.02136
HRCSA	0.02039	0.02614	0.02382	0.02196
HRCSD	0.02039	0.02608	0.02377	0.02196
LRCSE	0.02039	0.02039	0.02039	0.02039
LRCSB	0.02039	0.02039	0.02039	0.02039
EOGCS	0.02039	0.02857	0.02597	0.02192

* The various energy scenarios and new service policies were described above. Fuller descriptions are to be found in Volume II.

all scenarios. In order to reduce the number of alternatives that need to be considered the various scenarios were assigned to three groups based on similarity of forecasted energy prices and quantities.[6] Thus, group A consists of scenarios MRTSF and EOGCS, group B consists of scenarios MRTSC, HRCSA and HRCSD, while group C is composed of scenarios LRCSE and LRCSB.

The rankings of the policies in terms of the various indicators under group A are presented in Table 5-9. Clearly there is no one policy that has the most desirable impacts under all the scenarios and in terms of all the criteria. For group B similarly calculated results are presented in Table 5-10. Since values of all the financial indicators were the same no matter which policy was considered under the assumptions of group C, no results are presented.

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[6] A full description of the various energy scenarios is to be found in Chapter 3 of Volume II.

Table 5-9. Policy Rankings by Policy and Financial Indicator Under the Assumptions of Group A.

Financial Indicator	New Service Policies			
	No New Service Policy	Company Initiative	Selected Residential Only	Industrial Only
TATR	1	2	3	2
RTAR	4	1	2	3
ROCER	1	4	2	3
NPMP	4	1	2	3
GPMR	4	1	2	3
INTCOV	4	1	2	3
IRBC	1	4	3	2

Table 5-10 Policy Rankings by Policy and Financial Indicator Under the Assumptions of Group B.

Financial Indicator	New Service Policies			
	No New Service Policy	Company Initiative	Selected Residential Only	Industrial Only
TATR	1	4	3	2
RTAR	4	3	1	2
ROCER	2	4	1	3
NPMR	4	1	2	3
GPMR	4	1	2	3
INTCOV	4	1	2	3
IRBC	1	4	3	2

In order to obtain a weighted average evaluation of the policies each policy was weighted by 1 in case it was the best policy, by .66 in case it was the second best policy, by .33 in case it was the second worst policy and by 0 in case it was the worst policy. Using these arbitrary weights, the weighted average was calculated as $\sum_i P_i W_i$, where P_i is the occurence of the policy as best, second best, etc. The results of these calculations for groups A and B are presented in Table 5-11.

Table 5-11 The Weighted Rankings of Policies Under Groups A and B

Policy	Weighted Average Rankings	
	Under Group A	Under Group B
No New Service Policy	0.43	0.38
Company Initiative	0.57	0.48
Selected Residential Only	0.56	0.67
Industrial Only	0.40	0.47

Based on the assumptions implicit in the above calculations and financial impacts alone, the choice of the preferred policy is relatively easy. If energy scenarios comprising group A are considered, the company initiative policy emerges superior, although the selected residential policy is almost indistinguishable from it. If energy scenarios comprising group B are considered, the selected residential policy is deemed preferred, with no policy coming close to it in terms of the financial impacts. It is noteworthy, however, that no analysis was carried out to examine how harmful would be the choice of the alternative policies if their implementation deviated from the implementation process selected.

New Service Policies and The Consumers

From the consumers' point of view two aspects of new service policies are of interest: the impact of policies on the quality of service and their impact on customers' bills. Since the Btu content of natural gas does not vary to a great extent, quality of service is most often understood in terms of gas flow interruptions. Policies' impact on customers' bills, on the other hand, is typically evaluated in terms of the resulting relative burdens and customers' ability to pay.

It is significant to note that in terms of quality of service there is no policy that does not lead to the necessity of curtailments. The extent to which curtailments are made necessary varies greatly depending on the policy and scenarios considered. Tables 5-12, 5-13, and 5-14 contain estimates of the average number of months in a year with industrial, commercial, and residential curtailments, respectively.

In terms of industrial customers the need for curtailments is almost universal. The only exception occurs under the EOGC assumption concerning energy supply. Under the other energy supply assumptions, the company initiative policy, quite naturally, leads to the most extensive curtailments, while the no new service policy results in minimal curtailments. In terms of commercial customers the results are more varied. The company initiative policy results in curtailments under all but the EOGC supply forecasts, while the other policies result in no commercial curtailments under several other energy scenarios. In terms of residential customers the results are unambiguous. No policy results in curtailments except under energy scenarios LRCSE and LRCSB, under which no new hook-ups are authorized. The need for universal curtailments when these two scenarios are assumed is not surprising. As is evident from Table 5-15 the natural gas supplies implicit in these scenarios are such that there is no year of the simulation period, during which the average historic demand can be fully satisfied. And thus, according to the assumptions of the capacity expansion sub-model this situation does not permit new hook-ups and so there is no distinction between the various policies.

Table 5-12 Average Number of Months per Year with Industrial Curtailments, by Policy and Energy Scenario, Based on Simulations for the Period 1978-2000.*

Energy Scenario	New Service Policies			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	0.52174	0.73913	0.65217	0.60870
MRTSC	0.82609	0.95652	0.86957	0.86957
HRCSA	0.26087	0.52174	0.30435	0.26087
HRCSD	0.30435	0.65217	0.34783	0.30435
LRCSE	4.08695	4.08695	4.08695	4.08695
LRCSB	3.73913	3.73913	3.73913	3.73913
EOGCS	0.00000	0.00000	0.00000	0.00000

Table 5-13 Average Number of Months per Year with Commercial Curtailments, by Policy and Energy Scenario, Based on Simulations for the Period 1978-2000.*

Energy Scenario	New Service Policies			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	0.00000	0.04348	0.04348	0.00000
MRTSC	0.04348	0.04348	0.04348	0.04348
HRCSA	0.00000	0.04348	0.00000	0.00000
HRCSD	0.00000	0.04348	0.00000	0.00000
LRCSE	1.65217	1.65217	1.65217	1.65217
LRCSB	1.34783	1.34783	1.34783	1.34783
EOGCS	0.00000	0.00000	0.00000	0.00000

* The various energy scenarios and new service policies were described above. Fuller descriptions are to be found in Volume II.

Table 5 -14 Average Number of Months per Year with Residential Curtailments, by Policy and Energy Scenario, Based on Simulations for the Period 1978-2000.*

Energy Scenario	New Service Policies			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	0.00000	0.00000	0.00000	0.00000
MRTSC	0.00000	0.00000	0.00000	0.00000
HRCSA	0.00000	0.00000	0.00000	0.00000
HRCSD	0.00000	0.00000	0.00000	0.00000
LRCSE	0.39130	0.39130	0.39130	0.39130
LRCSB	0.34783	0.34783	0.34783	0.34783
EOGCS	0.00000	0.00000	0.00000	0.00000

Table 5 -15 Average Annual Excess Demand Frequency Index, by Policy and Energy Scenario, Based on Simulations for the Period 1978-2000.*

Energy Scenario	New Service Policies			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	0.30435	0.30435	0.30435	0.30435
MRTSC	0.34783	0.34783	0.34783	0.34783
HRCSA	0.17391	0.17391	0.17391	0.17391
HRCSD	0.17391	0.17391	0.17391	0.17391
LRCSE	1.00000	1.00000	1.00000	1.00000
LRCSB	1.00000	1.00000	1.00000	1.00000
EOGCS	0.00000	0.00000	0.00000	0.00000

* The various energy scenarios and new service policies were described above. Fuller descriptions are to be found in Volume II.

The impact of the new service policies on customers' bills was studied with the help of forecasts of the absolute frequency with which the annual reviews of rates would lead to rate increases, beyond those necessitated by wholesale price changes, and with the help of forecasts of average annual change in projected retail price by customer class. The results are presented in Tables 5-16 and 5-17, respectively.

Consideration of these results reveals that in terms of average annual change in retail gas prices the differences among energy scenarios are greater than the differences among new service policies. Although this may seem peculiar this result is easily explained. First, differences among energy scenarios are primarily due to great differences in wholesale prices. Secondly, the differences among policies are slight because the cost of the increased capacity associated with new hook-ups is spread over greater quantities of gas sold. This interpretation is further corroborated by reference to the rate increase frequency index. It is important to note that this index does not take into account rate increases made necessary by wholesale price increases, and therefore, that the frequency of need for additional revenues is lesser under the company initiative policy.

The impact of the alternative policies on customers in terms of natural gas bills can be considered neutral. In terms of service quality, however, the results are difficult to interpret. Since the impact of curtailing a customer is dependent upon the frequency, duration, and time of the curtailment, as well as the use to which gas is put, in the absence of a calculation that assigns monetary values to the curtailments a very imprecise conclusion emerges: the frequency and extent of curtailments is inversely related to the extent of new hook-ups.

Finally, the various new service policies were analyzed from the point of view of relative energy prices and the implicit subsidies that may be denied to some deserving customers. It is reasonable to assume that as long as natural gas price is below the price of a competing fuel a policy that denies gas to a customer is less "fair" than a policy that permits customers to hook-up to the system. Tables 5-18, 5-19 and 5-20 contain estimates of the retail prices of electricity and oil in the case of residential customers, and coal for industrial customers, per equivalent Btu.

Table 5-16 Forecasted Absolute Frequency of Rate Increases, by Policy and Energy Scenario, Based on Simulations for the Period 1978-2000.*

Energy Scenario	New Service Policies			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	14	14	14	14
MRTSC	14	13	13	13
HRCSA	15	12	15	15
HRCSD	15	13	13	15
LRCSE	19	19	19	19
LRCSB	18	18	18	18
EOGCS	14	14	14	15

Table 5-17 Average Annual Change in Projected Natural Gas Price by Policy and Energy Scenario, for Residential Customers Based on Simulations for the Period 1978-2000 ($/MMBTU)*

Energy Scenario	New Service Policies			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	0.260	0.259	0.259	0.260
MRTSC	0.151	0.150	0.150	0.150
HRCSA	0.156	0.154	0.154	0.155
HRCSD	0.163	0.162	0.162	0.162
LRCSE	0.167	0.167	0.167	0.167
LRCSB	0.163	0.163	0.163	0.163
EOGCS	0.263	0.258	0.259	0.262

* The various energy scenarios and new service policies were described above. Fuller descriptions are to be found in Volume II.

Table 5-18 Average Residential Price of Natural Gas as a Percentage of Retail Price of Electricity, by Policy and Energy Scenario Based on Simulations for the Period 1978-2000.*

Energy Scenario	New Service Policies			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	36.2	36.2	36.2	36.2
MRTSC	26.2	26.2	26.2	26.2
HRCSA	26.5	26.4	26.4	26.4
HRCSD	27.3	27.2	27.2	27.3
LRCSE	27.9	27.9	27.9	27.9
LRCSB	26.9	26.9	26.9	26.9
EOGCS	36.2	36.1	36.1	36.2

Table 5-19 Average Residential Price of Natural Gas as a Percentage of Retail Price of Oil, by Policy and Energy Scenario Based on Simulations for the Period 1978-2000.*

Energy Scenario	New Service Policies			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	86.2	86.0	86.1	86.1
MRTSC	92.1	92.0	92.0	92.1
HRCSA	94.8	94.6	94.6	94.7
HRCSD	97.2	97.0	96.9	97.1
LRCSE	96.5	96.5	96.5	96.5
LRCSB	93.7	93.7	93.7	93.7
EOGCS	86.1	85.8	85.8	86.0

* The various energy scenarios and new service policies were described above. Fuller descriptions are to be found in Volume II.

Table 5-20 Average Industrial Price of Natural Gas As A Perdentage Of The Retail Price of Coal, By Policy and Energy Scenario Based On Simulations For The Period 1978-2000*

Energy Scenario	New Service Policies			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	236.9	236.5	236.6	236.9
MRTSC	194.8	194.5	194.6	194.7
HRCSA	193.8	193.3	193.3	193.6
HRCSD	196.7	196.3	196.2	196.5
LRCSE	207.2	207.2	207.2	207.2
LRCSB	203.3	203.3	203.3	203.3
EOGCS	236.7	235.8	235.9	236.6

* The various energy scenarios and new service policies were described above. Fuller descriptions are to be found in Volume II.

Several conclusions can be reached on the basis of these results. First, irrespective of the energy scenario considered the possibility of consuming natural gas does represent a price break to residential energy consumers. In some cases natural gas price may represent as little as 26.2 percent of the price of electricity and 85.8 percent of the price of oil. Secondly, new service policies affect relative energy prices. The more customers are permitted to hook-up the lower the resulting price of gas will be in relation to other fuels.[7] In some sense a partial new service policy is less fair from the point-of-view of customers who cannot hook-up to the system than an universal ban on new service. Thirdly, from the industrial customers' point of view, natural gas is forecasted to cease to hold a competitive edge on other fuels before the year 2000. On the average, when the entire simulation period is considered, the natural gas price is at least 193.3 percent of the price of coal. Indeed, the price of gas becomes so high relative to other fuel prices for industrial customers that industrial consumption of natural gas is forecasted to be limited to feedstocks only. (For results, see Appendix K in Volume III).

Based on the consideration of impacts on customers alone, two major conclusions emerge concerning new service policies. Curtailments increase as new hook-ups decrease and industrial hook-ups are forecasted to last for a few years only, since in the future industrial energy users will not consume natural gas.

New Service Policies and Economic Efficiency

Two aspects of economic efficiency were taken into account in an attempt to analyze the repercussions of new service policies. Calculations of end-use efficiency were performed to estimate the extent to which new service policies result in the allocation of gas to those consumers who value it the most. Calculations of production efficiency were performed to analyze the extent to which new service policies encourage or discourage wasteful production. The impacts of the new service policies on overall economic efficiency were estimated by reference to the sum of end-use and production efficiency.

[7] The addition of customers does not affect aggregate demand for gas in the U.S. so a to change the price of gas. The forecasted change would be due to the spreading of changes in rate base among a greater number of customers.

Table 5-21 contains estimates of end-use efficiency associated with various policies under various energy scenarios. Several aspects of these results are noteworthy. First, the almost universal presence of negative values in Table 5-21 is due to the fact that under most energy scenarios and under most new service policies the value of unsatisfied demand for natural gas exceeds the value of the satisfied demand. Thus, while the volume of the satisfied demand may exceed the volume of the unsatisfied demand, its value, measured in terms of consumers' willingness-to-pay for gas, may not. Secondly, the company initiative policy leads to the highest estimates of end-use efficiency. This is not surprising because this policy consists of the provision of new service to the greatest number of new customers and, thus, the elimination of the greatest amount of unsatisfied demand. Thirdly, in the absence of the company initiative policy, the selected residential policy leads to highest end-use efficiency followed by the industrial only and, finally, the no new service policies. Implicit in this order is the fact that residential customers value gas more than industrial customers. This is primarily due to the ready availability of coal to many industrial customers at competitive prices.

Table 5-22 contains estimates of production efficiency associated with the new service policies under various energy scenarios. The results, in terms of the desirability of the new service policies, are almost identical to those associated with end-use efficiency. A potential implication of these results is that at least in the context of the new service policies considered, increasing sales generate more revenues than costs. This is due to the fact that the aggregate demand for gas is sufficiently inelastic so that as the price of gas is raised revenues do not decline. It is important to note that the information available is not sufficient to judge the economies of scale in the distribution of natural gas.[8] From production efficiency point-of-view the results could be different if a policy of full new service outside the currently served areas were considered.

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[8] These statements are not a contradiction to the explanation of total assets turnover ratio estimates.

Table 5-21 Present Value of Aggregate End Use Efficiency, by Policy and Energy Scenario, Based on Simulations for the Period 1978-2000 ($).*

Energy Scenario	New Service Policies			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	-1,039,022,080	-647,378,432	-722,427,392	-993,706,752
MRTSC	-1,028,616,700	-761,248,000	-830,892,800	-966,765,824
HRCSA	-1,028,020,740	-151,624,880	-403,337,728	-851,245,312
HRCSD	-1,030,512,640	-148,733,744	-406,049,792	-848,013,568
LRCSE	-988,881,536	-998,881,536	-998,881,536	-998,881,536
LRCSB	-1,017,921,020	-1,017,921,020	-1,017,921,020	-1,017,921,020
EOGCS	-1,038,089,980	1,039,731,970	-583,605,504	-757,539,584

Table 5-22 Present Value of Aggregate Production Efficiency, by Policy and Energy Scenario, Based on Simulations for the Period 1978-2000 ($).*

Energy Scenario	New Service Policies			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	200,008,480	208,457,248	205,874,832	201,432,240
MRTSC	326,045,184	334,999,808	331,682,560	328,875,262
HRCSA	319,894,784	347,521,024	336,839,424	326,314,496
HRCSD	316,429,824	343,438,592	333,272,576	322,777,600
LRCSE	329,603,072	329,603,072	329,603,072	329,603,072
LRCSB	330,427,648	330,427,648	330,427,648	330,427,648
EOGCS	197,334,992	245,034,304	230,086,688	204,485,792

* The various energy scenarios and new service policies were described above. Fuller descriptions are to be found in Volume II.

Table 5-23 contains estimates of aggregate economic efficiency associated with the new service policies and the various energy scenarios. Aggregate economic efficiency consists of the sum of end-use efficiency and production efficiency. In light of results contained in Tables 5-21 and 5-22, the estimates in Table 5-23 are not surprising. Considering each energy scenario in isolation, the company initiative policy yields the highest economic efficiency index followed by the selected residential policy. Comparison of the alternate energy scenarios yields a variety of results. It is fairly certain, however, that higher forecasts of gas supply and policies that lead to most hook-ups generate the best results in terms of economic efficiency.

Synthesis of Results

Based on the results described above Table 5-24 contains a summary of policies ranked in terms of the desirability of their impacts on utility finances, on customers, and on net aggregate economic efficiency. These

Table 5-23 Present Value of Aggregate Economic Efficiency, by Policy and Energy Scenario, Based on Simulation for the Period 1978-2000 ($).*

Energy Scenario	New Service Policies			
	No New Service	Company Initiative	Selected Residential Only	Industrial Only
MRTSF	-839,013,376	-438,920,960	-516,552,448	-792,274,432
MRTSC	-702,571,520	-426,248,192	-499,210,240	-637,890,560
HRCSA	-708,125,952	195,896,144	-66,498,304	-524,930,816
HRCSD	-714,082,816	194,704,848	-72,777,216	-525,235,968
LRCSE	-669,278,464	-669,278,464	-669,278,464	-669,278,464
LRCSB	-687,493,376	-687,493,376	-687,493,376	-687,493,376
EOGCS	-840,754,944	-1,284,766,210	813,692,160	-553,053,691

* The various energy scenarios and new service policies were described above. Fuller descriptions are to be found in Volume II.

results are based on averages of annual impacts only. No reference is made to the time incidence of the impacts. Nor is there reference to the best or worst results.

Table 5-24 Policy Rankings by Type of Impact Based on Simulations for the Period 1978-2000.*

Policy	Impact on Utility Finances	Impact on Customers	Impact on Net Aggregate Efficiency
No New Service Policy	3	1	4
Company Initiative Policy	2	4	1
Selected Residential Policy	1	2	2
Industrial Only Policy	3	3	3

Yet, even the limited information contained in Table 5-24 is too rich to yield an objective and unambiguous choice of the preferred policy. All policies, except the industrial only policy, emerge as the preferred policy in terms of at least one of the impact criteria used in this study. Two of the policies considered emerge as second best policies. Thus, concern for company finances alone would lead the decision-maker to choose the selected residential policy as a guide for new service offering by Ohio's gas distribution companies. Concern for customers alone would lead the same decision-maker to prefer the current ban as the preferred policy. Concern for economic efficiency, on the other hand, would lead the decision-maker to select the selected residential policy. The choice of the preferred policy depends on the relative importance, in the form of weights, that decision-makers attach to the decision criteria.

Finally, although no full-scale attempt has been made to select the preferred policy under various assumptions concerning the relative importance of the decision criteria, an examination of results during each year of the simulation period leads to the conclusion that in some cases the selected residential policy is clearly preferred. In other cases, where the policy is not ranked as the preferred policy, it is almost indistinguishable from the preferred policy. Overall, it is ranked as the best policy in terms of impacts on utility finances and second best in terms of impacts on customers and on economic efficiency.

CHAPTER 6

POLICY CONCLUSIONS

There is a great number of potential new service policies that could have been subjected to evaluation in this study. Generally potential new service policies can be defined in terms of (a) the type of customer to receive new service, (b) the location of the customer in relation to the existing distribution system, and (c) the contractual arrangement under which the new service is to be provided. The potential of introducing combined policies in terms of the above categories and the differentiation of policies in terms of time of implementation increases vastly the number of policies that need to be analyzed. Not all such policies were in fact studied.

Yet, the mere existence of a multitude of potential policies serves to emphasize that the choice of the preferred policy must be based on its capacity to satisfy regulatory objectives. With the exception of the end-use efficiency and fairness objectives, the criteria used in the policy evaluation are traditional and standard. Thus, the impact of new service policies on the utilities' finances was evaluated with the help of such standard financial indicators as (a) total asset turnover ratio, (b) net profit margin ratio, (c) gross profit margin ratio, (d) return on total assets ratio, (e) return on common equity ratio, and (f) interest coverage ratio. The extent to which the acequacy of service is affected by these policies was assessed with the help of average annual excess demand indexes. In addition, monthly curtailment indexes were calculated for each customer class.

Due to time and budget limitations only representative new service policies were studied under alternative assumptions concerning future conditions, especially those related to the availability of various types of energy and associated prices. In particular, four policies were analyzed under seven energy scenarios. The four policies are:

1. No New Service Policy - the present ban is continued;
2. Company Initiative Policy - this policy permits the company to provide new service within the supply limits and in a particular

order of customer classes. Residential, commercial, and industrial customers within the currently served areas are hooked-up in sequence, followed by residential customers outside the currently served areas;

3. Selected Residential Service - only residential customers within the currently served areas are hooked-up;
4. Industrial Service - only industrial customers within the currently served areas are connected.

The analysis of these policies was carried out with the regulatory simulation model that was developed for this purpose. The results were obtained by applying the model to the East Ohio Gas Company (EOGC). It is important to note that the extent to which the results indicate differences in achievement of the various regulatory objectives is a function of differences in policies and scenarios only. No other exogenous forces were permitted to influence the results. Differences in the achievement of objectives by policies cannot be attributed to changes in the behavior of the EOGC or the PUCO. For example, the model assumes that the cost of doing business will expand at an average historic rate as new services are offered by the EOGC. Should new hook-ups lead the company to incur reduced or increasing operating costs, the model does not take such possibility into account. Similarly, the model does not take into account changes in the operations of the PUCO.

Based on the results fully described in Chapter 5 Table 6-1 contains a summary of policies ranked in terms of the desirability of their impacts on utility finances, on customers, and on net aggregate economic efficiency as calculated for the EOGC's service area. These results are based on averages of annual impacts only. No reference is made to the time incidence of the impacts.

Table 6-1 Policy Rankings by Type of Impact Based on Simulations for the Period 1978-2000

Policy	Rankings in Terms of		
	Impact on Utility Finances	Impact on Customers	Impact on Net Aggregate Efficiency
No New Service Policy	3	1	4
Company Initiative Policy	2	4	1
Selected Residential Policy	1	2	2
Industrial Only Policy	3	3	3

Yet, even the limited information contained in Table 6-1 is too rich to yield an objective and unambiguous choice of the preferred policy. All policies, except the industrial only policy, emerge as the preferred policy in terms of at least one of the impact criteria used in this study. Two of the policies considered emerge as second best policies. Thus, concern for the company finances alone would lead the decision-maker to choose the selected residential policy as a guide for new service offering by Ohio's gas distribution companies. Concern for customers alone would lead the same decision-maker to prefer the current ban as the preferred policy. Concern for economic efficiency, on the other hand, would lead the decision-maker to select the selected residential policy. The choice of the preferred policy depends on the relative importance, in the form of weights, that decision-makers attach to the decision criteria.

No full-scale attempt has been made to select the preferred policy under various assumptions concerning the relative importance of the decision criteria. An examination of the results reveals, however, that in some cases the selected residential policy is clearly preferred. In other cases, where the policy is not ranked as the preferred policy, it is almost indistinguishable from the preferred policy. Overall, it is ranked as the best policy in terms of impacts on utility finances and second best in terms of impacts on customers and on economic efficiency.

Finally, these results are valid for the EOGC only. Generalizations based on these results may be subject to errors due to circumstances that could be unique to the EOGC service area. The determination of precise new service policies for other companies could benefit from a similar analysis with the regulatory simulation model.

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