

NATURAL GAS PRICING PROPOSALS:
A COMPARATIVE ANALYSIS

PRINTED AT THE REQUEST OF
HENRY M. JACKSON, *Chairman*
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MEMORANDUM OF THE CHAIRMAN

To Members of the Senate Committee on Energy and Natural Resources:

"Natural Gas Pricing Proposals: A Comparative Analysis" was prepared by the Congressional Budget Office at my request for use by Members of the Senate during the upcoming debate on natural gas price policy.

The study is a comprehensive analysis of one of the most difficult public policy issues facing us today. In 1954 the United States Supreme Court ruled that the Natural Gas Act required the Federal Power Commission to regulate the wellhead price of natural gas dedicated to interstate commerce. Ever since that time, natural gas price policy legislation has been an active issue before the Congress. In spite of the prolonged debate and discussion during this 23 year old controversy, no substantial modification of the Natural Gas Act has been enacted.

Natural gas is the fuel which makes the largest domestic contribution to United States energy consumption. Domestic production of the fuel peaked in 1973 and production decreases since that time have resulted in producers being unable to meet their supply contracts. Last winter's massive curtailments resulted in losses to the economy totaling millions of dollars.

The decision Congress makes this year on gas prices will have an impact for years to come. It is imperative that it be a thoughtful judgment based upon sound economic analysis of the options available to us.

The Congressional Budget Office provides an independent, objective analysis of several natural gas pricing proposals. The Committee is grateful for the continuing assistance of the Congressional Budget Office in providing objective analysis of important policy issues.

HENRY M. JACKSON,
Chairman.

PREFACE

One of the major issues of a national energy policy to be addressed by the 95th Congress is the pricing policy for natural gas. Because natural gas is one of the most valuable energy resources available, this issue affects virtually every household and business in the United States.

Natural Gas Pricing Proposals was prepared at the request of the Senate Committee on Energy and Natural Resources. It was written by Lawrence Oppenheimer under the supervision of Raymond C. Scheppach and Richard D. Morgenstern of CBO's Division of Natural Resources and Commerce. The manuscript was prepared for publication under the supervision of Johanna Zacharias. Special thanks go to Angela Z. Evans for her skill and patience in typing the many drafts.

In keeping with CBO's mandate to provide objective analysis, the paper offers no recommendations.

Alice M. Rivlin
Director

September 1977

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(IX)

NOTE

All years referred to in this report are calendar years. All prices are presented in 1977 dollars.

(X)

SUMMARY

Various amendments to the Natural Gas Act of 1938 have been proposed to alter current pricing policies. The primary reason for concern is that current policies have led to shortages of gas in the interstate market during the winter heating season. Most forecasts agree that future shortages will be increasingly serious if measures are not taken.

Many proposed remedies attempt to increase domestic production of natural gas and permit reallocation of supplies of gas toward interstate and residential consumers. At issue are how much domestic production can be increased and what the consequent cost to consumers would be. If production responses are small relative to the cost, then regulation and careful allocation of this scarce resource might be necessary.

Among experts there is basic disagreement about future production, and some proposed remedies, such as immediate deregulation, are, in essence, a gamble of considerable consumer expenditures on the expectation of increased future production.

This paper concludes that the size of consumer expenditures at risk under deregulation is large and that the likelihood that increased production will be substantial by 1985 is small. If these findings are right, then the question of natural gas deregulation becomes primarily one of income distribution and, to a lesser extent, one of reducing and reallocating the demand for natural gas in response to higher prices. With regard to income distribution, deregulation would transfer large amounts of money from consumers to producers. Thus a value judgment is necessary regarding whether national goals are better served by the income remaining with consumers or being passed to producers. The money received by producers would flow to government in the form of taxes, to stockholders, and/or be retained and, subsequently reinvested.

Although the expected higher cost to consumers, as well as the lack of substantial production, arouses considerable skepticism about immediate deregulation, it is attractive in some respects because it bears the promise of being a simple, sweeping solution to a complex and exasperating problem. There are, however, several alternative remedies, some of which can modify deregulation in a manner that lowers the costs but preserves most of the benefits. These alternatives include incremental pricing, a phase-in of deregulation, alternative price ceilings, and deregulation with a wellhead tax.

The analysis performed for this paper is restricted to the period 1977-1985 in order that it can be compared with analyses completed by the Administration and various interested parties. It must be stated, however, that there is nothing unique about 1985, and in fact pricing policies that move in the direction of deregulation are likely to have significant effects after that date.

THE ADMINISTRATION'S PLAN

The theory behind the Administration's plan is that price incentives beyond current intrastate prices are an inefficient way to increase production and that most of the short-term problem is in the current misallocation of supplies between the intrastate and interstate markets. Accordingly, the plan focuses on reallocation of resources, and the production incentives in the plan are modest compared to deregulation. This analysis finds that the production incentive (the ceiling price on newly discovered gas) is even lower than prevailing average intrastate rates. Nonetheless, in part because of the price increase for Outer Continental Shelf (OCS) production, the Administration's course of action would, on balance, be stimulative. It would probably result in a continuing increase in expenditures on exploration and production. The following table summarizes the Congressional Budget Office's analysis of the potential impacts of the Administration's plan and of deregulation.

COMPARISON OF THE ADMINISTRATION PLAN WITH DEREGULATION: 1978, 1980, AND 1985

	1978		1980		1985	
	Adminis- tration Plan	Deregu- lation	Adminis- tration Plan	Deregu- lation	Adminis- tration Plan	Deregu- lation
Wellhead Price of New Gas (Cents per thousand cubic feet)	175	400	189	317	208	280
Average Price of All Gas (Cents per thousand cubic feet)	103	149	121	178	156	220
Net Annual Production (Trillion cubic feet)	19.2	19.5	18.7	19.1	18.9	19.8
Revenues to Industry (Billions of dollars) <u>a/</u>	20	28	23	32	29	41
Total Consumer Costs (Billions of dollars) <u>b/</u>	46	54	49	58	57	69
Typical Monthly Winter Heating Bill (Dollars per month)	42.80	55.60	43.20	61.60	47.20	70.00

NOTE: Prices are expressed in 1977 dollars.

a/ Revenues to industry are measured at the wellhead and are computed on the basis of the quantity produced under the Administration's plan. The difference in cumulative revenues by 1985 comes to \$76.5 billion.

b/ The difference in cumulative costs by 1990 comes to \$162 billion. These costs include wellhead prices, pipeline costs, and substitute fuels. Consumer costs are measured after shipment to the point of consumption.

DEREGULATION

Although many costs and benefits would undoubtedly result from deregulation, the two critical factors are the additional production response and the amount of additional costs to consumers. The analysis concludes that future production resulting from deregulated prices would probably be only 5 percent greater in 1985 than the production resulting from the Administration's plan. The reason for this conclusion is that recent discoveries, both in the aggregate and per foot drilled, have been very low. Recent intrastate prices have provided a marked stimulus to drilling and exploration. By most accounts, drilling has accelerated in recent years as fast as possible. Nonetheless, this drilling has not succeeded in reversing the decline in discoveries per foot drilled.

By CBO's calculations, deregulation of natural gas prices two years ago would not have yielded significantly more gas than has actually been found. Yet deregulated prices of new gas would be much higher today than they are because of bidding by interstate consumers. It follows, then, that in the short run the principal benefit to be weighed against the costs of deregulation is that the interstate market would be able to bid gas away from the intrastate market and could thereby reallocate some gas from intrastate to interstate consumers.

Several studies of deregulation disagree with this conclusion, and they forecast large discoveries. None of them, however, is explicit about where the new production will come from or what amount of investment and drilling will be necessary. Many of the studies rely on aggregate elasticities to predict future supply. CBO believes that this technique is not altogether valid.

Clearly, no analysis can predict whether any given well will yield oil or gas, and perhaps new bonanzas will be discovered immediately after deregulation. It is clear, however, that the recent surge of drilling resulting from rising intrastate prices has not brought forth much new gas.

Discoveries per well or per exploratory foot drilled have dropped drastically, and there is no reason to expect this trend to improve. ^{1/} Consequently, although there might be vast quantities of undiscovered gas underfoot, only small amounts are likely to be available in the near future.

Concerning prices, CBO's analysis indicates that prices of new deregulated gas would likely rise to something between \$3.50 and \$5.00 per thousand cubic feet (/MCF) in the short run—say the next 24 months—but they would then be forced down by institutional pressures and possibly by price competition from substitute fuels. In total, these price increases would cost consumers about \$10 billion a year more than under the Administration's plan between now and 1985.

ALTERNATIVE PLANS

As often is the case, there are a number of alternative pricing strategies that could be adopted. Some of these, such as the Administration's plan, continue price regulation. Others attempt to modify deregulation in order to minimize the effect of the price increase to the ultimate consumers.

Incremental Pricing

Various mechanisms to regulate consumer prices, such as incremental pricing, would be adjuncts to, not substitutes for, a wellhead pricing policy such as deregulation. Incremental pricing is an essential feature of the Administration's plan. Combined with deregulation, it would moderate the price effects of deregulation but not avoid them. It could, however, direct costs toward particular groups of consumers.

^{1/} With the exception of some Atlantic and Alaskan OCS areas, all domestic gas provinces have been explored to an extent that discovery of huge reservoirs is increasingly unlikely. The unexplored Alaskan OCS areas are not a factor in the 1985 time frame, and the projected reserves in the entire Atlantic are relatively small (less than one year's current production).

Incremental pricing would extend virtually the same price incentives to producers as would deregulation, but it has several added advantages. It could buffer residential consumers from some or all of the price rises. By placing incremental costs on large industrial and commercial users, it would offer incentives for them to conserve and/or convert to other forms of energy—thereby making more gas available to other consumers. Incremental pricing would also provide a brake against some of the price instability and potential bidding wars that could occur in a transitional period after passage of deregulation.

Phase-In of Deregulation

Much of the cost of deregulation would occur in the first years after passage, when many potential buyers would be shopping for limited supplies of unregulated gas. The likely price escalations and fluctuations in this period would offer very little incentive to expand exploration because investment decisions on exploration and development are generally based on prices expected several years further in the future. A phase-in can avoid those short-term costs, yet it would offer a fair degree of certainty about future prices upon which investment decisions could be made. Probably the simplest yet most effective mechanism for phasing in deregulation is to mandate national price ceilings for both markets, which escalate over time until they exceed the price of alternative fuel sources and can then be terminated. This system would require temporary regulation of the intrastate market in order to ensure that ceilings are not exceeded by consumers' attempts to bid supplies away from each other. A program similar to the Administration's plan, but with higher price ceilings, could accomplish that objective.

Great care should be taken, however, to ensure that the phase-in is not so rapid that producers have incentives to withhold production of new gas until prices increase. An annual escalation rate of 5 to 8 percent (plus inflation) is probably the maximum that would avoid withholding.

Alternative Price Ceilings

If the defect in the Administration's plan is considered to be lack of production incentives, that defect could be remedied by changing the recommended price ceilings. Essentially, this approach is similar to a phase-

in except that the ceiling prices might never attain the market price. The benefits in terms of production would be similar to, but slightly smaller than, those of deregulation. Depending on the level of the ceiling, the costs to consumers and the extent of economic dislocations would likely be lower than those of deregulation.

Excess or Windfall Profits Tax

Several variants of these forms of taxes have been suggested. This analysis concludes that taxes on "excess" profits are generally ineffective and difficult to levy, but that a form of windfall profits tax based on prices and sales at the wellhead could recapture most of the windfall gain. It should be recognized, however, that such a tax is actually regulation after the fact. To be effective, it would involve complicated rebate procedures and administrative controls.

Wellhead Tax

A wellhead tax coupled with a rebate on new gas produced under deregulation could effectively limit the transfer of income from consumers to the oil and gas industry. The approach would be similar in some respects to the crude oil equalization tax except that new gas would be taxed and vintage gas would remain under current controls.

CONCLUSION

On balance, this analysis finds that the potential costs of immediate deregulation are large, i.e. the additional costs to consumers are large compared to the small amount of additional production expected. It also concludes that most of the production that can be expected in the future can be gained by incentives within the Administration's plan, or by various modifications to the ceiling prices of the plan. Any pricing policy that limits prices during the next few years provides large cost savings to consumers. If current prices for unregulated gas are not rolled back, the incentives are expected to provide production in 1985 that is within 5 percent of that provided by deregulation. With respect to these alternatives, deregulation coupled with incremental pricing, a phase-in, or a wellhead tax would all be more effective policies than immediate deregulation with an excess profits tax.

At present, natural gas is sold in the United States under two different market systems. Gas that is in interstate commerce is sold under prices regulated by the Federal Power Commission; gas sold in the state in which it was produced is not regulated. Slightly less than half the net marketed production of gas is consumed in intrastate markets. Current negotiated prices for most production from recent discoveries of gas vary between \$1.70 per thousand cubic feet (/MCF) and \$2.00 on the intrastate market, but if the gas is transported over state lines, the price is limited to \$1.46/MCF by federal regulations. Intrastate prices have been increasing fairly steadily for several years while interstate prices have moved sporadically in response to new regulatory actions. As a consequence of the price disparity between the intrastate and interstate markets, about 90 percent of new production in recent years has been dedicated to the intrastate markets.

In the past, contracts between gas producers and interstate pipelines have typically extended for periods of 15 to 25 years—often at fixed prices. This practice of long-term contracts has protected distributing utilities from the possibility of running out of gas. And because prices of new gas are averaged, or "rolled in," with the prices of already flowing gas, this practice has tended to hold down the price of gas to consumers. Therefore, the average wellhead price of natural gas is about \$0.85/MCF—considerably below the price for new gas.

Alternative proposals before the Congress would either deregulate new gas sold in the interstate market or place an identical price ceiling on both markets. The Administration's plan would follow the latter course, placing a ceiling on the price of new gas in both markets in order to prevent prices from being bid up rapidly. The plan proposes an upper limit for prices of what is designated "newly discovered" gas; this limit would be equivalent to the average refinery acquisition cost of domestic crude oil, or about \$1.75/MCF in 1978, rising to about \$2.08/MCF in 1985. (Prices in this paper are expressed in 1977 dollars. If inflation continues at the rate of 6 percent per year, the ceiling price in 1985 would be about \$3.32/MCF in 1985 dollars). Some exemptions to the ceiling price would be allowed, and separate limits have been proposed for renegotiation of contracts existing in 1977.

Deregulation would allow prices to reach a market clearing level without government intervention. This price might be as high as \$3.50 to \$5.00/MCF in the short run, but would be likely to stabilize at about \$2.80/MCF during the mid-1980s when gas consumers—particularly industries and electrical utilities—are expected to substitute alternative fuels for high-priced natural gas. The principal reason short-term prices could rise substantially above the price of substitute fuels is that gas distribution pipelines can roll in small quantities of expensive new gas with larger quantities of old gas without greatly affecting the average price. Because consumers compare the average price of gas they receive from pipelines to the price of alternative fuels, the wellhead price of marginal quantities of new gas can rise above the price of competing fuels as long as it is rolled in with old gas.

Whichever general pricing policy—or some variation on the general policy—is selected by the Congress, it appears that the historical cost-based method of regulating gas prices will no longer serve. For that reason, this analysis will not address the cost of producing gas. Rather, the focus will be on the quantity of gas produced at various wellhead prices.

The purpose of this paper is to compare the price and production responses of the Administration's plan with those for deregulation.^{1/} The paper also addresses a number of the indirect costs and benefits, including the effect on inflation and employment associated with the alternative policies. Several modifications of both alternatives are examined. Specifically, the prices and production responses of deregulation are compared with those of the Administration's plan in Chapter II. The effects of the policies are described in Chapter III, and the alternatives of incremental pricing, phase-in of deregulation, higher price ceilings and escalation rates, wellhead and excess profits taxes are discussed in the final chapter.

^{1/} Deregulation in this analysis is defined as an elimination of Federal Power Commission jurisdiction to regulate wellhead prices of gas produced from wells drilled after April 20, 1977 that are more than two-and-one-half miles from present production, are produced from zones more than 1,000 feet below present production, or are specified by state regulatory agencies as being produced from a new field within such limits. Renegotiations would be severely limited, but gas from expired contracts could be sold at deregulated prices.

CHAPTER II. PRICE AND PRODUCTION ESTIMATES

The decision about whether or not to deregulate the price of natural gas depends largely on the costs and benefits associated with the proposed policy change. Although deregulation could yield other advantages; its main benefit would be increased production. The major cost would be raised prices. This chapter focuses on these two effects.

The analysis concludes that prices for new gas over the next year or two are likely to rise to \$3.50-\$5.00/MCF—well above the BTU equivalent price for oil. Such price rises would increase consumer costs for new gas by an average of about \$10 billion per year between now and 1985. The analysis also finds that deregulation is unlikely to increase annual production by more than one trillion cubic feet (TCF) per year by 1985.

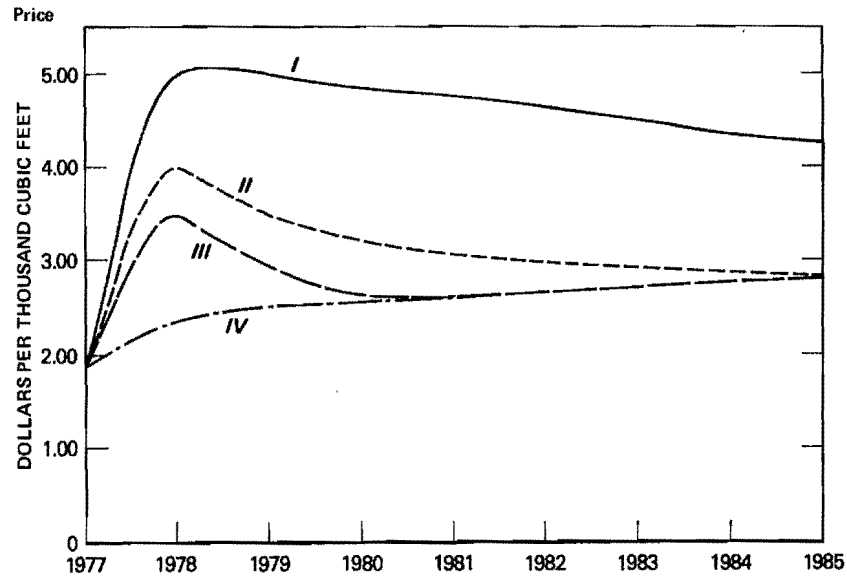
PRICE BEHAVIOR UNDER DEREGULATION

There are several schools of thought concerning how gas prices would react to deregulation. It is generally agreed that prices would rise fairly rapidly during the first few years because incremental supply would be limited and new demand from interstate pipelines would be large. The Congressional Budget Office estimates that, in the short run, prices would probably rise to more than \$3.00/MCF and might go as high as \$6.00/MCF because interstate pipelines would be forced to pay premium prices to bid supplies away from intrastate consumers. ^{1/}

^{1/} Natural gas prices are lower than the prices of almost all petroleum fuels. Natural gas is also a clean and easy-to-handle fuel. Most coal is cheaper, in raw form, than gas—but costs more to burn—and usually involves substantial conversion costs. Consequently, gas is, in many applications, the cheapest fuel available. Consumers cannot be expected to shift willingly away from gas until prices rise. Some conversion to residual fuel oil is probably occurring now because marginal gas prices are passing the \$1.70/MCF to \$1.90/MCF point at which they are equivalent to residual fuel. Few large users, however, pay the marginal rate and many are unable to convert without substantial costs. For that reason, the point at which consumers are expected to shift rapidly from gas is when the price is equivalent to industrial distillate fuels (about \$2.50/MCF at the wellhead in 1978, rising to about \$2.80/MCF by 1985, as measured in 1977 dollars).

Over the next year or two, few mechanisms would resist such increases. Public utility commissions (PUCs) would probably not oppose price increases if the gas were necessary to avoid shortages. Consequently, CBO expects that if natural gas is deregulated, 1978 wellhead prices for new gas are likely to average between \$3.50 and \$5.00 per MCF, although it is possible that the prices could be either higher or lower. Figure 1 has been developed to illustrate the variety of plausible price paths for 1978 and beyond.

FIGURE 1.
FOUR POSSIBLE PRICE PATHS FOR NEW GAS
UNDER DEREGULATION: 1977-1985



- o Path I of Figure 1 represents a likely path of prices in the event that distributing pipelines bid for new supplies up to the point at which their average rolled-in price becomes equal to that of distillate fuel oils by the mid-1980s. It can even be argued that during the period 1978 to 1982, Path I prices are unrealistically low.
- o Path II is a mid-range estimate with no particular theoretical basis in its own right; but it seems to be a reasonable "best guess" within the range of the other scenarios.
- o Path III assumes that resistance from PUCs and consumers will constrain price increases after a brief transition period to the approximate level of industrial distillates.
- o Path IV rests on the assumption that distributing utilities will not bid up the price of new gas in the short term.

Those who argue that prices for new gas will remain high after the transition period believe that consumers will be willing to pay high prices for the new supplies as long as the average prices of all gas are lower than those of distillates or other alternative fuels. And because the volume of new gas is small in relation to the volume of flowing inexpensive gas, average gas prices are likely to remain lower than distillate prices through the mid-1980s.

Others argue that PUCs would not permit expensive purchases once the pipelines have enough gas to avoid shortages, and that pressure from the PUCs and consumers would be able to force prices down. Proponents of this approach generally acknowledge, however, that consumer pressure on energy prices has not been noticeably effective in recent years.

Prices would also be affected by the response of production to those prices. If ultimate production of new gas were large, the prices of new gas would tend to be lower than otherwise. Conversely, if new supply were small, prices would tend to remain high.

This analysis concludes that Path IV in Figure 1—a gradual increase in prices—is extremely unlikely. Immediate deregulation would result in a rapid surge in prices. There is, however, great uncertainty about the extent and duration of the price increase. Both Paths I and III seem reasonable; in

CBO's view there is little evidence that can be used to choose between them. Accordingly, this analysis bases its projections on a mid-range estimate (Path II) that is a compromise between the widely varying possibilities. It should be noted, however, that the degree of uncertainty regarding future prices is high—higher, for instance, than the level of uncertainty about future production.

An important point is that high prices during the transitional period are not expected to exert a strong influence on the production of new gas because exploration decisions would generally be made on the basis of expected long-term prices. Therefore, CBO expects that high short-term prices would provide little commensurate benefit. Some other studies have concluded that the short-term prices would result in substantial increases in supplies of gas in the short run. CBO believes that increases in short-term production might result from an acceleration of the production of old gas but would involve little new gas. ^{2/} The next section addresses this and other production-related issues.

PRODUCTION OF NATURAL GAS

The general conclusion of the following section on natural gas production is that deregulation would increase gas production by less than one TCF per year by 1985 compared to the Administration's plan. In view of the importance of the production response as a result of the alternative pricing policies, this section provides details on the assumptions and methods used to develop the estimates. CBO has chosen to present, in understandable terms, some complex materials that would be confined to technical appendixes if the conclusions were less important. ^{3/}

^{2/} There would, of course, be a large incentive for producers to attempt to define gas from old reservoirs as new gas, in order to receive new prices.

^{3/} The descriptions and data in this section are not adequate for a reader to replicate the analysis fully. Such support materials, however, can be obtained from CBO.

In considering natural gas production, it is useful to distinguish between associated gas, which is produced in conjunction with oil, and non-associated gas, which is produced alone. Controversy among students of natural gas production largely concerns non-associated gas from undiscovered reserves. The analysis here therefore focuses on this type of gas. ^{4/}

Gas production from known fields is declining rapidly (see Figure 2). It is possible that no policy will be able to develop new reserves fast enough to compensate for the decline in production from known reserves. This decline is rapid in part because many of our largest fields were brought into production at about the same time and are being depleted simultaneously.

The conclusion of this study is pessimistic: even with the maximum effort resulting from the incentives provided by deregulation, gas supplies are unlikely to increase by more than 5 percent above the supplies anticipated under the Administration's plan.

METHODOLOGY

Forecasting

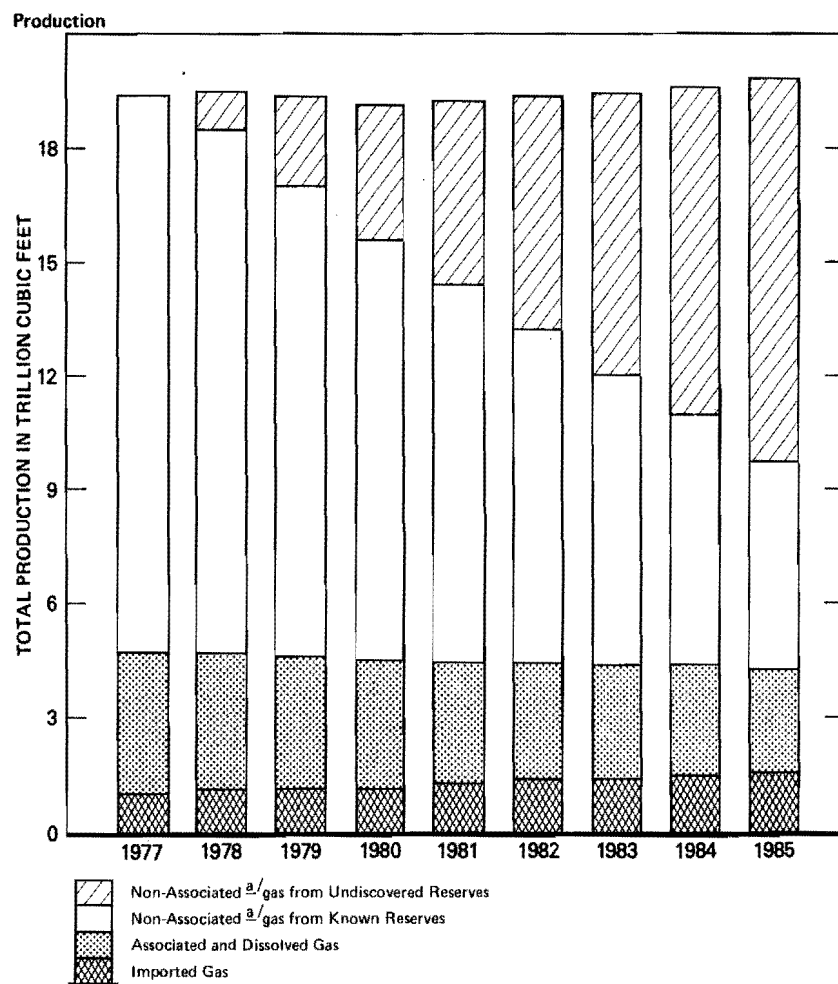
The technique used to forecast future production of non-associated gas from known reserves ^{5/} relies on projecting how much exploratory drilling would result from increased prices (revenues to the industry), regional discovery rates, and production to reserve ratios. For such a forecast, it was necessary to project:

^{4/} Imports from proposed projects in Alaska, Northern Canada, and Mexico are not included in this forecast.

^{5/} Seven production regions were used: West Coast (onshore and Outer Continental Shelf), Rocky Mountain, West Texas, East Texas, Mid-Continent, Gulf of Mexico, and East Coast. These regions are a simplified combination of those used by the National Petroleum Council.

Non-associated gas from known reserves was estimated using conventional decline rates for each region. These projections are similar to those used by the Federal Energy Administration (FEA) in its forecast of supply from existing reserves. See FEA, National Energy Outlook 1976, (February 1976), p. 139.

FIGURE 2.
SUMMARY FORECAST OF PRODUCTION OF NATURAL GAS
UNDER DEREGULATION: 1977-1985



^a/ Associated and Non-Associated Gas are defined in text Chapter II.

- o Revenues to the industry,
- o Regional drilling rates, and
- o Regional discovery rates.

Taking into account delays between discovery and production, drilling requirements for production, and regional ratios of production to reserves, the average expected production of non-associated gas from undiscovered reserves can be forecast with reasonable accuracy for the next seven to ten years. ^{6/}

Drilling

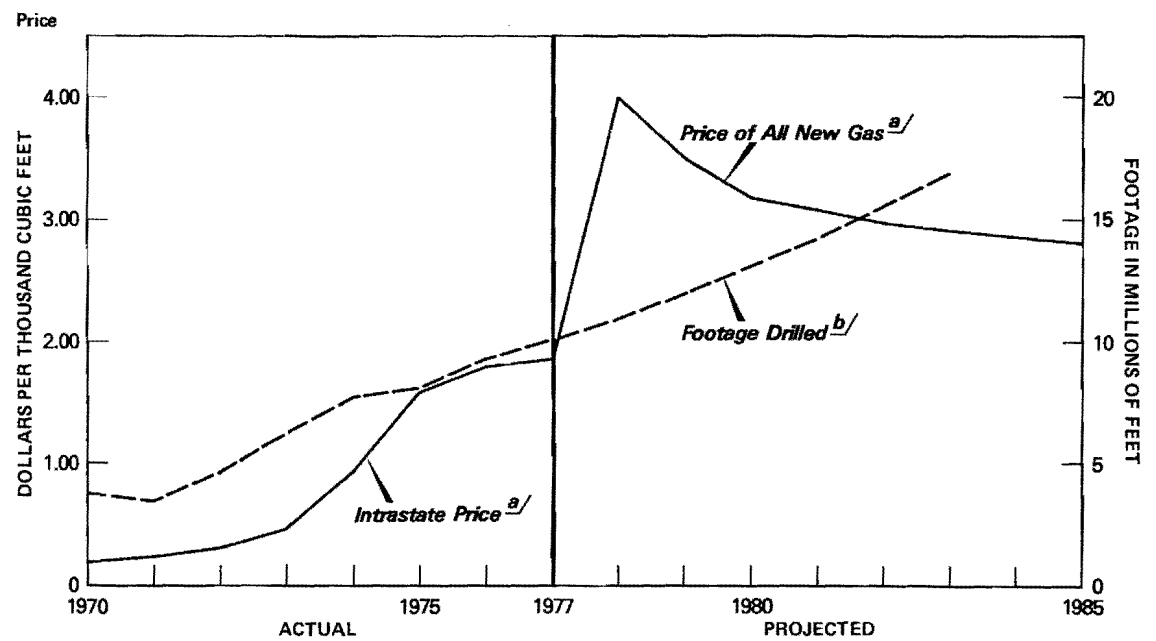
The fundamental assumption of this analysis is that deregulation would stimulate drilling for gas at the maximum practical rate. Since 1973, increases in prices of intrastate gas have led to increases in total drilling for gas at a rate of about 9 percent per year. ^{7/} CBO projects that deregulation would continue this acceleration of drilling through the early to middle 1980s, because the incentives for acceleration would be large.

Drilling for non-associated gas in 1976 totaled 63 million feet, of which about 9 million feet was successful gas exploratory footage (see Figure 3). By 1985, according to this scenario, annual drilling would total about 140 million feet per year. This is more footage than was drilled for both oil and gas in 1973.

^{6/} The actual methodology used is more complicated than this description. Simply put, the process for projecting non-associated gas from undiscovered reserves included steps to forecast (1) future prices, (2) revenues to industry, (3) exploration costs per region, (4) potential reserves per region, (5) expected value of investment, (6) amount of investment per region, (7) exploratory drilling per region, (8) finding rates per region, (9) discoveries, (10) developmental drilling, (11) delays before production per region, (12) reserve to production ratios, (13) regional decline rates, and (14) production per region. Several of these steps, of course, fed back to previous steps.

^{7/} This relates to footage drilled for gas. The total number of wells drilled has expanded at a greater rate, but the majority of new wells are developmental and relatively shallow.

FIGURE 3.
PRICES AND FOOTAGE DRILLED UNDER DEREGULATION: 1977-1985



^{a/} Under deregulation the intrastate-interstate distinction would disappear.

^{b/} Successful gas exploratory drilling footage. Source: *API Quarterly Review of Drilling Statistics*.

SOURCES: 1970-1972 - The American Gas Association; 1973-1974 - *Natural Gas Prices: 1973-1975* by H. Huntington, 1975-1976 - *FEA Monthly Energy Review* (Mar. 1977).

The Administration's plan would limit prices to the equivalent BTU price of domestic crude oil. Compared to deregulation, this would affect investment in two ways: investors would be more certain about future prices because there would be less price movement; and investors would know that the controlled price would be lower than the deregulated price. In the aggregate, CBO projects that the acceleration of drilling would be more moderate under the Administration's plan (5.5 percent per year compared to 9.0 percent per year under deregulation). (See Figure 4). ^{8/}

Discovery of Reserves

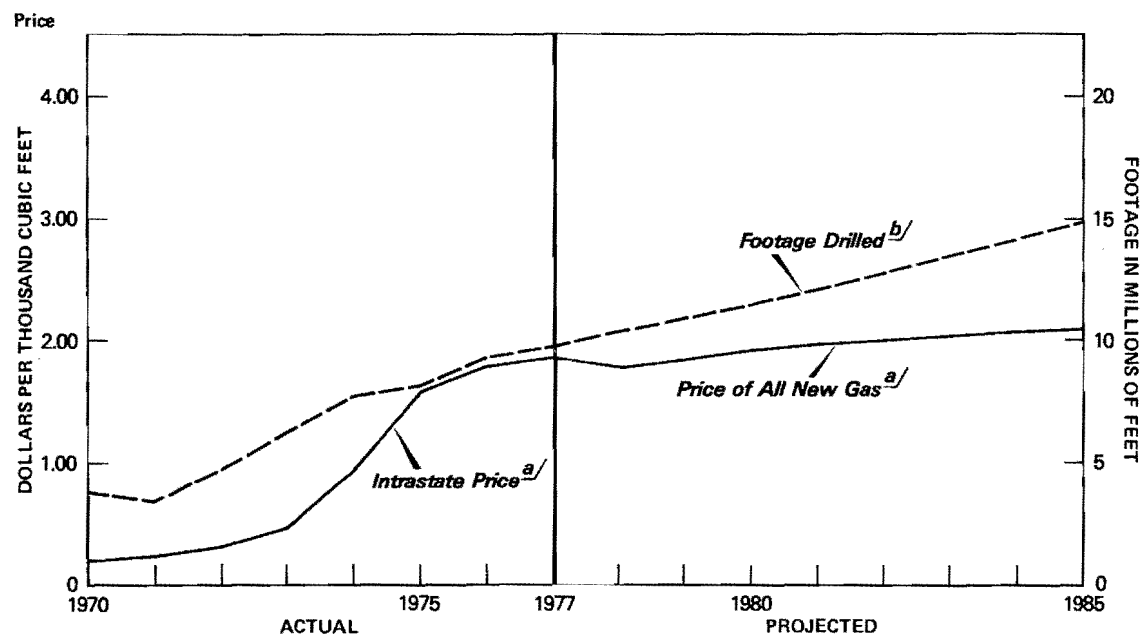
Reserves discovered per foot drilled have declined in most years since 1965 (see Figure 5). ^{9/} Discoveries of new fields and of new reservoirs in old fields was 1,297 MCF per exploratory foot in 1970 and 469 MCF per foot in 1975. ^{10/} Most analysts believe that this trend will continue, particularly for on-shore regions, because the largest, easiest-to-find discoveries have been made. Although new Alaskan and Outer Continental Shelf (OCS) provinces have been opened up in recent years and have led to new discoveries, they have not yielded enough gas to reverse the decline and will probably not be important contributors within the time period studied in this paper. This

^{8/} The acceleration of drilling under deregulation is considered to be the upper plausible limit. It could be either 8 or 10 percent per year, but it is not very likely to be higher because of construction and manpower constraints and because of the inflated costs of all the factors of production. The acceleration due to the Administration's plan is more difficult to estimate. A reasonable range for its acceleration is four to eight percent per year. Although revenues to industry are much smaller under the Administration's plan, drilling costs are expected to be lower and the return on investment is generally high—probably higher than most alternatives available to the industry.

^{9/} "Reserves" includes both new fields and new reservoirs in old fields. Extensions to known reservoirs are included in the projection of future production.

^{10/} The 1970 data are based on 4.76 TCF discovered (new fields and new reservoirs in old fields) by 3.67 million feet drilled (successful gas exploratory drilling). Sources: AGA-API Reserves Report and API Quarterly Review of Drilling Statistics.

FIGURE 4.
PRICE AND FOOTAGE DRILLED TO DATE AND UNDER THE
ADMINISTRATION'S PLAN: 1970-1985

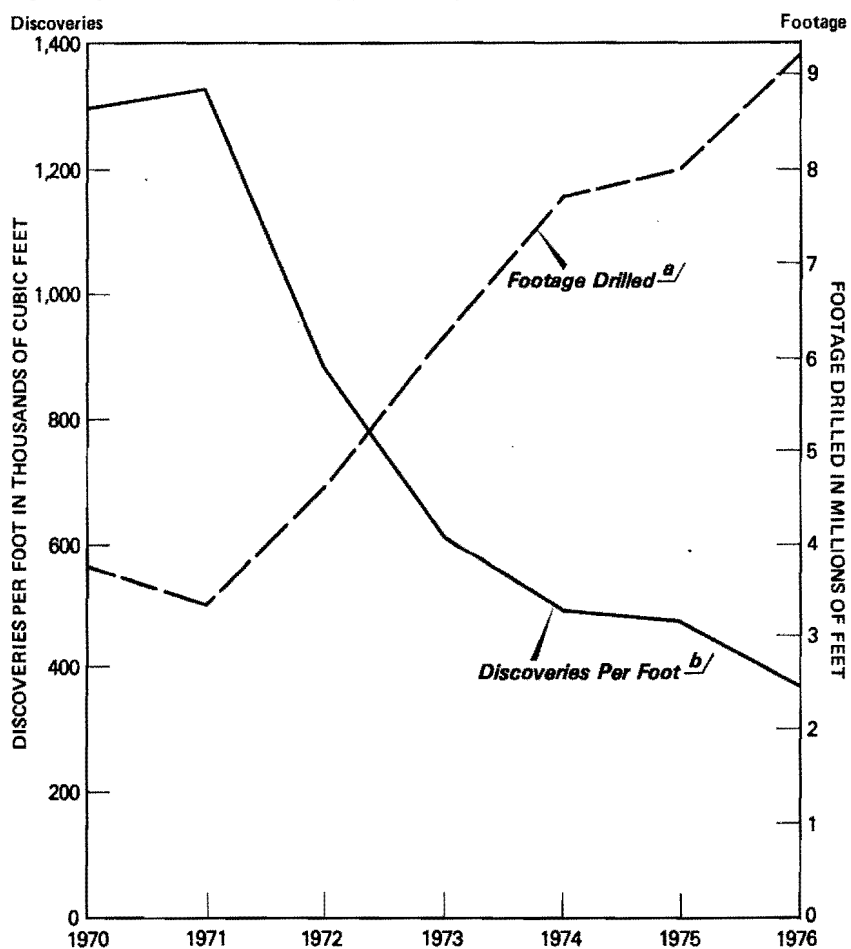


^{a/} Under the Administration's plan, the intrastate-interstate distinction would disappear.

^{b/} Successful gas exploratory drilling footage. Source: *API Quarterly Review of Drilling Statistics*.

SOURCES: 1970-1972 - The American Gas Association; 1973-1974 - *Natural Gas Prices: 1973-1975* by H. Huntington, 1975-1976 - *FEA Monthly Energy Review* (Mar. 1977)

FIGURE 5.
FOOTAGE DRILLED AND DISCOVERIES PER FOOT: 1970-1985



b/ (New Field Discoveries and New Reservoir Discoveries in Old Fields) ÷ Successful gas exploratory drilling footage.

a/ Successful gas exploratory drilling footage.

SOURCES: Discoveries from AGA-API Reserve Report, American Petroleum Institute, May, 1977. Footage Drilled from API Quarterly Review of Drilling Statistics.

analysis assumes, however, that because of accelerated leasing of OCS lands, the ratio of total average discoveries per foot drilled through 1985, will remain the same as it was in 1975. This assumption is important. It is also optimistic. If discoveries per foot continue to decline, total production in future years as a result of either pricing policy would be lower than projected here.

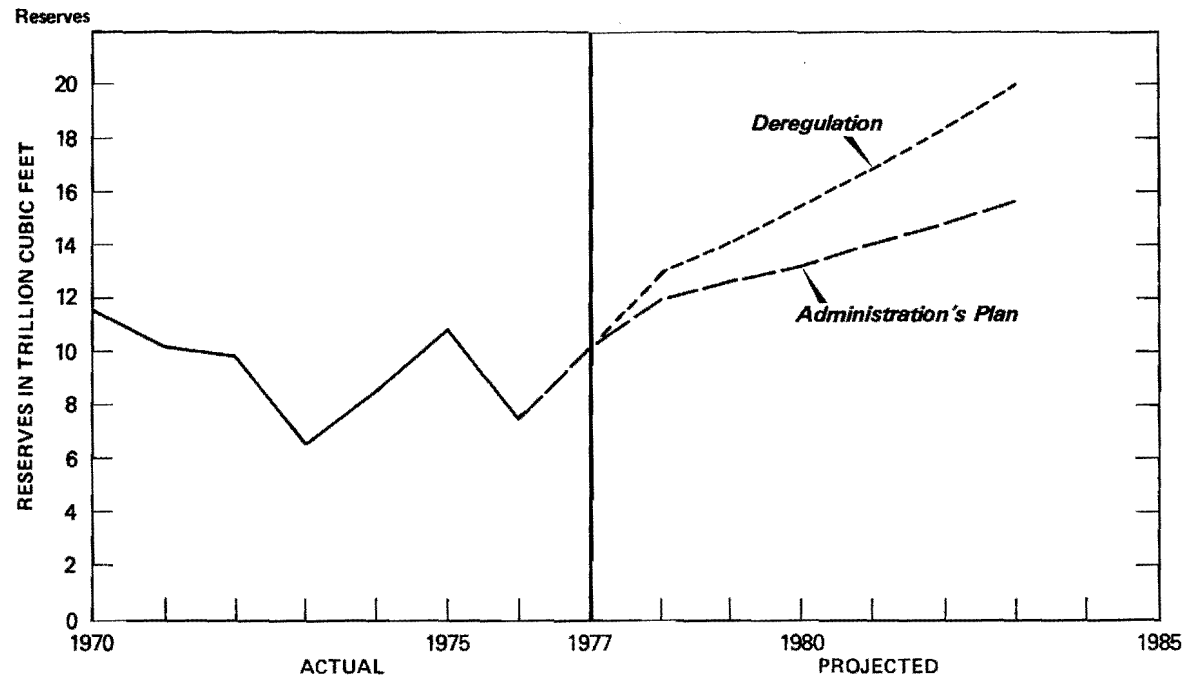
Proven reserves of non-associated gas were about 160 TCF in 1974. If discoveries per foot drilled are constant, and the rate of drilling accelerates at 9 percent as a result of deregulation, reserves discovered through 1985 would be about 166 TCF. However, no more than about 105 TCF would be discovered in time—that is, by 1982 or 1983—to be produced by 1985 (see Figure 6). Based on current ratios of reserves to production by year and by region, and on regional decline rates based on type of field, deregulation would result in about 10.1 TCF of new non-associated natural gas in 1985. The Administration's plan would result in about 9.2 TCF of new non-associated gas in 1985. 11/

To these estimates should be added production from known reserves associated-dissolved gas in oil, and imports. 12/ Total supplies of gas projected under both plans are shown in Table 1.

11/ If the discovery rate declines 25 percent between 1975 and 1985, production of new non-associated gas in 1985 would be about 8.9 TCF under deregulation and 8.1 TCF under the Administration's plan. All other things being equal, total production in 1985 would be 18.6 TCF and 17.8 TCF respectively.

12/ Production from existing reserves is declining by about 11.5 percent per year. This decline is greater than expected for two reasons. Approximately half of gas production comes from about 100 large fields, most of which were brought into production in the same period of time. Production from those fields is declining rapidly and newer, smaller fields are unable to offset the decline completely. The second reason is that ultimate production from some types of fields—called "waterdrive" fields—is now expected to be much lower or slower than previous estimates.

FIGURE 6.
 DISCOVERIES OF NATURAL GAS TO DATE, UNDER DEREGULATION,
 AND UNDER THE ADMINISTRATION'S PLAN: 1970-1985



SOURCE: Historical - *United States Petroleum Statistics*, Independent Petroleum Association of America, 1977 edition.

TABLE 1. ESTIMATED SUPPLY OF NATURAL GAS IN 1977-1985: IN TRILLIONS OF CUBIC FEET

	1977	1980		1985	
		Deregulation	Adminis- tration Plan	Deregulation	Adminis- tration Plan
Non-Associated Gas					
Known reserves	14.7	11.1	11.1	5.5	5.5
New reserves	—	3.5	3.1	10.1	9.2
Associated and Dissolved Gas	3.7	3.4	3.4	2.7	2.7
Imported Gas					
Pipeline	0.9	0.9	0.9	1.0	1.0
Liquified natural gas	<u>0.1</u>	<u>0.2</u>	<u>0.2</u>	<u>0.5</u>	<u>0.5</u>
TOTAL	19.4	19.1	18.7	19.8	18.9

Several conclusions can be drawn from these projections of natural gas production:

- o The decline in production from known reserves is rapid. Any drilling and exploration program will have difficulty offsetting that decline. Because of the assumption that finding rates will be constant, it is likely that these projections are optimistic.
- o The recent decrease in finding rates is a serious problem. It seems unreasonable to expect the decline to be reversed. At best, one might hope for no further decline. Given such pessimistic statistics on finding rates, exploration is almost certain to be disappointing.
- o The OCS and Alaskan unexplored areas are not expected to provide a panacea. The U.S. Geological Survey estimates that the reserves in unexplored areas are small relative to explored areas. 13/
- o It is possible that a bonanza could be discovered. If so, the discovery could increase production estimates by 5 or 10 percent by 1985. One can as easily argue, however, that the nation will have poor luck as has been the recent experience on the OCS. In that case production would be lower than this forecast. On balance, this projection has been designed to be moderately optimistic.
- o Some analyses forecast large amounts of new production in the short term. This analysis does not dispute that possibility; however, short term production will come from already discovered reserves. Most of this gas is technically old gas (but could receive new prices). This production is simply an acceleration of production that would otherwise occur later.

13/ The total undiscovered reserves in the United States (including the OCS) is about 484 TCF. Unexplored offshore areas in the Atlantic and Pacific total 13 TCF. The Alaskan OCS areas have more expected reserves—44 TCF—but production of gas from these areas is not likely to be significant by 1985. Source: USGS, Geological Estimates of Undiscovered Recoverable Oil and Gas Resources in the United States, (Circular 725, 1975), pp. 30-31.

CHAPTER III. THE EFFECTS OF DEREGULATION

Chapter II described the effects of deregulated prices on wellhead prices and gas production. The purposes of this chapter are: (1) to estimate the direct costs and benefits of the two alternatives, (2) to describe indirect costs or benefits that affect consumer and public welfare, (3) to summarize all costs and benefits of deregulation versus the Administration plan, (4) to describe the effects of the plans on different consumers, and (5) to examine the indirect effects of the two policies.

MAJOR COSTS AND BENEFITS OF DEREGULATION

In Table 2, the direct costs and benefits in terms of increased production and additional consumer costs of the two plans are compared for the years 1978, 1980, and 1985. Several conclusions can be drawn from these projections:

- o An increase in consumer expenditures for gas in 1978 of \$8 billion would stimulate production of 0.3 TCF more gas under deregulation than under the Administration's plan;

TABLE 2. COMPARISON OF THE ADMINISTRATION PLAN WITH DEREGULATION: 1978, 1980, AND 1985

	1978		1980		1985	
	Adminis- tration Plan	Deregu- lation	Adminis- tration Plan	Deregu- lation	Adminis- tration Plan	Deregu- lation
Wellhead Price of New Gas (Cents per thousand cubic feet)	175	400	189	317	208	280
Average Price of All Gas (Cents per thousand cubic feet)	103	149	121	178	156	220
Net Annual Production (Trillion cubic feet)	19.2	19.5	18.7	19.1	18.9	19.8
Revenues to Industry (Billions of dollars) <u>a/</u>	20	28	23	32	29	41

NOTE: Prices are expressed in 1977 dollars.

a/ Revenues to industry are measured at the wellhead and are computed on the basis of the quantity produced under the Administration's plan. The difference in cumulative revenues by 1985 comes to \$76.5 billion.

- o Because prices are "rolled in," new gas prices exceed the price of imported oil on a BTU basis;
- o The increase resulting from deregulation in cumulative revenues to industry between now and 1985 is about \$76 billion. It is difficult to predict what proportion of its additional profits the industry would invest in new exploration and development.

ADDITIONAL DIRECT COSTS OR BENEFITS OF DEREGULATION

Because deregulation would encourage more production than the Administration's plan, it would reduce two types of "down-stream" costs: per unit transportation costs and the use of substitute fuels.

Transportation Costs

In recent years the quantity of gas produced, and especially the quantity transported in interstate pipelines, has declined. As a result, there is unused pipeline capacity. Because fixed capital costs are the largest proportion of pipeline costs, they must be borne to some extent by the remaining gas customers. In other words, transportation costs per unit increase as the quantity being transported decreases.

Based on data derived from a report by Zinder and Associates, fixed annual costs of interstate pipelines are estimated to be about \$13.2 billion, plus variable costs of about \$0.35 billion per TCF transported. ^{1/} This analysis calculates that, because deregulation would provide more gas to the interstate market than would the Administration's plan, average transportation costs would be \$.09/MCF and \$.15/MCF lower in 1980 and 1985, respectively, under deregulation than under the Administration's plan. ^{2/}

^{1/} H. Zinder and Associates, Inc., UDC Filing in RM75-19/Statement 2, Exhibit A. Schedule 5, Zinder Interstate Gas Model.

^{2/} Volumes transported in interstate commerce are estimated to be about 9.4 TCF in both 1980 and 1985 under the Administration's plan. Under deregulation, they would be 10.2 in 1980 and 10.6 in 1985.

If the Interstate Commerce Commission (ICC) permitted full pass-through of costs, total annual transportation costs that would be avoided by deregulation would be about \$0.85 billion in 1980 and \$1.41 billion in 1985. These costs would have to be deducted from the costs of deregulation that would be caused by wellhead price increases.

Substitute Fuels

Most analyses agree that unfulfilled demand for gas will be met by competing fuels, largely oil. Therefore, incremental production of natural gas should lower demand for oil imports. The fuels that would substitute for incremental supplies of gas are expected to be fuel oils (residual and distillate) that can be used most easily by industrial and large commercial users and by some utilities. 3/ Present distillate equivalent costs are about \$2.50/MCF, and are projected to be about \$2.80/MCF by 1985. 4/ Because the short-term cost of incremental supplies of natural gas is projected to be between \$3.50 and \$5.00/MCF under deregulation, oil clearly would be less costly to use. 5/ Consequently, the direct economic cost of substitute fuels

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- 3/ Some analysts argue that the prices of substitute fuels are higher than the price used in this study; i.e. that electricity is a substitute fuel. CBO does not believe this to be so because marginal supplies would be consumed by the industrial sector under interruptible contracts. But if it were, the deregulated price of natural gas would seek that higher level. Therefore, the total cost of a policy of deregulation would be much higher than this analysis projects.
 - 4/ Present delivered costs of industrial distillates average about \$0.40/gal., or \$2.90/MCF equivalent. However, about \$0.80/MCF should be deducted for the difference in transportation costs and \$0.40/MCF added for differences in quality and operational costs. The validity of this comparison is strengthened by the recent tentative pricing agreed upon for new natural gas from Mexico. Its price would be set by the price of distillates in New York, which is equal to \$2.60/MCF in 1977.
 - 5/ This calculation is somewhat complicated. A consumer whose supply would be curtailed must replace \$2.00/MBTU gas with \$2.80/MBTU oil. However, his gas prices would be low because of the rolled-in old gas. At the margin, the trade really is between \$3.50/MBTU gas and \$2.80/MBTU oil. Rolling in old prices is actually encouraging consumers to make uneconomical decisions. (Incremental pricing addresses this problem.) For this reason, this analysis argues that for the most part there is no net cost of substitute fuels.

is expected to be negative in the short run, and negligible in the longer run. This might be misleading, however, because there are substantial indirect costs of importing oil, for example, the more oil we import the greater our vulnerability to supply interruptions.

There are some circumstances, however, in which more expensive substitute fuels, such as liquified natural gas (LNG), could be used. For instance, LNG would probably be used during peak consumption periods by utilities in the Northeast and in California. The forecasts for the Administration's plan and deregulation predict that use of LNG and some other supplemental sources will expand from the present level of about 0.1 TCF/year to about 0.5 TCF/year with or without deregulation. The price of LNG is projected to be about \$3.15/MCF through 1985, based on current contracts.

If some additional LNG or synthetic gas is used as a substitute fuel (instead of distillates), and if the prices are higher than the prices of new gas, then there would be a net cost to the nation of substitute fuels that should be deducted from the cost of deregulation. At the upper limit, CBO projects such costs could be about \$0.45 billion in 1985. ^{6/}

A SUMMARY OF DIRECT COSTS

The costs of producing gas under the Administration's plan and under deregulation were developed in Chapter II and are summarized in Table 3. To these costs must be added costs for transportation and for substitute fuels to make up the difference in production.

In Table 3, these cost elements are compared for the year 1985 and are accumulated through 1990. These costs do not represent a comprehensive comparison of costs but are those in most common use in other analyses. Additional costs, such as those of regulatory policies and shortages, are evaluated in a later section of this paper. For both 1985 and 1990, the direct

^{6/} In 1980, costs of substitutes would be negligible in all cases. The assumptions for 1985 are that 0.45 TCF of additional LNG at \$4.00/MCF would substitute for gas priced between \$2.80 and \$3.25/MCF. This is considered the highest reasonable cost that can be foreseen.

TABLE 3. TOTAL DIRECT COSTS OF NATURAL GAS IN 1985 AND CUMULATIVE COSTS THROUGH 1990: IN BILLIONS OF DOLLARS

	Costs in 1985		Cumulative Costs Through 1990	
	Deregulation	Administration Plan	Deregulation	Administration Plan
Gas Supply Costs	43.6	29.5	576	390
Extra Transport Costs	—	1.4	—	15
Substitute Fuels <u>a/</u>	—	0.5	—	9
Total Direct Costs	43.6	31.4	576	414
Net Cost of Deregulation	12.2		162	

a/ Substitute fuels are required to make up the difference between supplies of domestic gas produced under alternative plans.

costs of deregulation would be greater than the accumulation of costs under the Administration's plan. In 1985, deregulation costs are estimated to exceed the costs of the Administration's plan by \$12.2 billion and, cumulatively for the period 1978 to 1990, are estimated to exceed the Administration's plan by about \$162 billion. The basic reason that costs exceed benefits is that gas supply costs under deregulation are large and outweigh by a large margin the extra transport and substitute fuels costs incurred under the Administration's plan. Even if deregulation were able to produce as much as 3 TCF more gas per year by 1985 than the Administration's plan—an event CBO finds unlikely—the net cost of deregulation would not be reduced by more than \$2 to 3 billion per year.

In summary, a policy of deregulation would be more costly to the nation than the Administration's plan. In 1985, the national cost of the same quantity of fuel would be more than 35 percent greater under deregulation than under the Administration's plan. The cumulative costs (in 1977 dollars) through 1990 would come to about \$162 billion more for deregulation, an increase of about 39 percent for the same amount of energy.

INDIRECT EFFECTS

A comparison between deregulation and the Administration's plan is incomplete unless several additional factors are taken into account. This section describes and evaluates the indirect effects of deregulation on:

- o domestic employment,
- o inflation,
- o gas supplies,
- o regulatory costs, and
- o boom and bust cycle.

Domestic Employment

An important argument in the debate on deregulation is that deregulation would stimulate more production of gas and therefore reduce oil imports and payments to foreign nations. The claim is made that importation of oil is an exportation of domestic jobs. In fact, deregulation of natural gas would have two largely offsetting effects on domestic

employment. Higher prices for natural gas would encourage domestic production and thereby increase employment in the natural gas and related industries. However, higher gas prices would affect the prices of many goods and services in the economy and increase the overall inflation rate, especially in the short term. Higher inflation rates would, in turn, force up interest rates and reduce the demand for goods and services, including business investment. On the basis of simulations in large econometric models of the U.S. economy, CBO has estimated that the net effect of these two forces would lead to a slight reduction in employment. In the aggregate, deregulation would add two to four tenths of a percentage point to the unemployment rate by 1980 compared to the Administration's plan.^{7/}

Although deregulation would lead to greater total unemployment, it would definitely stimulate employment in the oil and gas industry. The stimulus could easily be quantified, while the retardation of employment in other sectors and regions due to the price effects of deregulation would be indirect and less easily observed.

Inflation

CBO has estimated that deregulation would increase consumer costs by an average of about \$10 billion per year between now and 1985. A large proportion of these costs would be passed on to consumers in the form of higher prices for products. In the aggregate, the Consumer Price Index would rise by about half of one percent per year more under deregulation than under the Administration's plan during the years 1978-1985. This increase in inflation is about as much as would result from the imposition of the entire balance of the Administration's plan as originally proposed.

^{7/} Two to four tenths of a percentage point equals 180,000 to 360,000 workers who would be unemployed as a result of deregulation. In 1985, the level of unemployment would be somewhat lower.

Shortages of Gas Supplies

The Administration's plan merges the interstate and intrastate markets and thereby permits interstate consumers to acquire new (expensive) gas through the distributing utilities at incremental prices, thereby removing the threat of widespread shortages from most interstate consumers. Nevertheless, because the Administration's plan continues price controls below market clearing prices, end-use allocation and curtailments would be likely to continue—at least through the early 1980s. Curtailments and shortages are expected to be less severe than at present and would be spread among industries in both interstate and intrastate markets.

Under deregulation, there would be no curtailments, but large quantities of gas—about 0.8 TCF or 9 percent of intrastate supply—would be bid away from intrastate regions by interstate consumers in 1980. The gas that would be retained by the intrastate market in 1980 would be 120 percent more expensive at the wellhead (in 1977 dollars) than it is now, and 47 percent more expensive than it would be under the Administration's plan.^{8/}

Boom and Bust Cycle

In Figure 1, the prices under deregulation appear to increase rapidly in the first year and then recede thereafter. Beyond 1985, the prices would probably climb again, but slowly. As discussed earlier, there is considerable uncertainty about future prices: the cycle could be more or less violent than that projected in this study. The price uncertainties can, on the one hand, discourage long-term investment, and, on the other hand, can over-stimulate investment in the short run. Generally, cyclical prices are expected to make investment less efficient than would a more stable increase in prices.

^{8/} Present wellhead prices for all gas on the intrastate market average \$0.92/MCF. In 1980 under deregulation, the average would be \$2.05/MCF in 1977 dollars. Under the Administration's plan, the average would be \$1.39/MCF.

By regulating prices, the Administration's plan offers much more certainty and would avoid the potential boom and bust cycle. Because it would provide a more stable pattern of investment, drilling costs per foot are expected to be lower under the Administration's plan than under deregulation.

Regulatory Constraints

Regulation per se has a cost that is manifested in bureaucratic costs, industry staff costs and, in costs of delay. Some studies have estimated that costs due to these factors can be substantial and should not be ignored. However, this study has not attempted to estimate this impact.

THE EFFECTS OF THE PLANS ON CONSUMERS

The previous sections have compared costs and benefits of deregulation and the Administration's plan for the nation as a whole. Individual gains and losses from deregulation would vary greatly, depending on whether one is a residential or industrial customer and on whether one is served by interstate or intrastate pipelines. In Table 4 the effects of both plans are summarized for residential and industrial consumers now served by the two markets.

An examination of Table 4 indicates that residential consumers would generally get less gas and pay more under deregulation than under the Administration's plan. Many intrastate residential consumers would be particularly affected.

Generally, under deregulation, the industrial sector—especially those firms served by the interstate pipeline system—would gain at the expense of the residential sector. Assuming no user taxes were instituted under deregulation, interstate industry would get more gas and at lower prices than they would under the Administration's plan. (If user taxes were imposed, industry's costs for gas could be increased up to the level of the Administration's plan.) Intrastate industry would not lose supplies under deregulation, but its growth rate in the short term would be lower than under the Administration's plan.

TABLE 4. EFFECTS OF DEREGULATION AND ADMINISTRATION PLAN ON CONSUMERS: 1980 AND 1985

	1980		1985	
	Deregulation	Adminis- tration Plan	Deregulation	Adminis- tration Plan
Delivered Cost to Interstate Residential Consumers <u>a/</u> (Dollars per thousand cubic feet)	2.98	2.28	3.56	2.51
Typical January Heating Bill (Dollars per month) <u>b/</u>	61.60	43.20	70.00	47.20
Delivered Cost to Intrastate Residential Consumers <u>a/</u> (Dollars per thousand cubic feet)	3.05	2.02	3.31	2.22
Quantity Consumed by Residential and Commercial Sectors (Trillion cubic feet)	7.6	7.9	7.3	8.2
Quantity Available to Interstate Industry (Trillion cubic feet)	3.3	2.7	4.2	3.3
Delivered Price to Interstate Industry <u>c/</u> (Dollars per thousand cubic feet)	1.93	2.69	2.51	3.32
Quantity Available to Intrastate Industry <u>d/</u> (Trillion cubic feet)	3.9	4.2	4.8	4.8
Delivered Price to Intrastate Industry <u>c/</u> (Dollars per thousand cubic feet)	2.25	2.69	2.51	3.32

NOTE: Prices are expressed in 1977 dollars.

a/ Incremental pricing would be used in the Administration's plan, but not under deregulation. Incremental pricing accounts for about half the difference in price.

b/ This computation was based on the demand for heat in January for a typical homeowner (detached, single-family, four-bedroom house) in St. Louis, Missouri. He would need about 20 MCF during the month. This demand approximates the national average for January. The rates for the gas are national average rates for interstate residential consumers.

c/ The estimates include user taxes under the Administration's plan, but not under deregulation. Taxes as proposed in the plan would average \$1.04/MCF in 1980 and \$1.18/MCF in 1985.

d/ The estimate does not include "lease and plant" gas consumed in the field.

If deregulation of new natural gas prices is approved, some of its adverse effects could be moderated by (1) incremental pricing of gas to consumers, (2) passage of a wellhead tax similar to the crude oil equalization tax, and/or (3) a windfall profits tax. Alternatively, deregulation could be phased in over a period of time. A phase-in could also include any or all of the measures listed above. A third basic alternative is to adopt a permanent regulatory policy such as the Administration's plan but, if necessary, to set the ceiling prices at different levels from those of the Administration's plan. This chapter discusses these alternatives.

MODIFICATIONS TO IMMEDIATE DEREGULATION

Incremental Pricing

The essence of any incremental pricing scheme is that gas consumers must pay the incremental production costs required to meet their demands. Because new gas prices are so much higher than old or average prices, the incremental costs are generally high. To a great extent, incremental pricing would correct the problem caused when new gas prices are rolled in with those of already flowing gas. Incremental pricing could be combined either with deregulation or with a policy of continued controls such as the Administration proposes.

There are two general types of incremental pricing. One approach—the method selected in the Administration's plan—would allocate to large consumers all costs in excess of the present average price of new contracts. This would protect small consumers almost entirely and would place all the incremental production costs on large consumers. A second approach—one advocated in the past by the Federal Power Commission (FPC)—would be a form of block-rate pricing in which incremental costs of expensive new contracts would be allocated to an increment of all consumers' demand for

fuel. Under this approach, both large and small consumers would pay the incremental production costs, but any consumer could avoid the incremental costs by reducing his/her consumption.

The objectives of the incremental pricing provision in the Administration's plan are:

- o Buffer residential consumers from price increases. Because residences cannot easily be converted to other fuels, consumers have little choice (other than conservation) but to accept price increases. The Administration's plan would encourage conservation in the residential sector through the use of tax incentives for home insulation.
- o Provide economic incentives for large consumers to convert or conserve. Several studies done for the Federal Energy Administration conclude that conservation in the industrial sector as a result of price increases has, to date, been greater than that in any other sector. The Administration's plan would couple incremental prices with user taxes in order to bring prices for industrial (and utility) consumers to parity with alternative fuels. Over time, it is argued, the industrial consumers would tend to convert to the alternative fuels.
- o Provide resistance to price escalation at the wellhead. Incremental pricing would avoid shielding consumers from high prices that would otherwise occur if distribution utilities were allowed to average in prices of new gas with prices of gas already flowing. This analysis has projected that new gas prices would jump to about \$3.50-5.00/MCF in 1978 under deregulation. Incremental pricing might restrain that jump somewhat and would tend to exert downward pressure on wellhead prices during the 1980s.

Although incremental pricing for every consumer is, in principle, the most economically desirable situation, administration can become costly. The Administration's plan would attempt to achieve most of the economic objectives (e.g. allow prices paid by gas consumers to reflect production costs) and some energy objectives (e.g. inducing "low-priority" users to convert) by applying all of the incremental costs to a designated proportion of consumers.

Incremental pricing would provide similar benefits whether the wellhead prices were controlled or not. In fact, the justification for incremental pricing is even stronger under deregulation because the difference between new and average prices would be greater under deregulation than under the Administration's plan.

Effect of Incremental Pricing on Wellhead Prices. Without incremental pricing, wellhead prices for new gas are expected to surge to somewhere between \$3.50 and \$5.00/MCF in 1978. If certain designated "low-priority" consumers assume the full cost of that price increase, however, their fuel costs could go up by 30 to 60 percent in the first year. CBO expects that, in response to such price hikes, many of the affected consumers would reduce consumption substantially and that within three years the incremental pricing would begin to place downward pressure on the wellhead price of new gas. Incremental pricing would not appreciably affect wellhead prices before 1980, however, because of the large volume of unsatisfied demand in the industrial sector.

Administration of Incremental Pricing. The type of incremental pricing scheme proposed in the Administration's plan is designed so that the two different prices paid by gas users could be easily established. The billing procedures for pipelines and distributors already involve multiple rates for various consumers. By rolling in all incremental costs to designated users, the plan would avoid determination of which gas being consumed was "new," when users consumed it, or how much new gas was consumed. Basically, the incremental pricing aspect of the plan sets only two rates: one for high-priority and one for low-priority users.

Alternative incremental pricing programs can be much more complex, but evaluating them is beyond the scope of this paper.

A Wellhead Tax

Deregulated prices faced by consumers provide incentives to conserve and reallocate resources. In the long run, it is important that consumers face prices that reflect the replacement cost (that is, the BTU value) of the gas. This cost has been established in large part by OPEC's pricing of oil,

not by the domestic production costs of gas. ^{1/} Because of the relatively large gap between world prices and domestic production costs for at least 90 to 95 percent of the gas consumed, the issue is who should capture the difference—the so-called economic rent.

The same issue pertains to crude oil, and a equalization tax has been proposed so that the federal government could rebate the tax to the public. The natural gas situation is somewhat complicated, however, by the existence of long-term fixed price contracts in the gas industry—often as long as 20 years. The analogous equalization tax would thus not be placed on old gas—for which the prices are fixed by contract—but rather on new gas which, in the absence of an equalization tax, could rise above the BTU equivalent. The tax could take any of several basic forms: it could tax all or most revenues over a specific amount, or it could be a flat rate on new production. It could be constant over time, or it could decline. Revenues to producers under several alternative tax approaches are shown in Table 5.

TABLE 5. REVENUES TO PRODUCERS RESULTING FROM ALTERNATIVE TAX POLICIES: IN DOLLARS PER THOUSAND CUBIC FEET

Year	Deregulated Wellhead Price	Tax Policy				
		\$1.50 Constant (100% Tax)	Base (80% Tax)	Increasing Base (100% Tax)	\$1.30 Constant Tax Rate	Decreasing Tax Rate
1978	4.00	1.50	2.00	1.50	2.70	2.70
1980	3.17	1.50	1.83	1.75	1.87	2.07
1982	2.97	1.50	1.79	2.04	1.67	2.04
1984	2.84	1.50	1.77	2.38	1.54	2.05

^{1/} Some gas cannot be produced except at a cost equivalent to that of oil—approximately \$2.50/MCF. However, the amount of this gas is less than 10 percent of the total expected to be on the market by 1985.

The first example outlined in Table 5 would tax all revenues over a constant base of \$1.50/MCF. If the wellhead price in 1978 were \$4.00/MCF, the tax would be \$2.50/MCF and revenues that accrue to the producer would be \$1.50/MCF. If the price changed in subsequent years, the tax would also change, but revenues to the producers would remain constant under this policy. An alternative would be for the tax to take only a proportion of revenues over the base of \$1.50/MCF. If, say, 80 percent of revenues over \$1.50/MCF were taxed, producers would receive a total of \$2.00/MCF in 1978.

The base rate need not be constant. If it were escalating, producers would receive increased revenues, and the tax receipts would decline correspondingly. The third example in Table 5 shows the revenues resulting from a base of \$1.50/MCF that is escalating at a rate of 8 percent per year.

A different approach would be for the tax to be a constant rate, set at an arbitrary level regardless of the price. Producer revenues would accordingly fluctuate with the price. In Table 5, a tax rate of \$1.30/MCF is used. Alternatively, this tax rate could vary. In the last example in the Table, the level of the tax is decreased at an annual rate of 8 percent so that producers' revenues do not fluctuate as widely as they do with a constant tax.

Because prices cannot be predicted accurately for 1978-1980, there is some advantage to a tax of all revenues over a certain amount, so that producers would be able to forecast their revenues. In selecting escalation rates, however, care should be taken that the rate is not so high that it encourages producers to delay production.

The benefits of a wellhead tax are that it would be relatively simple to administer, and it could capture and presumably rebate most of the economic rent. ^{2/} On the demand side, it would provide the desirable incentives. The disadvantage is that it would foreclose production of some high-cost gas. In effect, the industry would continue to face price regulation, but consumers would face free-market prices.

^{2/} Tax revenues in 1980 which would be collected and could be rebated to consumers under each of the five alternatives which are illustrated in Table 5 would be approximately \$12.5 billion for the 100 percent tax over \$1.50/MCF; \$10.5 billion for the 80 percent tax over \$1.50/MCF; \$11.5 billion for the 100 percent tax over an increasing base; \$7.5 billion for the constant tax of \$1.30/MCF; and \$7.0 billion for the decreasing tax rate.

Windfall Profits Tax

A windfall profits tax (WPT) has been proposed to syphon away a portion of the windfall or economic rent gained by the industry if prices of some categories of gas increase substantially. ^{3/} Unlike the wellhead tax, a WPT would not affect revenues to producers at the wellhead. Prices could rise and be passed on without constraints. The tax would reclaim some proportion of the price increase after the fact. One proposed mechanism would exempt revenue gains that are reinvested and tax those that are not. This mechanism would provide a very large incentive toward reinvestment; it might or might not specify or limit the kinds of reinvestment necessary to qualify for exemption.

A WPT has great appeal because of its potential to reclaim some of the windfalls associated with deregulation. The practical difficulties are, however, of such magnitude as to almost preclude its use. The following is a brief summary of the problems foreseen:

- o Definition of a tax base — The determination of what constitutes normal and excess profits. None of the standard definitions of tax bases is well suited to the gas industry, which has been at least partially regulated since 1954 and which is subject to numerous special provisions of the federal tax code.
- o Identification of Profits — Companies that have a large business offshore or in other interstate markets could suffer from rate-of-return limits in comparison with predominantly intrastate firms.
- o Administration — As a practical matter, a WPT in lieu of regulated prices simply shifts the point of regulation from wellhead prices to profits. This could be more onerous to the industry than price regulations because their internal accounting procedures would then be the focus of debate.

This analysis concludes that a WPT is not generally an effective mechanism to recapture economic windfalls. It would be inefficient because much of the windfall could be sheltered by accounting procedures within the

^{3/} An "excess profits" tax in various forms has also been proposed but is not analyzed in this paper because of problems in the definition of what level of profits is "excessive."

industry. The WPT might also encourage some questionable reinvestment in an attempt to avoid the tax. And administering an effective tax would be extremely difficult and burdensome on both the public and private sectors. Consequently, CBO projects that a windfall profits tax would be unable to regain as much of the profits at issue as would continued regulation.

PHASED-IN DEREGULATION

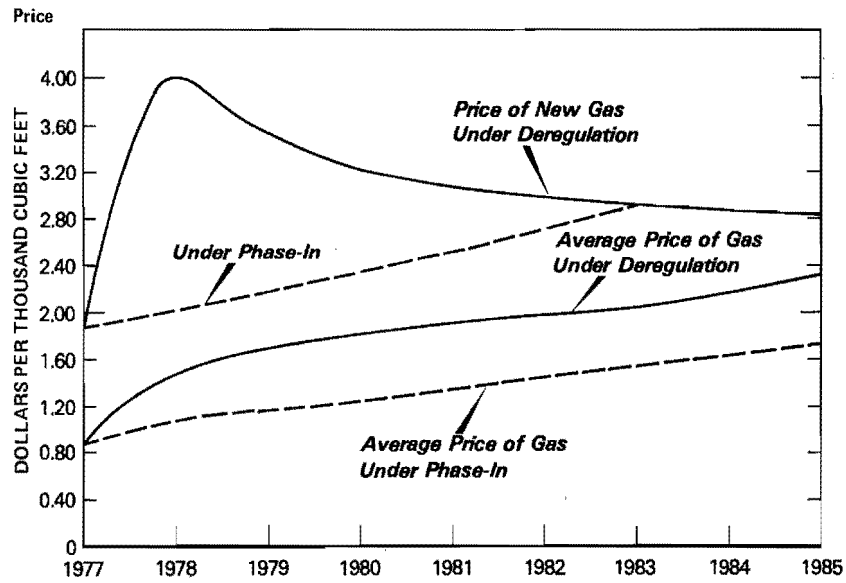
The easiest way to phase in a policy of price deregulation is to use price ceilings that escalate over time. The mechanism could be similar to that proposed in the Administration's plan; however, in the Administration's plan, the proposed ceilings and escalation rate never reach the expected deregulated price. An alternative would be for the ceiling price to escalate at a faster rate until it reaches the equivalent price of alternative fuels. This policy, like the Administration's plan, would require both intrastate and interstate production to be controlled at the same ceiling price. Exclusion of the intrastate market would simply continue the present price imbalance between the two markets. Phased-in deregulation could also be coupled with incremental pricing and with various taxation programs.

The advantage of a phase-in policy over immediate deregulation is that it would avoid many of the costs of deregulation but provide most of the benefits. As pointed out in Chapter II, deregulation is expected to result in a surge in prices for new gas for a few years, followed by a period of price decline until stability is reached. Because investment decisions are based on forecasts of long-run prices, a brief surge in prices is not likely to stimulate much new production. A phase-in would avoid that surge and therefore save money for consumers without significantly reducing production.

In Figure 7, prices for new gas under deregulation and under a five-year phase-in are plotted and compared to the average prices that would result from them. This phase-in policy is specified as "Phase-in I" in Table 6. This particular phase-in policy reduces consumer costs in 1978 by 28 percent compared to immediate deregulation. Average wellhead prices in 1978 are estimated to be about \$1.07/MCF with a phase-in, \$1.49/MCF under immediate deregulation, and \$1.02/MCF under the Administration's plan. 4/

4/ This assumes a starting ceiling price of \$2.00/MCF, increasing at 8 percent per year in real terms to \$2.90/MCF after five years. At that point, market prices are expected to be able to clear and de facto deregulation would occur.

FIGURE 7.
NEW AND AVERAGE PRICES OF NATURAL GAS UNDER
DEREGULATION AND PHASE-IN: 1977-1985



In 1985, average prices would be 22 percent lower as a result of a phase-in policy than they would be under immediate deregulation. (In 1985, the ceiling price would be about \$3.38/MCF, in 1977 dollars. This ceiling would be considerably higher than market prices; thus, in effect, the price would not be regulated.) Revenues to the industry in 1978 would be about \$8 billion less than under immediate deregulation. By 1985, the cumulative difference in revenues would be about \$69 billion less than they would be under immediate deregulation.

Several factors should be considered in the selection of a phase in: the starting point for the ceiling price, the rate at which the ceiling rises, and whether or not incremental pricing is used.

Initial Ceiling Price. In the previous example, a starting ceiling price of \$2.00/MCF in 1978 was used. This is slightly higher than current intrastate prices for new gas. Investment in exploration is more sensitive to the escalation rate and to prices five years in the future than it is to the initial ceiling price; thus, any initial price in the general range of \$1.75 to \$2.15/MCF would have about the same short-term effect, providing that prices after a few years are similar, except that the higher revenues would provide more cash flow to producers.

Escalation rate. The rate of escalation is important because it informs the industry about the level of future prices so that they can plan their investments accordingly. If the escalation rate is slow, deregulation would be delayed. If the rate is rapid, producers could be tempted to delay production until the higher prices are permitted. As a rough rule of thumb, the maximum escalation rate would be about 6 to 8 percent per year in real terms—a rate low enough to avoid creating incentives to withhold gas.

Proponents of a phased-in deregulation usually want to phase in the policy quickly. This might not be feasible or desirable because the price at which the market would clear (and deregulation occur) is unknown. It is preferable to choose an initial ceiling price and escalation rate, and then let the market determine when and how deregulation occurs. In this case, all the economic incentives operate in the preferred direction. If production increases are small and prices remain above \$3.00/MCF, more time would be required to attain market prices. Alternatively, if prices stay below \$2.50/MCF, controls would phase out in just a few years.

TABLE 6. PRICING POLICIES UNDER THE ADMINISTRATION PLAN, IMMEDIATE DEREGULATION, AND ALTERNATIVE PHASE-INS

	1978 New Gas (\$/MCF)	1980 New Gas (\$/MCF)	1985 New Gas (\$/MCF)	Real Escalation Rate (Percent)	Average Price of All Gas in 1985 (\$/MCF)	Savings from Deregulation (Percent)	Production in 1985 (TCF)	Production in 1985 Compared to Deregulation (TCF)	Years Until Deregulation
Administration Plan	175	189	208	2.5	156	29	18.9	-0.9	a/
Immediate Deregulation	400	317	280	—	220	—	19.8	—	—
Phase-In:									
I	200	232	280	8	171	22	19.7	-0.1	5
II	175	200	280	7	164	25	19.6	-0.2	7
III	215	239	280	5.5	177	20	19.7	-0.1	5
IV	200	220	280	5	168	24	19.6	-0.2	7
V	175	193	246	5	161	28	19.4	-0.4	10
VI	150	174	250	7.6	159	26	19.2	-0.6	9

NOTE: Prices are expressed in 1977 dollars.

a/ The Administration's plan would never deregulate prices.

Incremental pricing. As noted in the previous section, incremental pricing can be used with any wellhead pricing policy. Incremental pricing would tend to exert downward pressure on wellhead prices after the first few years. Accordingly, it would accelerate the phase out of controls.

Alternative Phase-In Policies. In Table 6, six different starting prices and escalation rates are tabulated in terms of their estimated 1985 production and cost. These alternative phase-ins are also compared to immediate deregulation and to the Administration's plan.

The key conclusion of this analysis is that any phased in deregulation policy would provide striking reductions in consumer costs, compared to immediate deregulation. The lower the starting point and the slower the phase-in, the smaller the production by 1985; the differences in production, however, are generally small. The lower the starting point, the greater the cost savings to consumers. No scenario that escalated prices faster than 8 percent was evaluated because of the risk of encouraging some producers to delay production.

ALTERNATIVE PRICE CEILINGS

An alternative to deregulation is to continue controls in a way similar to that proposed in the Administration's plan, but with different price ceilings. Deregulation in any form implicitly assumes that domestic gas prices should be set by foreign oil prices. The Administration's plan rejects that assumption. It uses measures such as incremental pricing and user taxes to facilitate market equilibration; therefore, deregulated wellhead prices are not in most cases essential to the pricing of gas at its replacement value.

A major difference between policies involving below-market-level ceiling prices and deregulation is in the flow of funds. Under deregulation, the petroleum industry receives the "producer's surplus," i.e., the difference between production costs and prices. Under a ceiling price, consumers receive the equivalent funds. Under a plan like that of the Administration, the savings are further allocated toward residential and small commercial users by incremental pricing and user taxes.

TABLE 7. PRICING POLICIES UNDER THE ADMINISTRATION PLAN, DEREGULATION, AND ALTERNATIVE CEILINGS

	1978 New Gas (¢/MCF)	1980 New Gas (¢/MCF)	1985 New Gas (¢/MCF)	Real Escalation Rate (Percent)	Average Price of All Gas in 1985 (¢/MCF)	Savings from Deregulation (Percent)	Production in 1985 (TCF)	Production in 1985 Compared to Deregulation (TCF)
Administration Plan	175	189	208	2.5	156	29	18.9	0.9
Immediate Deregulation	400	317	208	—	220	—	19.8	—
Ceiling Price:								
\$1.50	150	150	150	0	117	47	18.5	-1.3
2.00	200	200	200	0	152	31	18.8	-1.0
2.25	225	225	225	0	164	25	19.2	-0.6
2.50	250	250	250	0	171	22	19.4	-0.4

NOTE: Prices are expressed in 1977 dollars.

Several alternative ceilings are compared to deregulation and to the Administration's plan in Table 7. Like the alternative phase-in policies in Table 6, the salient characteristics of these plans are, on the one hand, the large savings in average prices compared to deregulation and, on the other hand, the relatively small loss in production as a result of the ceiling price.

CONCLUSION

If deregulation is desired, some of the principal defects of immediate deregulation could be mitigated by adopting policies such as phased-in deregulation and/or alternative price ceilings, or wellhead taxes and/or incremental pricing, without greatly affecting future production.

