Approved January 11, 1984
Date

MINUTES OF THE Senate COMMITTEE ON Energy and Natural Resources.

The meeting was called to order by Senator Charlie L. Angell at
Chairperson

8:00 a.m./~~p.m.~~ on Tuesday, January 10, 1984 in room 123-S of the Capitol.

All members were present except:
Senator Paul Hess
Senator Ben Vidricksen

Committee staff present:
Ramon Powers, Research Department
Rainey Gilliland, Research Department
Don Hayward, Revisor's Office
LaVonne Mumert, Secretary to the Committee

Conferees appearing before the committee:
Carol Zarley, Kansas Geological Survey

Chairman Angell called the meeting to order. He explained the purpose of a proposed bill concerning water appropriation rights being subject to minimum desirable streamflow requirements (No. 3 RS 1819). The bill provides that all rights applied for or granted after January 1, 1984 will be subject to streamflow standards. Senator Werts moved that the bill be introduced by the Committee, and Senator Roitz seconded the motion. After discussion, the motion carried.

"Natural Gas Price Decontrol: A Comparison of Two Bills" from the Congressional Budget Office (Attachment 1) was distributed to the Committee. The Sub-section on Minimum Desirable Streamflows of the Kansas Water Plan (Attachment 2) was distributed to the Committee.

Staff reviewed Interim Report No. 20 - Natural Gas Issues. Natural gas distribution and regulations were discussed as well as problems of the Hugoton Field. Infill drilling, economic waste, major federal legislation and committee activity and recommendations were reviewed.

Carol Zarley read her written statement on Elasticity of Demand (Attachment 3). She explained that elasticity of demand measures how much the quantity demanded changes in response to price changes. She pointed out she was using the term as an aggregate measure of demand behaviour. She said that natural gas is used both as an essential item and a convenience item. Answering a question from Senator Roitz, Ms. Zarley said that the demand for natural gas has been found to be more elastic than was previously thought. In response to a question from Senator Feleciano, Ms. Zarley said no one has done a comprehensive study on the elasticity of demand for natural gas for Kansas. She told the Committee that some large users have the capability of switching to alternate forms of energy, and the price goes up to the remaining consumers because the fixed costs, which remain constant, are borne by fewer consumers. She also discussed economic waste as being the difference between what a product sells for and what people are willing to pay for it.

The meeting was adjourned at 9:02 a.m. by the Chairman. The next meeting of the Committee will be at 8:00 a.m. on January 11, 1984.

Unless specifically noted, the individual remarks recorded herein have not been transcribed verbatim. Individual remarks as reported herein have not been submitted to the individuals appearing before the committee for editing or corrections.

Senate Energy & Natural Resources
Jan. 10, 1984

Name	Organization
Chip Wheelen	Ks Legis. Policy Group
Carol Zarley	Kansas Geological Survey
David W Nickel	Kansas Corp. Comm.
Jerry Coonrod	KG&E
Don Schnacke	KIOGA
Roy D. Shenkel	K.C.P.&L.
LON STANTON	NORTHERN NATURAL GAS CO.
George A. Sims	Mobil

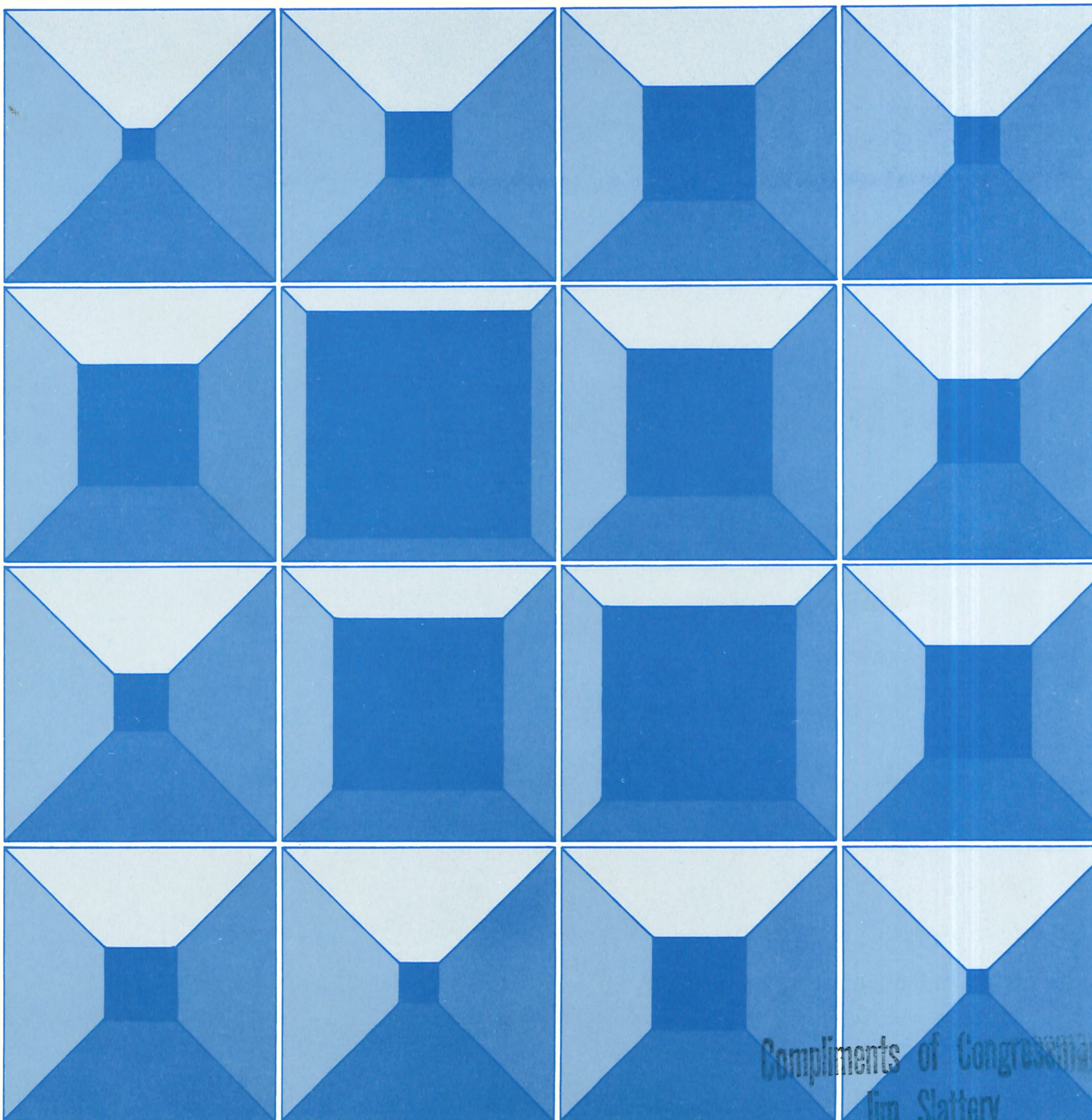
A [illegible]TUDY

November 198

Attachment 1

Natural Gas Price Decontrol: A Comparison of Two Bills

Congress of the United States
Congressional Budget Office



Compliments of Congressma
Jim Slattery

NATURAL GAS PRICE DECONTROL: A COMPARISON OF TWO BILLS

The Congress of the United States
Congressional Budget Office

NOTES

All constant dollar numbers in this report are 1982 dollars, using the Gross Domestic Product deflator projected in the simulation.

All gas prices are expressed in thousands of cubic feet.

PREFACE

The Congress is once again considering natural gas wellhead pricing policy. In previous considerations of this issue, the debate has centered on the issue of redistributing income from consumers to gas producers through decontrol. But since the passage of the Natural Gas Policy Act of 1978, the average price of gas appears to have risen to levels that it would reach in a competitive market. Thus, the issue inherent in the gas decontrol debate may now be how to restore competition to the gas market. At the request of the Fossil Fuels Subcommittee of the House Energy and Commerce Committee, this report examines the effects of two approaches to natural gas pricing policy on the natural gas market and the economy. In keeping with CBO's mandate to provide objective analysis, the report makes no recommendations.

This report was prepared within CBO's Natural Resources and Commerce Division, under the direction of David L. Bodde and Everett M. Ehrlich, the report's author. The estimates found in this report are based on an econometric model of the gas market and the economy developed by Timothy J. Considine, who, together with Mollie V. Quasebarth, prepared the computer simulations. Mark Prell developed the submodel estimating gas exploration and production, and Paul McCarthy provided research assistance. The author wishes to thank several reviewers for valuable comments, including Dr. Harry G. Broadman of Resources for the Future, various members of the Department of Energy's Office of Economic Analysis, Dr. Raymond Scheppach of the National Governors Association, Peter M. Taylor of CBO's Fiscal Analysis Division, and Kathleen Gramp of CBO's Budget Analysis Division. Responsibility for errors, however, remains with the author. Patricia H. Johnston edited the manuscript, which was typed and prepared for publication by Philip F. Willis.

Rudolph G. Penner
Director

November 1983

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APPENDIX TABLE

SUMMARY

As the Natural Gas Policy Act of 1978 approaches its 1985 partial deregulation date, the Congress is once again considering natural gas pricing policy. In the past, the debate over gas pricing has focused on the question of whether consumers should bear the burden associated with a rise in gas prices to the "free-market" level. But today, substantial evidence exists that the average price of gas has already risen to the level it would reach if gas competed freely with oil. Thus, the major issue in gas pricing policy today may be how to improve the efficiency and competitiveness of the gas market, rather than the redistribution of income from consumers to gas producers.

This report examines two approaches to gas pricing policy, the decontrol provisions found in S. 1715, as reported by the Senate Energy and Natural Resources Committee, and the extended controls found in legislation proposed by Congressman Gephardt (H.R. 2154). These bills are compared to the existing provisions of the Natural Gas Policy Act of 1978 (NGPA), which serves as the base case. The NGPA allows much of the nation's gas to reach a competitive price in 1985, but preserves controls on some gas, notably low-cost gas from older fields sold in interstate markets.

The results of this analysis indicate that, by 1990, the gas price differences resulting from these three measures are slight, and that the effects of the two new proposals on the natural gas market and on the economy, are often negligible when compared to the NGPA. Using the base oil assumptions found in this report, the average current dollar price of gas delivered to local distribution companies (the "city-gate" price) in 1990 would rise to $6.00 per thousand cubic feet under the NGPA, $6.01 under the Senate bill, and $5.98 under the Gephardt proposal. Both the Senate and Gephardt proposals would result in slightly higher economic output (as measured by the Gross Domestic Product) in the mid-1980s when compared to the NGPA, but by 1990, these differences would be negligible. 1/

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1. Gross Domestic Product (GDP) is a national income concept based on production within the geographic borders of a country. Gross National Product (GNP) covers production by and incomes to citizens of a country no matter where they live. GDP is used in this report because changes in gas prices would not appreciably affect income earned from foreign sources.

The differences between the two proposals are somewhat more pronounced with regard to gas markets. By encouraging domestic production--and particularly by promoting the extended development of older, larger gas fields--the Senate bill would result in higher levels of domestic gas reserves and lower gas imports. The effects of the Gephardt proposal would be the reverse--production and reserves would drop while imports would rise. Since gas imports are assumed to remain more expensive than domestic supplies in this analysis, the rise in imports under price controls and their fall under decontrol contribute to the converging trend in average prices under these two approaches. An overview of the results of this paper is present in Summary Table 1.

CURRENT STATE OF THE GAS MARKET

The differences between the effects of the Senate and Gephardt bills would be small because gas prices, despite current regulation, have already risen to levels equal to those that would arise if gas and oil competed freely. Understanding how this occurred necessitates understanding recent developments in the gas market.

In 1978, the Congress passed the Natural Gas Policy Act (NGPA). The NGPA created price ceilings for older, cheaper gas while permitting the eventual deregulation of various categories of newer and higher-cost gas. One of these (Section 107, or "high-cost" gas) was deregulated immediately. The legislation sought to bring the average price of gas to the equivalent of the price of oil (then projected to be about $15 per barrel in 1977 dollars) by 1985. Unfortunately, the framers of the act did not envision that oil prices would rise substantially in the interim. With this oil price increase, the NGPA became a new system of controls that held gas prices below their oil equivalent level, rather than gradually phasing up gas prices to a decontrolled level. 2/

In this environment, gas pipelines were eager to secure new supplies to meet growing demand for the cheaper gas. Since they enjoyed an endowment of old gas under controlled prices, pipelines could afford to pay premi-

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2. The "oil-equivalent" price of gas is the price that gas would achieve if it were to compete freely with oil. It is assumed to be the price of oil used by manufacturers, calculated on a Btu basis, minus the average costs of transporting gas from the gas field to its point of use. If all gas were priced at the oil-equivalent level at the wellhead, therefore, gas and oil would cost the same amount per Btu when burned in the manufacturing sector.

SUMMARY TABLE 1. GAS PRICES, GAS MARKET EFFECTS, AND ECONOMIC EFFECTS UNDER THE NGPA, THE SENATE BILL, AND THE GEPHARDT BILL, CALENDAR YEARS 1984-1990.

	1984	1985	1986	1987	1988	1989	1990
NGPA Base Case							
Average city-gate price (in current dollars per thousand cubic feet)	4.17	4.49	4.75	5.08	5.38	5.69	6.00
Domestic reserve additions (in trillions of cubic feet)	14.2	15.3	14.9	14.1	13.4	12.9	12.4
Gas consumption (in trillions of cubic feet)	17.3	17.1	17.1	17.1	17.3	17.3	17.2
Gas imports (in trillions of cubic feet)	0.9	1.6	1.7	1.9	1.9	1.9	2.0
	Changes from NGPA Base Case						
Senate Bill							
Average city-gate price (in current dollars per thousand cubic feet)	-0.24	-0.20	-0.05	0.08	0.06	0.03	0.01
Domestic reserve additions (in trillions of cubic feet)	0.5	0.4	0.8	1.7	1.9	1.8	1.7
Gas consumption (in trillions of cubic feet)	0.2	0.2	0.1	0.0	0.0	0.0	0.0
Gas imports (in trillions of cubic feet)	-0.1	-0.2	-0.3	-0.4	-0.5	-0.5	-0.6
Real gross domestic product (GDP, percent change in level)	0.16	0.11	0.02	-0.06	-0.02	0.01	0.03
Price level (GDP deflator, percent change)	-0.31	-0.26	-0.09	0.08	0.08	0.06	0.04
Gephardt Bill							
Average city-gate price (in current dollars per thousand cubic feet)	-0.38	-0.38	-0.33	-0.02	-0.04	-0.04	-0.02
Domestic reserve additions (in trillions of cubic feet)	-0.7	-1.7	-2.2	-0.9	-0.6	-0.5	-0.5
Gas consumption (in trillions of cubic feet)	0.3	0.4	0.4	0.2	0.2	0.2	0.1
Gas imports (in trillions of cubic feet)	0.6	0.2	0.7	0.6	0.5	0.6	0.7
Real gross domestic product (GDP, percent change in level)	0.24	0.20	0.15	-0.06	-0.03	-0.01	-0.01
Price level (GDP deflator, percent change)	-0.51	-0.49	-0.46	-0.08	-0.07	-0.05	-0.02

um prices for new higher-priced gas, which could be averaged with the cheaper gas supplies. Moreover, pipelines had lost many of their customers when they were unable to deliver gas during the gas shortage in the winter of 1976-77 and wanted to secure new reserves to avoid a repetition. Thus, pipelines signed contracts with a variety of provisions that forced them to assume a high level of risk. Most notable are take-or-pay provisions, which obligate pipelines to pay for higher-priced gas even if they cannot use it and cheaper gas supplies are available. Other contracts include clauses that tie the price of gas upon deregulation to prices well above the oil-equivalent price, such as 110 percent of the price of distillate (home heating) oil, or the average of the highest three prices found in the region.

The recession of 1981-82 and the resulting decline in oil prices changed gas market conditions. As pipelines were forced to buy more and more high-cost gas and as the price of oil fell, average gas prices reached the level at which gas was as expensive to burn as oil. This can be seen by the fact that the average price of high-cost gas contracts is falling, that many such contracts are being renegotiated, and that gas is losing customers to oil, particularly industrial users. But while pipelines were unable to sell all of their gas, their take-or-pay provisions went into effect. Obligated to buy newer, more expensive supplies, pipelines often had to cut back on cheaper sources. Last winter, gas costs rose rapidly, in part because of these take-or-pay obligations. Moreover, because of contract rigidities, there is a surplus of lower-priced gas in the market. Gas decontrol, therefore, could potentially lower gas prices if it allowed pipelines to resequence their purchases of gas supplies from higher- to lower-priced gas or to renegotiate their contracts.

Policy Options

Two alternative legislative approaches to gas pricing policy are now before Congress. H.R. 2154, submitted by Congressman Gephardt (with a comparable but not identical proposal submitted by Senator Kassebaum) seeks to roll back gas prices and delay the partial deregulation found in the NGPA by two years (assuming immediate enactment, this would move the NGPA's deregulation date to January 1, 1987). S. 1715, reported by the Senate Energy and Natural Resources Committee, would decontrol all gas by 1987 and would encourage the renegotiation of gas contracts, allowing the gas market to be reordered. In this report, the effects of these two proposals are compared to the anticipated effects of the NGPA.

METHODOLOGY AND ASSUMPTIONS

This analysis involves two interrelated steps: estimating the price of gas under the NGPA, the Senate bill, and the Gephardt bill, and then estimating the effects of these prices, combined with other provisions found in the bills, on the economy and on the gas market.

The NGPA and the Gephardt bill, which essentially delays the provisions of the NGPA by two years, divide the nation's gas supply into nine major categories, or "sections." Some of these are to be deregulated (in 1985 under the NGPA, in 1987 under the Gephardt bill), while others are to be regulated in perpetuity. Regulated gas would follow a series of price paths tied to the rate of inflation by the law. This analysis uses those prices to establish the NGPA base case. The price of deregulated gas was determined by assuming that gas, once delivered to local distribution companies (at what is called the "city-gate" price), was equal in price per Btu to oil purchased in the manufacturing sector--the so-called "oil-equivalent" level. Once regulated and deregulated gas prices were estimated, the relative shares of each under the NGPA and Gephardt bills were calculated based on similar projections made by the Energy Information Agency. 3/

Prices under the NGPA and Gephardt bills also reflect assumptions regarding contract provisions. Contracts now in place have a variety of provisions that could lead gas prices to untenable levels upon deregulation. Many of these contracts were written in the 1970's, when pipelines feared running short of gas supplies. These provisions sometimes call for gas to be priced at 110 percent of the value of distillate oil, or equal to the three highest prices found in the region. If these provisions were to be honored universally, many pipelines would be in great financial jeopardy. Thus, it was assumed that these contracts were renegotiated to allow prices to rise to the oil-equivalent level upon decontrol. The exception to this rule is the price of Section 107 high-cost gas, which is already priced above the oil-equivalent price; it was assumed to fall to $4.50 per thousand cubic feet in 1985 under the NGPA (it remains regulated under the Gephardt bill). The price of imported gas was assumed to remain at its present level in constant dollars. While there are strong pressures for renegotiation of foreign gas contracts, no assumption could be made regarding the outcome of these international negotiations.

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3. Department of Energy, Energy Information Administration, The Current State of the Natural Gas Market, DOE/EIA 0313 (December 1981).

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Prices under the Senate bill reflect that measure's provisions. The bill would deregulate some gas immediately, and phase most of the rest towards a free-market "indicator" price by 1987. The indicator price is equal to the average price of gas sold under contracts written in the previous six months. This analysis assumes this price to be the oil-equivalent price of gas. All expensive gas would be phased down to that level in one year, and all cheap gas up to that level in three. The Senate bill would also allow pipelines and producers to reach new agreements in a competitive context. Thus, once again, it was assumed that contracts would be renegotiated to permit gas prices to reach the oil-equivalent level as the Senate bill phased out price controls.

A final important assumption is that local gas distribution companies, under the direction of state regulatory commissions, do not assign residential users a disproportionate part of any price increase associated with changes in pricing policy. Since residential users are often willing to pay higher gas prices than industry users (because home heating oil costs more than industrial fuel), some state regulators might consider charging them a higher price in order to keep local business costs low. This analysis assumes that the distribution of costs between these two groups is consistent with past patterns.

The second step of the analysis involves estimating the economic and gas market effects of these proposals, using an econometric model. The model estimates the demand for inputs--such as capital, labor, energy, and materials--in each sector of the economy. When energy prices change, the model reallocates consumer expenditures among sectors, and then changes each sector's demand for inputs. This allows the model to calculate the economy's demand for capital and labor, which allows it to estimate national income and unemployment and total energy demand. Once energy demand is estimated, the model breaks it down into demands for specific fuels, such as natural gas.

The model also estimates gas supplies by estimating the rate at which gas reserves (both new reserves and extensions of old ones) are sought and discovered. These reserves are then depleted to form supplies. When domestic gas supply and demand change, the model changes gas imports to accommodate them. But since gas imports are more expensive than domestic gas, the model recalculates average gas prices and restarts the process until it reaches a solution.

One final caveat is in order. In theory, macroeconomic modeling resembles a science, but in practice it is more of an art and is, therefore, less precise. Results obtained from different models will differ as do the models themselves. Many of the results presented in this analysis depend critically on important parameters, such as the responsiveness of gas supply and demand to changes in price, and on critical assumptions. Consequently, the estimates presented in this analysis should not be construed as unerring and definitive statements of the effects they represent. They do, however, strongly indicate the magnitude and direction of those effects.

RESULTS

Summary Table 1 presents the effects of the Senate and Gephardt bills compared to the NGPA. Under the NGPA, average current dollar city-gate prices are projected to rise by 51 percent (or by 10 percent in constant dollars) from 1983 to 1990. While natural gas consumption is projected to remain constant, domestic reserve additions would fall. Gas supplies consequently fall, resulting in higher gas imports.

The Senate bill would result in immediate price relief when compared to the NGPA, since it would allow for extensive renegotiation of gas contracts and, therefore, permit excess gas supplies to put downward pressure on prices. By 1987, however, prices under the Senate bill would catch up to NPGA levels, and by 1990 they would be roughly equal. By allowing the resequencing of gas supplies and by equalizing the long-term average price received by all gas producers, the Senate bill would expand both reserve additions and supplies. Under the Senate bill, cumulative reserve additions for 1984-1990 would be 8.8 trillion cubic feet higher than under the NGPA, roughly equal to one-half year's consumption. The actual supply response under the Senate bill may be smaller than these estimates, however, since the NGPA gives the Federal Energy Regulatory Commission the authority to offer higher "incentive prices" to gas in price-controlled categories. Potential new supplies generated in response to these incentive prices, however, were not incorporated in this report's simulations of the NGPA. Gas imports would decline by 0.6 billion cubic feet in 1990 in response to higher domestic gas supplies, producing an exportable surplus. The Senate bill would also lead to modest improvements in real economic activity and small reductions in price levels in 1990, when compared to the NGPA base case. These macroeconomic effects, however, are generally very small.

The Gephardt bill, in contrast, would sacrifice some reserves and supplies in exchange for a small but further decline in the price of gas in the mid-1980s. Gas prices would be lower between 1984 and 1986 under the Gephardt bill than under the NGPA or the Senate bill. But by 1990, city-gate gas prices would converge under all three cases. Lower wellhead prices under the Gephardt bill, however, would discourage reserve additions by a cumulative 7.1 trillion cubic feet over the 1984-1990 period. Thus, 1990 gas imports would rise to 2.7 trillion cubic feet (16 percent of domestic consumption) under the Gephardt bill.

The Gephardt bill would result in a small increment in real Gross Domestic Product (GDP) and smaller increases in the price level between 1984 and 1986 when compared to the NGPA. But all the differences among these bills are eliminated by 1990, the end of the analysis period. Under the Gephardt bill, old gas would eventually be depleted and replaced by new, higher-priced gas, increasing average wellhead prices. Growing gas imports would also increase the average prices paid by consumers. Under the Senate bill, higher domestic supplies would reverse this import effect, and could increase the likelihood of successful renegotiation of foreign gas contract prices, although this effect was not assumed for this analysis.

Effects of Higher and Lower Oil Prices

Because oil prices are central in determining gas prices, this analysis examined the sensitivity of its results to changes in oil prices. The base oil price assumption sets oil prices at a level of $27.59 per barrel (in constant dollars) from 1984 to 1990. Under an assumed low oil price path, oil prices fall to $21.22 per barrel (in constant dollars) by 1986, and remain at that level through 1990. A high oil price path assumes that oil prices rise to $32.31 per barrel (in constant dollars) in 1986 and remain at that level to 1990.

While higher and lower oil prices change the NGPA base case dramatically, they do not appear to expand the differences between the NGPA, on the one hand, and the Senate and Gephardt bills, on the other. In fact, these differences essentially would disappear by 1990. Under low oil prices, current gas prices are unambiguously above oil prices. The differences between the Senate, Gephardt, and NGPA measures are strictly related to how quickly they fall. Under high oil prices, the Senate bill would yield higher gas prices than the Gephardt bill throughout most of the 1980s. But the supply response to higher gas prices under the Senate bill is great enough to more than eliminate more costly gas imports. These added supplies would glut the domestic market and push prices downward in constant dollars by 1989, and in current dollars by 1990. Thus, under high oil prices, the major difference between the Senate and Gephardt bills would appear in reserve additions--cumulative reserve additions from 1984-1990 would be 18.4 trillion cubic feet higher under the Senate bill, and 10.4 billion cubic feet lower under the Gephardt bill, when compared to the NGPA.

CHAPTER I. INTRODUCTION AND BACKGROUND

The Congress is once again considering natural gas pricing policy. The Senate Energy and Natural Resources Committee has reported a bill (S. 1715) that would lead to complete decontrol of natural gas prices at the wellhead in 1987. The House Energy and Commerce Committee is in the process of marking up comparable legislation. At the same time, a major legislative proposal by Congressman Gephardt (H.R. 2154) would reestablish controls on wellhead gas prices by, in effect, postponing for two years the provisions found in current law. (A similar but not identical proposal has been submitted by Senator Kassebaum). This analysis compares these two major legislative approaches--the Senate Committee and Gephardt bills--and their effects on the natural gas markets and the economy.

Historically, the issue in natural gas pricing policy has been whether consumers should have to bear the burden of allowing gas prices to rise to "free-market" levels. But this concern may no longer be valid; rather the problem now may concern how to create competitive conditions in the natural gas market.

Much evidence exists that the average price of natural gas has already risen to levels at or near the price it would reach if gas competed freely with oil and other fuels (called the "oil-equivalent" price). But while the average price of gas probably has risen to this level, the prices received by individual gas producers (and, to a lesser extent, paid by individual gas consumers) vary widely because of the variety of gas price ceilings found in current law. Moreover, because of the rigidities in current contracts, many pipeline companies now have to buy gas from expensive sources when lower-cost alternatives exist. Thus, the issue currently underlying the gas decontrol debate is less whether income will be redistributed from gas consumers to gas producers (although gas decontrol will change the gas prices consumers pay, depending on the particular transmission pipeline that serves them) than it is the redistribution of existing gas revenues among gas producers and pipelines. Understanding this evolution requires understanding current gas pricing policy and special gas contract provisions and how these factors have interacted with rapidly changing conditions in gas markets.

RECENT DEVELOPMENTS IN THE NATURAL GAS MARKET

For almost 50 years, the natural gas market has been subject to controls. These have led to changed behavior by gas producers, pipeline companies, and consumers; unintended economic effects; and unanticipated administrative burdens and judicial interpretations. All of these side effects, in turn, have led to new or different controls. As a result, the gas market now reflects political and regulatory decisions as much or more than it does economic signals regarding supply, demand, and prices.

The Congress first introduced controls into the gas market in the Natural Gas Act of 1938 (NGA). The NGA sought to restrain the monopolies enjoyed by the gas pipelines that delivered natural gas from the wellhead to local distribution companies and end users. It did so by regulating the rate of return these pipelines could earn and established the Federal Power Commission (FPC—now the Federal Energy Regulatory Commission) to administer the NGA. The scope of the NGA was expanded in 1954 by a Supreme Court decision that required the FPC to regulate prices charged by natural gas producers as well as pipelines in the sale of interstate gas. The FPC initially sought to do so on a case-by-case basis, but the resulting administrative burden was overwhelming. It therefore established regional wellhead price ceilings for gas, based on average production costs in each region, a concept upheld by the Supreme Court in 1968.

But the regulation of interstate gas prices led to different prices for interstate and intrastate gas. Since interstate gas was subject to price controls, and therefore cheaper, the demand for it began to exceed its supply. At the same time, since intrastate gas was allowed a higher, free-market price, consumers in gas-producing states were able to bid supplies away from their out-of-state counterparts. The discrepancy between interstate and intrastate prices was exacerbated by the OPEC oil price increase of 1973-1974. By the winter of 1976-1977, interstate gas shortages became prevalent, and the Congress began to reexamine gas pricing policy.

The result of this reexamination was the Natural Gas Policy Act of 1978 (NGPA). The NGPA brought interstate and intrastate gas under a common set of regulations. It maintained price ceilings for older, cheaper gas, while either deregulating immediately or establishing paths to the eventual deregulation of various categories of newer and higher-cost gas in order to provide incentives for new gas production. Moreover, the legislation sought to raise gradually the price of most gas to the equivalent of the act's projected price of oil by 1985--about $15 per barrel in 1977 dollars. With the eventual depletion of older gas fields, and the ensuing shift to deregulated newer gas, many proponents of the act saw it as a program of "phased decontrol."

What the framers of the act did not envision was that the price of oil on which the act was predicated would rise substantially in the interim. By 1980, oil prices reached $30 per barrel and more, and the NGPA became, in effect, more like a new system of price controls than a phased decontrol program. But the controls the NGPA inadvertently placed on rising gas prices were undermined by the fact that some gas--termed "high-cost" gas under section 107 of the NGPA--was already decontrolled. Gas pipeline companies could contract to buy this category of more readily available gas at prices far in excess of market prices and average in its cost with the cost of cheaper, regulated gas. Thus, while the NGPA did not allow for the deregulation of all gas, it did permit circumstances in which the average price of gas could rise as if all gas had been decontrolled. A numerical example illustrates this process. Suppose a pipeline can sell 400 billion cubic feet of gas at a price of $4 per thousand cubic feet. If its existing contracts provide it with 300 billion cubic feet of regulated gas at a cost of $1 per thousand cubic feet, the pipeline can afford to pay as much as $13 per thousand cubic feet for the remaining 100 billion cubic feet and still charge its consumers an average price of $4.

In fact, pipelines did exactly that--by June 1982, the price of decontrolled gas from deep reservoirs (so-called high-cost gas) rose to $7.41 per thousand cubic feet, substantially above the market-clearing price--that is, the price at which supply and demand would balance in an unimpeded market. Moreover, in their attempts to secure these high-cost supplies for the long term, many pipeline companies signed "take-or-pay" provisions with producers that obligated them to pay for gas even if it could not be marketed. Pipelines have significant incentives to secure supplies in this fashion because of their regulatory treatment; FERC allows pipeline companies to earn a return on the value of their pipelines only if they can demonstrate that they have contracted for enough gas reserves to keep the pipeline "used and useful." In addition, FERC prohibits large gas consumers from contracting for gas from a pipeline unless it can demonstrate its ability to satisfy their needs for many years to come. This particular concern arose because of the natural gas shortages of the mid-1970s when many pipelines were unable to meet their commitments to customers. Thus, gas pipelines were encouraged by regulation and economic conditions to secure large amounts of gas at prices above those sustainable in competitive markets and to guarantee the purchase of that gas through long-term contracts.

The recession of 1981-1982 and the simultaneous worldwide decrease of oil demand, however, dramatically changed conditions in the gas market. Gas prices historically had been lower than their oil-equivalent prices. But as more and more high-cost gas was contracted by pipelines and as the price of oil fell during the recession, the gap between oil and gas prices rapidly closed, and gas prices approached the level at which gas was as expensive to burn as oil. (This was particularly true in the industrial boiler market, in which gas competes with residual oil, a relatively cheap petroleum product). Gas prices now appear to have risen to levels at which they rival other fuels. This is demonstrated by the fact that the average price found in new contracts for high-cost gas fell by about $1 per thousand cubic feet from June 1981 to June 1982. Moreover, many pipelines are now renegotiating downward the prices they pay to gas producers. These price declines are evidence that demand for relatively higher price gas has fallen and that pipelines can no longer raise the price of gas paid by their customers. As pipelines found themselves unable to sell all their gas, their "take-or-pay" provisions went into effect. Obligated to buy new and more expensive supplies, pipelines were often forced to cut back their purchases of less expensive gas, precisely the opposite of the sequence that would presumably occur in a competitive market.

Under decontrol, therefore, gas prices would fall further only if pipelines could reorder the purchasing of their supplies, buying lower-cost gas before more expensive gas. With the soft gas market, a considerable amount of low-cost gas currently is available on the market, but pipelines often cannot buy it because their existing contracts lock them into more expensive purchases. This problem might be addressed through legislation that would allow pipelines to dissolve their contracts with high-cost producers or, short of that, to pressure high-cost gas producers to negotiate their prices downward. Thus, if pipelines can achieve this flexibility, then the oversupply of gas now available in the domestic market would force gas prices down, as it would in a competitive market.

This is the context within which the Congress is reconsidering gas pricing policy. Decontrolling the wellhead price of all gas might not lead to immediate increases in average gas prices if competition from oil prevents pipelines from passing on these higher prices to their customers. Given this strong competition from oil, pipelines have the incentive to search for lower gas prices if the law and their contracts allow them to.

But while gas prices have the potential to fall, gas supplies could nonetheless increase. If pipelines could escape from their high-cost gas contracts and resequence the purchase of their supplies (either in courts, through other contract provisions, or through Congressional action), natural gas wellhead price decontrol could result in a substantial redistribution of revenues within the natural gas industry--producers of high-cost gas would suffer while producers of low-cost, older gas would receive a substantially higher price. By redirecting revenues from high-cost to low-cost producers, decontrol might encourage a more efficient search for gas supplies and, therefore, result in both higher levels of domestic gas reserves and possible price decreases. Equalizing national wellhead gas prices, therefore, might be one way to increase the long-term availability of natural gas. However, equalizing the wellhead prices of all the nation's gas would change the prices that many consumers pay, depending on whether the pipelines that serve them have high- or low-priced gas under contract and whether they can recontract their supplies.

This analysis focuses on the NGPA and two major alternative gas pricing proposals--the Senate bill (as reported by the Energy Committee) to decontrol gas prices and the Gephardt proposal for recontrol. The major questions it seeks to answer are:

- Will the proposal change the average price of gas?

- How will the proposal affect natural gas markets, including consumption and supply decisions?

- What will be the economic effects of the proposal?

One important issue that this paper does not address is the redistribution of income among consumers. An examination of the prices paid by consumers in individual regions or served by individual pipelines is beyond its scope.

PLAN OF THE PAPER

Chapter II presents a projection of the natural gas market and the economy under current policy (the NGPA), and then analyzes the effects of the two alternate proposals on the gas market and the economy. Economic effects are presented in the form of changes from the CBO five-year forecast. 1/ It also discusses the methodology and assumptions underlying these estimates. Chapter III then examines the sensitivity of these results to changes in the price of oil.

The reader is also directed to other recent CBO publications in this area. In January 1983, the CBO published Natural Gas Pricing Policies: Implications for the Federal Budget. That report presents results comparable to those found in this paper for typical decontrol options. Appendix A

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1. These projections were presented in CBO, The Outlook for Economic Recovery, February 1983, and were updated in CBO, The Economic and Budget Outlook: An Update, August 1983. See Table 4 of this chapter for further explanation.

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of that report, "Natural Gas Regulatory History and Contract Provisions," is reprinted here for those who wish to read a more complete description of these subjects. In April 1983, the CBO published Understanding Natural Gas Price Decontrol, a report that describes the history of natural gas regulation in greater detail, and discusses the various facets of the decontrol problem. In addition to these two papers, a forthcoming technical paper, entitled An Empirical Analysis of Energy Economy Interactions, provides documentation for the econometric model used by the CBO in this analysis.

CHAPTER II. EFFECTS OF THE SENATE AND GEPHARDT BILLS

This chapter estimates the effects of the natural gas wellhead pricing provisions found in the bills reported by the Senate Energy and Natural Resources Committee (S. 1715, hereafter, the Senate bill) and proposed by Congressman Gephardt (H.R. 2154), compared to those that occur under the Natural Gas Policy Act (NGPA). It first discusses the assumptions and methodology underlying the estimates and then presents them. A third section analyzes major features of the two bills that concern issues other than wellhead pricing. Although these features (which mainly address changing contract provisions) are important, they cannot be precisely incorporated into econometric simulations of the bills.

In general, when compared to the NGPA, the macroeconomic effects of both the Senate and Gephardt proposals are very small--in many cases, negligible. These small differences can be attributed to the fact that gas prices under the NGPA's phased decontrol have already risen to the range that they would reach in a competitive market. In fact, decontrol under the Senate proposal would actually lower prices in the several years following its enactment by allowing the gas market the opportunity to "reorder" itself--that is, pipelines would have the freedom to renegotiate contracts with producers in order to buy low-priced gas before high-priced gas. Many of the pipeline's current contracts are with producers of high-priced gas and require the pipelines to purchase this gas whether or not the pipelines can resell it at the higher prices. Prices also would fall under the Gephardt bill, but more because of the reintroduction of controls rather than the reordering of gas supplies. However gas decontrol is implemented, its effects would certainly not be comparable to the dramatic increase in oil prices resulting from their decontrol in 1979.

The more sizable differences between the two proposals would occur in the natural gas market. By redistributing revenues from more expensive gas sources to cheaper ones, the Senate bill would encourage additions to domestic gas reserves and, in turn, supplies, thus lowering gas imports. By maintaining the dichotomy between high- and low-priced gas, the Gephardt proposal would do the opposite and, consequently, would result in larger gas imports. Yet even these effects would not be very large--by 1990 the difference in domestic gas reserves between the Senate and Gephardt bills would be less than one year's gas consumption. It should be noted, however, that the natural gas market effects of these two proposals would grow until old gas was depleted (presumably in the early 1980s) under the Gephardt bill, at which point they would converge.

ASSUMPTIONS AND METHODOLOGY

The analysis presented in this report involves two interrelated steps:

- o Annual gas prices must be estimated under the NGPA, the Senate, and the Gephardt bills; and
- o Based on these estimates, economic and natural gas market effects must be calculated.

As current law, the NGPA serves as the base case for this analysis. The effects of the Senate and Gephardt bills are shown as changes either from this base case or, for macroeconomic effects, from the CBO baseline projections. 1/

Gas Prices

Prices under the NGPA were determined in the following manner. The NGPA divides all of the nation's gas into categories according to nine major sections. The NGPA then stipulates prices for each of these sections--some are allowed to grow at the rate of inflation, some at the rate of inflation plus some growth premium, and one section (Section 107, or "high-cost" gas), was deregulated immediately in 1978. The provisions of the NGPA allow some sections to be deregulated on January 1, 1985, and the rest, including old, low-priced gas, to remain regulated (but allowing prices to rise at the rate of inflation) in perpetuity.

To establish the NGPA base case, CBO developed price projections for gas under each section of the NGPA. The price of gas deregulated in 1985 was determined by assuming that gas, once delivered to local distribution companies (at "city-gate" prices), was equal in price per Btu to the price of oil purchased by manufacturing firms (or, the oil-equivalent price), in which use gas most directly competes with oil. To determine the average wellhead price of gas, projected pipeline transmission costs were subtracted from this

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1. These projections were presented in Congressional Budget Office, The Outlook for Economic Recovery (February 1983); and were updated in The Economic and Budget Outlook: An Update (August 1983). See footnote d of Table 5 of this chapter for further explanation.

oil-equivalent price. Projections of the quantity of gas available in each section were then developed, based on similar projections made by the Energy Information Administration. 2/ In general, gas prices rise slightly more rapidly than the price of oil following the NGPA's decontrol in 1985 because low-priced gas comes from older fields and, therefore, would be depleted and replaced by newer supplies whose price reflects the price of oil.

Prices under the NGPA are also influenced by the assumptions made about contract provisions. As discussed in Chapter I, contract provisions are now the subject of a variety of legal proceedings, and many contract prices are being renegotiated downward. In the absence of renegotiation, many gas pipelines would be locked into contracts that tied the price of gas, upon deregulation, to prices in excess of oil-equivalent levels (such as 110 percent of the price of distillate fuel). If these contracts were honored, many pipelines would face substantial load loss and some would be in danger of bankruptcy. Thus, it was assumed that renegotiation would permit deregulated gas prices to reach oil-equivalent prices, rather than prices above that level. The exception to this assumption, however, is the price of high-cost (Section 107) gas, which is now above the oil-equivalent price but is decreasing as market pressures force pipelines to renegotiate. The price of Section 107 gas is therefore assumed to fall from $6.04 per thousand cubic feet in 1983 to $4.50 in 1985, and to remain thereafter at that level in current dollars.

An additional assumption concerns the price of imported gas. Imported gas is now more expensive than its average domestic counterpart, but indications are that its price also may be renegotiated downward over the next several years. This analysis, however, did not assume that further renegotiation would take place, given the international political issues involved. Thus, gas imports are assumed to cost about $4.42 per thousand cubic feet in constant (1982) dollars throughout the projection period.

Price levels under the Senate bill reflect the pricing guidelines found in that bill. The bill would deregulate some gas immediately, and phase the price of the rest of domestic gas production towards an "indicator price," which would be reached by 1987. This indicator price of decontrolled gas at the city gate was, again, assumed to be the heat-equivalent price of oil, that is, the price of delivered gas was assumed to reach the price of oil in the manufacturing sector on a per Btu basis. This assumption is discussed in

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2. Department of Energy, Energy Information Administration, The Current State of the Natural Gas Market, DOE/EIA 0313 (December 1981).

greater detail in the section describing the Senate bill. Prices under the Gephardt bill also reflect the provisions found in that bill. Specifically, the Gephardt bill postpones the decontrol provisions of the NGPA until January 1, 1987, at which time the price of gas that is decontrolled reflects the price of oil.

Gas prices in this analysis, therefore, depend on the price of oil. The higher the price of oil, the higher gas prices will be upon decontrol. Higher gas prices, in turn, increase the magnitude of the effects of decontrol. The results presented in this chapter assume that the price of oil delivered to U.S. refineries is, on average, $29.70 per barrel in 1984 (equivalent to about $28.00 per barrel at the wellhead) and remains at that level thereafter in constant dollars. In Chapter III, the analysis found in this chapter is reproduced, using higher and lower oil price assumptions.

Another important assumption in this analysis is that local gas distribution companies, under the direction of state public utility commissions, do not assign any particular group of users a disproportionate share of higher gas costs when they arise. This assignment of costs is a potential problem because, in general, industrial users pay a lower price for gas than do residential users, since gas competes with a cheaper fuel (residual oil) in the industrial sector than in the residential sector (which uses distillate fuel, or home heating oil). Therefore, some state utility commissions could direct any new cost burden to residential users rather than industrial ones. In fact, some commissions may consider doing so in order to keep business costs low in their jurisdictions. This analysis assumes that the distribution of gas costs between these two groups reflects patterns observed in the past.

Economic and Gas Market Effects

The second step of the analysis involved simulating, using an econometric model, interactions between the energy sector and the economy as a whole. Most of the previous work in this area has used one of two major approaches. The first examines the effects of energy price changes using existing macroeconomic models (for example, the DRI or Wharton models). The difficulty associated with this method is that most of these models may fail to measure realistically energy substitution possibilities, and they consequently run the risk of overstating the price, output, and energy market effects of decontrol or other pricing policies.

The alternative approach involves examining energy price changes in the context of long-term economic growth (the "Hudson-Jorgenson" approach). The difficulty associated with this approach is it fails to incorporate unemployment and wage-price rigidities. Thus, this approach risks understating the effects of pricing policy changes, since wage and price rigidities and the gradual response of households and firms to changing energy prices lie at the heart of the economy's adjustment to changing energy prices.

The methodology used in this analysis combines aspects of both approaches. A model is employed that explicitly links energy demand relationships with economic aggregates. It does so by estimating the demand for energy, labor, capital, and materials in each sector of the economy. When energy prices change, the model describes how consumers reallocate their expenditures among sectors and, given this reallocation, how each sector's demand for labor, capital, energy, and materials will change. Once each sector's demand for these productive factors is recalculated, the resulting factor payments (such as wages, interest, energy costs, and the like) are estimated. These factor payments are totaled into national income, which the model then reallocates among savings and consumption by sector. Once aggregate energy demand by sector is determined, different energy forms are allowed to compete until the cheapest combination of fuels is achieved. Thus, in this model, changing energy prices change the composition of goods the economy produces, changes the way the economy produces them, and changes total consumption and investment in the economy, all simultaneously. Moreover, the model allows observation of changes in inflation and employment. 3/

The model also estimates gas supplies by estimating the rate at which gas reserves (both new reserves and extensions of old ones) are sought and discovered. These reserves are then depleted to form supplies. When domestic gas supply and demand change, the model changes gas imports to accommodate them. But since gas imports are more expensive than domestic gas, the model recalculates average gas prices and restarts the process until it reaches a solution. Although some energy analysts contend that decontrol would completely eliminate gas imports, the model does not show that this happens under the base oil price assumptions described above. Imports do drop, however, as decontrol induces more domestic production.

One final caveat is in order. In theory, macroeconomic modeling resembles a science, but in practice it is more like an art and is, therefore, less precise. Results obtained from different models will differ as do the models themselves. Many of the results presented in this analysis depend

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3. See Congressional Budget Office, An Empirical Analysis of Energy-Economy Interactions (forthcoming). This technical analysis paper documents the model extensively.

critically upon important parameters, such as the estimated responsiveness of gas supply and demand to changes in price. Moreover, prices are affected by the ability of pipelines to shift their purchases of gas from high-cost to low-cost sources. While assumptions can be made regarding this type of institutional behavior, the true effect cannot be estimated with precision. Thus, a certain amount of uncertainty enters the estimates found in this analysis. Consequently, the estimates should not be construed as unerring and definitive statements of the effects they represent. They do, however, strongly indicate the magnitude and direction of those effects.

ANALYSIS OF WELLHEAD PRICING PROVISIONS

This section presents the results of simulations of the Senate and Gephardt proposals, using the assumptions and methodology described above. The effects of the Senate and Gephardt proposals are depicted in the form of changes from the effects that would result if the NGPA remained in force. Thus, this base case is described first.

The Base Case: NGPA

Table 1 presents estimated average wellhead and city-gate prices of natural gas (per thousand cubic feet) under the NGPA. It shows that average constant dollar wellhead gas prices will not change in 1985 as a result of the NGPA's decontrol provisions. This reflects that fact that prices have already risen to levels near the decontrolled prices. The average city-gate price (that is, the average price at which piplelines deliver their gas to local distribution companies) rises by 11 cents, or 3 percent, in constant dollars, reflecting rising gas imports, pipeline mark-ups, and reduced capacity utilization in that year. Gas prices then rise slightly over the remainder of the 1980s (about 1 percent annually) as price-controlled old gas is depleted and replaced by new gas at decontrolled, oil-equivalent prices, and as oil imports increase.

Table 2 presents estimates of natural gas consumption from 1983 to 1990 under the NGPA. Consumption declines from 17.8 trillion cubic feet in 1983 to 17.1 trillion cubic feet in 1985, and remains roughly constant thereafter. This lower consumption results from competition from oil and other fuels and continued improved energy efficiency in the economy. It should be noted that the decline in gas consumption occurs in the manufacturing, utility, and commercial sectors, in which gas more frequently competes with lower-priced residual oil. On the other hand, gas consumption increases in the the household sector, in which it competes with more expensive distillate (home heating) fuel.

TABLE 1. AVERAGE WELLHEAD AND CITY-GATE PRICES OF NATURAL GAS UNDER THE NATURAL GAS POLICY ACT AND BASE OIL PRICE ASSUMPTIONS, CALENDAR YEARS 1983-1990

	Wellhead Prices		City-Gate Prices	
Year	In Current Dollars	In Constant Dollars	In Current Dollars	In Constant Dollars
1983	2.63	2.54	3.98	3.85
1984	2.69	2.50	4.17	3.87
1985	2.81	2.49	4.49	3.98
1986	2.92	2.47	4.75	4.02
1987	3.11	2.51	5.08	4.11
1988	3.28	2.53	5.38	4.15
1989	3.45	2.54	5.69	4.19
1990	3.62	2.54	6.00	4.21

NOTE: Base oil prices are presented in the center columns of Table 8 in Chapter III.

TABLE 2. U.S. NATURAL GAS CONSUMPTION, BY SECTOR, UNDER THE NATURAL GAS POLICY ACT AND BASE OIL PRICE ASSUMPTIONS, CALENDAR YEARS 1983-1990 (In trillions of cubic feet)

Sector	1983	1984	1985	1986	1987	1988	1989	1990
Residential	4.9	5.0	5.0	5.1	5.2	5.3	5.4	5.5
Commerical	1.9	1.8	1.7	1.6	1.6	1.6	1.6	1.5
Manufacturing	5.3	5.1	5.0	4.9	4.9	5.0	5.1	5.1
Electric Utility	3.4	3.3	3.2	3.2	3.1	3.1	2.9	2.7
Other	2.2	2.2	2.2	2.2	2.3	2.3	2.3	2.3
Total	17.8	17.3	17.1	17.1	17.1	17.3	17.3	17.2

NOTE: Numbers may not add to totals because of rounding.

Table 3 depicts gas market reserves and supplies (production) under the NGPA. Domestic production is projected to decline from the 1983 level of 16.8 trillion cubic feet to 15.2 trillion cubic feet in 1990. Although reserve additions do increase in the first several years following decontrol in 1985 (up from 14.2 trillion cubic feet in 1984 to 15.3 trillion in 1985), by 1990 domestic reserves are about 12 trillion cubic feet lower than today's level. This occurs because the rate at which gas is added to reserves is lower than the rate at which gas is produced, reflecting declining geological discoveries. With reserve additions and domestic production that decline more rapidly than does domestic consumption, gas imports rise from 1.0 to 2.0 trillion cubic feet from 1984 to 1990. This gas, which is imported as

TABLE 3. NATURAL GAS RESERVE AND PRODUCTION PROJECTIONS UNDER THE NATURAL GAS POLICY ACT AND BASE OIL PRICE ASSUMPTIONS, CALENDAR YEARS 1983-1990 (In trillions of cubic feet)

	1983	1984	1985	1986	1987	1988	1989	1990
Total Reserves a/	182.0	179.0	179.0	179.0	178.0	176.0	173.0	170.0
Reserve Additions	14.3	14.2	15.3	14.9	14.1	13.4	12.9	12.4
Domestic Production	16.8	16.4	15.5	15.3	15.3	15.4	15.3	15.2
Natural Gas Imports b/	1.0	1.0	1.6	1.7	1.9	1.9	1.9	2.0

NOTE: Number changes in this table may not add because of rounding.

a. Changes in total natural gas reserves are calculated by subtracting domestic production from reserve additions.

b. Natural gas imports are equal to natural gas consumption, shown in Table 2, minus domestic production, shown in line 3 of this table.

overland gas from Canada and Mexico and liquefied natural gas, mainly from Algeria, is more expensive than domestic supplies.

Thus, under the NGPA, domestic consumption, production, and the rate of reserve discovery are all projected to decline. The effects of the two alternative legislative proposals described in the following section are presented in the form of changes from this NGPA base case. Macroeconomic effects presented in the next sections are expressed as changes from CBO's baseline forecast, extrapolated to 1990 to cover the period used in this report. The CBO baseline, which is based on current law, assumes the continuation of the NGPA. 4/

The Senate Bill

The bill reported by the Senate Energy and Natural Resources Committee assumes enactment on January 1, 1984, with a phase-in period for price and contract changes starting shortly thereafter. The bill would phase the price of all types of gas towards a target "free market" price. Initially, this target price--or, in the language of the bill, a "price indicator"--would be the price of section 103 gas, now about $2.77 per thousand cubic feet. This price is, in fact, close to the price that would prevail if gas and oil delivered heat at equal cost. The bill then specifies that, after six months of using the section 103 price, the price indicator will become the weighted average of prices for gas sold under contracts between producers and pipelines signed in the previous six months.

The price indicator would then be used to define a target price for all gas. Gas that is priced above the indicator price level could be phased down to it over a period of 12 months, and gas priced below the indicator price could be phased up to that level over 36 months. But this phasing would occur only if one of the parties to the contract elected to do so. If the two parties to the contract (the producer and the pipeline) voluntarily renegotiated it or agreed to continue it unchanged, then no phasing would occur. Moreover, if one party to a gas contract elected to begin phasing the contract price towards the free-market price, the other party would retain the right to find a new party who would not. Thus, for example, if a gas producer elected to begin phasing the price of his old gas up to the indicator price, the pipeline to whom he sells would retain the right to find a new

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4. The CBO forecast for fiscal years 1984-1988 can be found in Congressional Budget Office, The Outlook for Economic Recovery (February 1983), updated for fiscal years 1984-1986 in The Economic and Budget Outlook: An Update (August 1983).

producer who was willing to sell gas at a lower price. It is, of course, not clear why a producer would be willing to sell at a price lower than both markets and statutes allow. Pipelines, on the other hand, might be willing to pay a premium if it allowed them to secure long-term access to gas reserves. Similarly, a producer of high-cost gas might find a new pipeline to contract with if the pipeline to whom he sold elected to phase his price down to the indicator level.

The major exception to the decontrol provisions found in the Senate bill concerns direct sales of gas--that is, sales from producers to large end users who do not resell the gas to subsequent users or distribution companies. The great bulk of these direct sales occur in the intrastate gas market, in which large utilities and manufacturing facilities (predominantly in Texas and Louisiana) buy gas directly from producers under contracts that often predate the 1970s. The Senate bill, therefore, would shield substantial price savings for these users.

Through its price-phasing mechanisms, the Senate bill would provide fairly strong incentives for the average gas price to reach its oil-equivalent price at the point of final use. Pipelines with endowments of cheap, older gas would find its price increased substantially over the three years of phasing. Paying more for old gas would limit the amount of new higher-priced gas that pipelines could buy to average in with cheap gas. Thus producers of new gas should encounter difficulties in finding pipelines willing to pay prices for new gas greatly in excess of the oil-equivalent price. This analysis assumes that the Senate bill would induce wellhead gas prices to converge around a level equal to the heat-equivalent price of oil purchased by the manufacturing sector, minus an allowance for transportation and other processing and distribution costs.

The Senate bill also addresses the need to resequence the order in which differently priced gas is bought during periods of excess availability. Because of contract features and the effects of regulation on the gas market, gas is not now withdrawn from the market in descending price order when demand falls. Pipelines are now locked into contracts which force them to buy high-priced gas first when excess supplies of low-cost gas are available. By encouraging renegotiation and by other features that foster contract flexibility, the Senate bill could lead to lower-cost gas supplies either by allowing pipelines to buy the cheapest gas first or by forcing producers of new, higher-priced gas to accept a lower price because of the availability of cheap gas. This analysis assumes that such a resequencing of gas supplies would occur under the Senate bill until gas prices converge at an oil-equivalent price in 1987.

Table 4 presents the average projected wellhead and city-gate prices of gas under the Senate bill. Gas prices are somewhat lower in 1984 and 1985 when compared to the NGPA (see Table 1), because the Senate bill would allow low-cost gas back into the market. In 1985, when the NGPA's decontrol provisions go into effect, the Senate bill would lower city-gate gas prices by $0.17 (in constant dollars), or about 4 percent. Gas prices then would be higher under the Senate bill during the 1987-1989 period because it allows older, low-cost gas to rise to the oil-equivalent price while under the NGPA, older gas would remain controlled until it was depleted. But, by 1990, city-gate prices under the NGPA would catch up to prices under the Senate bill, reflecting the depletion of older gas, its replacement by new gas supplies, and the price escalation for low-cost gas that is allowed by NGPA formulas. This convergence would also occur because the Senate bill would result in the substitution of cheaper domestic supplies for more expensive gas imports. By 1990, city-gate prices would be within one cent per thousand cubic feet under the Senate bill and under the NGPA.

TABLE 4. AVERAGE WELLHEAD AND CITY-GATE PRICES OF NATURAL GAS UNDER THE SENATE ENERGY COMMITTEE PROPOSAL AND BASE OIL PRICE ASSUMPTIONS, CALENDAR YEARS 1983-1990

	Wellhead Prices		City-Gate Prices	
Year	In Current Dollars	In Constant Dollars	In Current Dollars	In Constant Dollars
1983	2.63	2.54	3.98	3.85
1984	2.46	2.29	3.93	3.66
1985	2.64	2.34	4.29	3.81
1986	2.91	2.47	4.70	3.98
1987	3.26	2.63	5.16	4.17
1988	3.41	2.63	5.44	4.19
1989	3.56	2.62	5.72	4.21
1990	3.72	2.61	6.01	4.22

NOTE: Base oil prices are presented in the center columns of Table 8 in Chapter III.

As seen in Table 5, long-term natural gas consumption under the Senate bill would be virtually unchanged from the base case, reflecting the fact that gas prices under the Senate bill and the NGPA are nearly equal. Consumption would be higher in the mid-1980s, however, when the Senate bill would offer some price relief. Gas production (supplies), however, would also be higher, since the Senate bill would provide greater price incentives to low-cost gas at the expense of higher-cost gas. This realignment of revenues within the industry would allow more investments in larger and older low-cost fields, so that the discovery and production of new gas reserves would increase. Under the Senate bill, natural gas reserves would be 5.6 trillion cubic feet higher by 1990 than if the NGPA remained in force. Most of these added reserves would come from extensions of known gas fields. 5/ Table 5 also shows that higher production levels would lead to lower levels of gas imports--a difference of 0.6 trillion cubic feet in 1990.

The macroeconomic differences between the Senate bill and the NGPA base case are very small, and are generally consistent with the price profiles of the two bills. Economic growth would be somewhat higher under the Senate bill in 1984 and 1985, as gas prices fall relative to the NGPA.

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5. This result depends on a crucial assumption. Under the NGPA, the Federal Energy Regulatory Commission (FERC) is authorized to offer producers "incentive" prices--that is, higher prices that, in FERC's judgment, will lead to increased gas supply. FERC has recently, in fact, offered a "production enhancement rule" to interstate producers that does just that. Under FERC's new rule, a pipeline may be allowed to pay a producer more than the controlled price for gas if the pipeline feels that the higher price will lead to higher levels of production. Thus, the FERC rule would allow pipelines to decide whether or not the higher price would lead to higher supply levels. This analysis assumed that this rule would not lead to significant changes in gas pricing and production for three reasons. First, the higher supply levels offered in response to higher prices may be small in comparison to the base volumes of gas involved. It may not be worthwhile, therefore, for pipelines to offer higher prices since the amount of new gas they receive may be small. Second, so long as the gas market is weak, such new supplies may not be marketable. Finally, given the contract provisions now found in the gas market, pipelines may be locked into existing supply sources. Specifically, if pipelines have outstanding take-or-pay obligations, they may be unable to purchase new supplies elsewhere, even if they are cheaper. This is a crucial assumption because, if it is incorrect, then some portion of the new reserves attributable to the Senate bill could be realized within the provisions of the NGPA.

TABLE 5. EFFECTS OF THE SENATE ENERGY COMMITTEE PROPOSAL ON THE NATURAL GAS MARKET AND THE ECONOMY, ASSUMING BASE OIL ASSUMPTIONS, CALENDAR YEARS 1983-1990 (Expressed as changes from the NGPA base case, in trillions of cubic feet)

Effects	1983	1984	1985	1986	1987	1988	1989	1990
Market Effects								
Total Reserves a/	0.0	0.2	0.2	0.6	1.8	3.2	4.4	5.6
Reserve additions a/	0.0	0.5	0.4	0.8	1.7	1.9	1.8	1.7
Consumption b/	0.0	0.2	0.2	0.1	0.0	0.0	0.0	0.0
Domestic production a/	0.0	0.3	0.4	0.4	0.4	0.5	0.6	0.6
Imports a/ c/	0.0	-0.1	-0.2	-0.3	-0.4	-0.5	-0.5	-0.6
Economic Effects d/								
Real Gross Domestic Product (GDP) (Percent change)	0.0	0.16	0.11	0.02	-0.06	-0.02	0.01	0.03
Price level (Percent change in GDP deflator)	0.0	-0.35	-0.25	-0.08	0.08	0.08	0.06	0.04
Price level (Percent change in Consumer Price Index)	0.0	-0.28	-0.27	-0.13	0.03	0.05	0.04	0.04

a. NGPA base case projections appear in Table 3.

b. NGPA base case consumption appears in Table 2.

c. Changes in natural gas imports are equal to changes in natural gas consumption minus changes in natural gas domestic production. Numbers may not equal total because of rounding.

d. The economic effects of the Senate and Gephardt bills are expressed in the form of changes from the CBO baseline macroeconomic forecast. This forecast was originally presented for the years 1984-88 in CBO, The Outlook for Economic Recovery (February 1983) and was updated for 1984-86 in CBO, The Economic Budget Outlook: An Update, (August 1983). Since this baseline forecast only extends to 1988, values for 1989 and 1990 were extrapolated from the rates of growth presented for 1987 and 1988 in the baseline forecast. While the CBO baseline forecast is revised annually, these revisions are generally so small that they do not influence the effects of the two bills analyzed here. It should also be noted that these effects are presented as changes in levels, as opposed to rate of growth. This is particularly relevant in measuring inflation. An inflation effect of "x" percent in any one year means that the price level is x percent higher, not that the price level is growing x percent more rapidly. Changes in the rate of growth in the price level can be calculated by comparing the price level in any one year to its value in the previous year.

Growth would be slightly lower under the Senate bill than it would be under the NGPA in the later 1980s, as gas prices rise relative to the NGPA. By 1989 and 1990 the situation would be reversed since the economy would already have adjusted to marginal increases in gas prices that would occur a few years later under the NGPA. Inflationary effects would work in the opposite direction, and by 1990, the price level, whether measured by the Gross Domestic Product (GDP) 6/ deflator or the Consumer Price Index (CPI), would be virtually unchanged.

The Gephardt Proposal

An alternative approach to natural gas pricing is found in H.R. 2154, submitted by Congressman Gephardt. The Gephardt proposal would defer most of the pricing provisions of the NGPA by two years. Presuming its enactment on January 1, 1984, the bill would roll back the price allowed each category of gas under the NGPA to the allowed price on January 1, 1982, in effect cancelling the price increases sanctioned by current law over the past two years. In addition, it would limit the price of high-cost (section 107) and imported gas to 150 percent of the price allowed new (section 103) gas. Once reestablished at these levels, gas prices would be allowed to escalate at three-quarters of the inflation rate as measured by the GNP deflator or the rate of inflation in the energy price index as defined by the Bureau of Labor Statistics, whichever is smaller. (In contrast, the NGPA allows gas prices to increase by the full rate of inflation.) The Gephardt proposal then would allow those categories of gas that were to be decontrolled under the NGPA in January 1985 to be decontrolled in January 1987.

Average gas prices under the Gephardt proposal are estimated in Table 6. In 1985, city-gate gas prices (in constant dollars) are 31 cents, or 8 percent, lower under the Gephardt proposal when compared to the NGPA. This difference would disappear in 1987, when the Gephardt proposal would allow the decontrol slated for 1985 under the NGPA.

Table 7 depicts the results of a simulation of the Gephardt proposal. Within the natural gas market, the lower prices delivered by the Gephardt

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6. Gross domestic product (GDP) is a national income concept based on production within the geographic borders of a country. Gross national product (GNP) covers production by and incomes to citizens of a country no matter where they live. GDP is used in this report because changes in gas prices would not appreciably affect income earned from foreign sources.

TABLE 6. AVERAGE WELLHEAD AND CITY-GATE PRICES OF NATURAL GAS UNDER THE GEPHARDT PROPOSAL AND BASE OIL PRICE ASSUMPTIONS, CALENDAR YEARS 1983-1990

Year	Wellhead Prices: In Current Dollars	Wellhead Prices: In Constant Dollars	City-Gate Prices: In Current Dollars	City-Gate Prices: In Constant Dollars
1983	2.63	2.54	3.98	3.85
1984	2.30	2.14	3.79	3.54
1985	2.49	2.22	4.11	3.67
1986	2.61	2.22	4.42	3.76
1987	3.07	2.48	5.06	4.09
1988	3.23	2.49	5.34	4.12
1989	3.40	2.50	5.65	4.16
1990	3.56	2.50	5.98	4.20

NOTE: Base oil prices are presented in the center columns of Table 8 in Chapter III.

proposal would encourage gas consumption and discourage production, resulting in gas imports that would be over 33 percent higher than those under the NGPA by 1990. Domestic gas consumption would be higher by 0.1 trillion cubic feet and domestic production lower by 0.6 trillion cubic feet in 1990, accounting for the difference in gas imports. (Oil imports, on the other hand, would be slightly lower--about 65 thousand barrels per day in 1990--because of the substitution of gas for oil induced by lower gas prices.) But because the price of domestic gas would be restrained, the Gephardt bill would result in lower reserve additions over the 1984-1990 period--reserves would be about 5 trillion cubic feet lower than under the NGPA, and about 10.4 trillion cubic feet lower than under the Senate bill.

Inflation would be somewhat lower and real economic growth somewhat higher under the Gephardt proposal than under the NGPA until 1987, after which these differences disappear. These divergences reflect the different average gas price paths found in the Gephardt proposal and the NGPA base case. City-gate gas prices would be lower under Gephardt than under the NGPA, since the NGPA decontrols much of the nation's gas supply in 1985. In 1987, when the partial decontrol found in the Gephardt proposal would occur, city-gate gas prices would rise by about 9 percent in constant

TABLE 7. EFFECTS OF THE GEPHARDT PROPOSAL ON THE NATURAL GAS MARKET AND THE ECONOMY, ASSUMING BASE OIL PRICE ASSUMPTIONS, CALENDAR YEARS 1983-1990 (Expressed as changes from the NGPA base case, in trillions of cubic feet)

Effects	1983	1984	1985	1986	1987	1988	1989	1990
Market Effects								
Total reserves a/	0.0	-0.4	-2.3	-4.2	-4.6	-4.9	-4.9	-4.8
Reserve additions a/	0.0	-0.7	-1.7	-2.2	-0.9	-0.6	-0.5	-0.5
Consumption b/	0.0	0.3	0.4	0.4	0.2	0.2	0.2	0.1
Domestic production a/	0.0	-0.3	0.2	-0.3	-0.4	-0.3	-0.4	-0.6
Imports a/ c/	0.0	0.6	0.2	0.7	0.6	0.5	0.6	0.7
Economic Effects d/								
Real Gross Domestic Product (GDP) (Percent change)	0.0	0.24	0.20	0.15	-0.06	-0.03	-0.01	-0.01
Price level (Percent change in GDP deflator)	0.0	-0.49	-0.48	-0.44	-0.08	-0.07	-0.05	-0.03
Price level (Percent change in Consumer Price Index)	0.0	-0.46	-0.51	-0.50	-0.18	-0.13	-0.10	-0.06

a. NGPA base case projections appear in Table 3.

b. NGPA base case consumption appears in Table 2.

c. Changes in natural gas imports are equal to changes in natural gas consumption minus changes in natural gas domestic production. Numbers may not equal total because of rounding.

d. The economic effects of the Senate and Gephardt bills are expressed in the form of changes from the CBO baseline macroeconomic forecast. This forecast was originally presented for the years 1984-88 in CBO, The Outlook for Economic Recovery (February 1983) and was updated for 1984-86 in CBO, The Economic and Budget Outlook: An Update, (August 1983). Since this baseline forecast only extends to 1988, values for 1989 and 1990 were extrapolated from the rates of growth presented for 1987 and 1988 in the baseline forecast. While the CBO baseline forecast is revised annually, these revisions are generally so small that they do not influence the effects of the two bills analyzed here. It should also be noted that these effects are presented as changes in levels, as opposed to rate of growth. This is particularly relevant in measuring inflation. An inflation effect of "x" percent in any one year means that the price level is x percent higher, not that the price level is growing x percent more rapidly. Changes in the rate of growth in the price level can be calculated by comparing the price level in any one year to its value in the previous year.

dollars. But the price difference between the Gephardt bill and the NGPA would disappear by 1990 because of the higher levels of gas imports under the Gephardt proposal.

OTHER PROVISIONS

It should be noted that both the Senate and Gephardt proposals contain other provisions that would influence the conduct of natural gas markets. These concern the restrictions of "take-or-pay" provisions, "market-out" clauses, "contract carriage" status for pipelines, and other institutional reforms of the gas market. The precise effect of these provisions is speculative, since it is impossible to say with precision how many pipelines would choose to cut back on their take-or-pay obligations or how many end users or local distribution companies would terminate their arrangements with pipelines and deal directly with producers, using pipelines for transportation of the gas only, a role known as contract carriage. But while these provisions cannot be incorporated into econometric simulations as readily as changes in wellhead pricing, they are nonetheless important in restoring economic signals to the gas market, and for that reason are discussed here.

Take-or-Pay

As discussed in Chapter I, many pipelines have signed contracts with producers that require them to pay for a certain volume of gas even if they cannot resell it. These provisions, known as take-or-pay, in effect transfer the risks associated with marketing gas from producers to pipelines.

The prevalence of take-or-pay provisions in high-cost gas contracts distorts gas markets by forcing pipelines to reduce purchases of relatively cheap gas rather than high-cost sources when consumption declines. Thus, average gas prices do not fall when consumption falls, as would be expected to happen in a competitive market. The Senate proposal would limit all pipelines' take-or-pay liabilities to 50 percent of their contractual liability in the first year following enactment, 60 percent in the second year, and 70 percent in the third year. Following the third year, all take-or-pay provisions would remain in force. Any gas for which a take-or-pay obligation exists but a pipeline declines to accept could be resold to any other purchaser for whatever price the market would bear.

Under the Gephardt proposal, take-or-pay clauses are restricted to 50 percent of their contract volume for three years, after which all take-or-pay provisions must be honored. Gas declined by pipelines under take-or-pay provisions could be resold up to the bills' price ceilings.

Market-Out Options

Some natural gas contracts--predominantly those signed after the NGPA's passage--have market-out clauses, which allow a pipeline to cease receiving gas from a producer in the event that it cannot be sold. Under the Senate bill, a pipeline or a producer would be allowed to exercise his right to market out if the other party to the contract elected to begin phasing the contract price to the indicator level. In addition, if a producer decided to market out and find a new purchaser, he would have to continue to sell to the old purchaser until a new one could be found. Thus, a producer could not "shut in" his production and wait for market conditions to improve or for the price-phasing period to end. Similarly, a pipeline that markets-out would have to continue to accept gas from its old producer until a new one could be found.

Market out options under the Senate bill are also limited by a specified "right of first refusal." If, for example, a pipeline decided to market out of its contract and succeeded in finding a new supplier willing to sell at a lower price, the old producer would have the right to match the lower price and continue sales. Conversely, if a producer markets out in search of a better price, the pipeline adversely affected by the producer's actions would retain the right to match any offer made by another pipeline and, therefore, to continue accepting deliveries.

The Gephardt proposal would allow pipelines, but not producers, to market out. It would require, however, that pipelines market out of their highest priced gas supplies first. Moreover, if a pipeline did market out of a contract, it would be prohibited from paying a price equal to or higher than the price of the gas it had declined to buy. Sellers whose gas was refused by a pipeline under a market-out provision could resell it within the price guidelines found in the Gephardt bill, but would have to offer the pipeline the right of first refusal, the same procedure required by the Senate bill.

The right of pipelines to market out of their contracts could present difficulties for producers, however, since producers sometimes have only one pipeline at their field. Thus, if a pipeline refused to purchase a producer's gas, the producer could be, for all practical purposes, involuntarily "shut in"--that is, unable to sell its gas. To rectify this problem, both the Senate and Gephardt proposals would require pipelines that refused to accept a producer's gas under their market-out option to agree to deliver that gas to another pipeline for a reasonable fee.

Contract Carriage

Pipelines are the only available vehicle for transporting natural gas overland. As recognized in the original Natural Gas Act of 1938, this gives them significant power over gas producers and consumers, since they can refuse to move gas from one point to another. Both the Senate and the Gephardt proposals would require pipelines to carry gas at the request of any producer or any other pipeline, so long as capacity was available and so long as doing so would not interfere with the pipeline's obligations to its existing customers. This transportation service, or contract carriage, would add a dimension of flexibility and competitiveness to gas markets by expanding the number of producers each potential end-use purchaser could do business with, and vice versa. The Senate bill would also extend this requirement, on a limited basis, to local distribution companies (which buy gas from pipelines and sell it to local users). If it met fairly rigorous criteria, a local gas user (such as an industrial facility), therefore, could negotiate directly with a producer and secure contract carriage all the way from the wellhead to the user's facility.

Contract carriage could become a contentious issue in determining how gas costs should be divided between residential and industrial users. In general, only industrial users are large enough to contract directly with producers. If pipelines and distribution companies lost industrial customers that elected to employ contract carriage, they could be forced to assign their fixed costs (that is, their pipeline costs and their contractual obligations to buy gas) to residential customers only. This would result in far higher residential gas bills. The Federal Energy Regulatory Commission (FERC) and state utility commissions could avoid this situation by incorporating these costs into the rates they compelled pipelines to charge for contract carriage.

Limitations on Passthrough of Gas Costs

Both the Senate and Gephardt bills would allow FERC to limit the extent to which a pipeline could pass through its purchased gas costs to local distribution companies and final consumers. Under the NGPA, FERC may prohibit the passthrough of gas costs that, in its judgment, reflect fraud or abuse. The Senate bill would expand this authority, allowing FERC the discretion to prohibit full passthrough for gas delivered under new or renegotiated contracts whose price in any month is in excess of 110 percent of the indicator price defined by the bill. FERC would not have this discretion for gas costs resulting from contracts signed before the bill's enactment.

The Gephardt bill would give FERC the general authority to disallow costs that, in FERC's view, do not reflect an effort to "minimize amounts paid for natural gas." FERC would be charged with the continual review and public posting of all gas contracts in order to fulfill this responsibility.

Elimination of Indefinite Price Escalator Clauses

Many gas contracts contain clauses--known as "indefinite price escalators"--that, upon deregulation, tie the price of gas to some percentage of the price of oil, a refined petroleum product, or other gas prices in the area. If decontrol was enacted and these provisions remained in contracts, prices could suddenly rise above oil-equivalent levels. This potential "price contagion" would occur if some contracts specified gas prices at an unsupportable level (such as 110 percent of the price of distillate oil, equivalent to about $8.00 per thousand cubic feet), and other contracts specified that gas be sold at a price equal to the highest price found in the area, thereby tying neighboring gas to this unsupportable price.

The Gephardt bill explicitly forbids the use of these indefinite price escalator clauses. The Senate bill does not mention them specifically but does limit the ability of pipelines to pass through gas costs in excess of 110 percent of the indicator price. The difference between the two bills in this regard, however, is slight. By allowing pipelines to phase down the price of gas above the price indicator and by allowing extensive market-out rights, the Senate bill would provide ample opportunitites for pipelines to escape the effects of indefinite price escalator clauses if they so desired. Similarly, the market-out provisions found in the Gephardt bill could provide comparable relief. Thus, the explicit prohibition on indefinite price escalators found in the Gephardt bill is, to some extent, redundant.

CHAPTER III. SENSITIVITY OF RESULTS TO OIL PRICE ASSUMPTIONS

In Chapter II, this analysis assumed that the average price of oil delivered to U.S. refineries would be $29.70 per barrel in 1984 and remain at that level in constant dollars throughout the 1984-1990 projection period. In this chapter, the effects of changes in that oil price assumption are analyzed.

In summary, under the NGPA, the Senate bill, and the Gephardt bill, the average city-gate price of gas converges by 1990, under both high and low oil price assumptions. The NGPA and the Gephardt proposal produce similar gas prices by 1990 since the Gephardt bill would simply postpone the NGPA's decontrol provisions by two years, rather than fundamentally change natural gas pricing policy. Given higher oil prices, gas prices under the Senate bill would be somewhat lower in the mid-1980s (reflecting the bill's provisions to reorder the purchase of gas supplies) and somewhat higher in the later 1980s (reflecting the provisions that allow low-cost gas prices to rise to the oil-equivalent price). But the price increases in the Senate bill prove self-correcting by 1990 as domestic supplies expand by more than enough to eliminate the need for more costly gas imports. Rather than assuming export of this gas surplus, this analysis assumed that it would be sold in the domestic market. The resulting excess of supply over demand would act to lower prices to levels comparable to those reached under the Gephardt bill and the NGPA.

With this convergence of prices, it is not surprising to note that the effects of the Gephardt and Senate bills on the natural gas market and on the economy are generally very small, regardless of the assumed oil price. The exception to this conclusion is the effects of the two bills on the gas market under the high oil price assumption. In that case, the Senate bill would result in cumulative additions to the nation's total gas reserves of about 18 trillion cubic feet compared to the NGPA and 29 trillion cubic feet compared to the Gephardt proposal. Thus, the Senate bill would lead to significantly higher supplies should oil prices rise dramatically. If oil prices should fall, however, gas prices would follow suit under all three measures, resulting in insignificant effects on the gas market and the economy under both the Senate and Gephardt bills when compared to the NGPA. This suggests that lower oil prices, rather than the individual bill's pricing provisions, are the principal influence on the results.

OIL PRICE ASSUMPTIONS

Two alternative oil price paths were constructed for this analysis. While they are referred to as the "high" and "low" paths, they are not necessarily upper and lower bounds for oil prices over the next decade. Indeed, if the Organization of Petroleum Exporting Countries (OPEC) was to dissolve or face severe internal disarray, or if political or logistical factors compromised the security of Persian Gulf oil supplies, oil prices far lower or higher than those presented here would occur. Rather, these alternative price paths represent possible outcomes under market conditions that do not reflect either of these extreme situations.

Table 8 presents the alternate price paths. Under the high oil price path, oil prices in constant dollars rise from an average refiner's acquisition cost of $29.39 in 1983 to $32.32 in 1986, and remain level thereafter. By 1990, the current dollar price of oil reaches $47.27 per barrel. Under the low price path, prices fall in constant dollars from an average refiners' cost of $28.51 per barrel in 1983 to $21.23 in 1986, and again remain level thereafter. By 1990, the price of oil reaches $28.56 per barrel in current dollars.

TABLE 8. ALTERNATIVE OIL PRICE ASSUMPTIONS, BASED ON REFINER'S ACQUISITION COST OF CRUDE OIL (By calendar year)

	High Oil Price		Base Oil Price		Low Oil Price	
Year	In current dollars	In constant dollars	In current dollars	In constant dollars	In current dollars	In constant dollars
1983	30.50	29.39	29.60	28.58	29.50	28.51
1984	34.50	31.64	29.70	27.59	26.50	24.88
1985	37.00	32.19	31.11	27.59	24.00	22.01
1986	39.00	32.32	32.56	27.58	24.00	21.23
1987	40.91	32.32	34.12	27.58	25.04	21.23
1988	42.91	32.32	35.75	27.58	26.14	21.23
1989	45.03	32.32	37.47	27.58	27.31	21.23
1990	47.27	32.32	39.30	27.58	28.56	21.23

SIMULATION RESULTS UNDER THE HIGH OIL PRICE CASE

As in Chapter II, the effects of the Senate and Gephardt bills are presented in the form of changes relative to a base case that reflects the provisions of the Natural Gas Policy Act (NGPA). The NGPA base case itself will change, however, if underlying oil prices change, since oil prices set a benchmark against which the price of gas competes. This section, therefore, presents a different NGPA base case reflecting higher oil prices, and then presents the effects of the Senate and Gephardt bills in the form of changes against this new, high oil price, base case. The two bills are compared to the NGPA with regard to wellhead and city-gate gas prices, natural gas market effects, and macroeconomic effects.

Gas Prices

Table 9 presents natural gas prices under the NGPA, the Senate bill, and the Gephardt bill. Since constant dollar oil prices rise under the high oil price assumption, gas prices under the NGPA follow suit, particularly upon deregulation in 1985. Constant dollar city-gate gas prices rise by 12 percent in 1985. They subsequently increase by about 1 percent per year in constant dollars until 1990.

Prices under the Senate bill are lower at both the wellhead and the city-gate in 1984 and 1985 than under the NGPA, reflecting the introduction of lower-cost supplies, as described in Chapter II. Senate prices are higher in the following three years, as the Senate bill allows older, low-cost oil to rise to oil-equivalent prices, in contrast to the NGPA, which maintains controls on this category of gas. By 1990, however, city-gate prices under the Senate bill and the NGPA are roughly equal. This parity reflects the decline in the proportion of controlled gas prices under the NGPA and the supply incentives provided by the Senate bill, which lead domestic production to increase above the amount needed to eliminate gas imports. Rather than allow this surplus gas to be exported, however, the analysis assumes the surplus gas is dedicated to the U.S. market, in which it acts to lower prices.

Long-term prices under the Gephardt bill parallel those under the NGPA, although the price increase accompanying decontrol occurs in 1987 rather than 1985. By 1990, constant dollar city-gate prices are roughly equal under the three proposals, reflecting controls in the NGPA and Gephardt cases, higher import levels under the Gephardt bill, and enough increased gas production to lower prices under the Senate bill.

TABLE 9. AVERAGE WELLHEAD AND CITY-GATE NATURAL GAS PRICES UNDER THE NGPA, THE SENATE BILL, AND THE GEPHARDT BILL, USING HIGH OIL PRICE ASSUMPTIONS (By calendar year)

Alternative	1983	1984	1985	1986	1987	1988	1989	1990	Percent Change 1983-1990
NGPA High-Oil Case									
Wellhead price (In current dollars)	2.63	2.72	3.29	3.48	3.69	3.92	4.17	4.43	68
Wellhead price (In constant dollars)	2.54	2.49	2.86	2.89	2.92	2.95	2.99	3.03	19
City-gate price (In current dollars)	4.00	4.24	5.03	5.39	5.72	6.06	6.43	6.81	70
City-gate price (In constant dollars)	3.85	3.89	4.37	4.46	4.51	4.56	4.61	4.66	21
Senate Bill									
Wellhead price (In current dollars)	2.63	2.72	3.26	3.76	4.33	4.54	4.66	4.70	79
Wellhead price (In constant dollars)	2.54	2.49	2.84	3.11	3.40	3.40	3.33	3.20	26
City-gate price (In current dollars)	4.00	4.21	4.93	5.55	6.21	6.51	6.74	6.70	68
City-gate price (In constant dollars)	3.86	3.87	4.30	4.59	4.88	4.88	4.81	4.57	19
Gephardt Bill									
Wellhead price (In current dollars)	2.63	2.30	2.49	2.62	3.70	3.88	4.07	4.26	62
Wellhead price (In constant dollars)	2.54	2.12	2.19	2.20	2.92	2.92	2.92	2.91	15
City-gate price (In current dollars)	4.00	3.76	4.15	4.41	5.80	6.11	6.45	6.79	70
City-gate price (In constant dollars)	3.85	3.47	3.65	3.70	4.58	4.60	4.63	4.64	21

Natural Gas Market Effects

The effects of the NGPA, the Senate bill, and the Gephardt bill on the natural gas market under the high oil price assumption are summarized in Table 10. Compared to the base oil price assumptions, higher oil prices raise the level of domestic production but have a minimal effect on consumption under the NGPA. Consumption is relatively unchanged because gas and oil prices rise in tandem--in fact, higher oil prices would shift some energy demand to gas, since gas prices must "catch up" to rising real oil prices. But the increase in domestic production is sufficient to lower 1990 gas imports from 2.0 trillion cubic feet, using base oil prices, to 1.3 trillion cubic feet, using high oil prices.

When combined with higher oil prices, the Senate bill's decontrol provisions lead to substantial increases in domestic production. Production rises by enough to eliminate imports and to create an exportable gas surplus in 1990. It was assumed, however, that this surplus is sold in the domestic gas market, rather than exported, thus lowering gas prices. This accounts for the falling price of gas in 1989 and 1990 under the Senate bill. Total gas reserves rise by 12.9 trillion cubic feet by 1990 when compared to their level under the NGPA when high oil prices assumed.

The controls placed on domestic prices by the Gephardt bill have the opposite effects. Domestic gas reserves in 1990 are 8.7 trillion cubic feet lower than they would be under the NGPA, but the bulk of this difference occurs in 1985 and 1986, the years in which the Gephardt bill extends controls on domestic wellhead prices beyond those specified in the NGPA. By 1990, the rate at which new gas reserves are discovered is virtually the same under the Gephardt bill and the NGPA. Because its extended controls result in lower prices, the Gephardt bill encourages gas consumption, particularly in the mid-1980s, leading to higher levels of gas imports. Gas imports in 1990 are 2.3 trillion cubic feet, almost double their estimated level under the NGPA in that year.

Macroeconomic Effects

Since the average city-price price of gas converges under the NGPA, the Senate bill, and the Gephardt bill, it is not surprising that the long-term macroeconomic differences among the three cases, presented in Table 11, are small. Higher oil prices lead to losses of real output and higher price levels under the NGPA and the two bills. The use of the high oil price assumption leads to a loss of real output (as measured by Gross Domestic Product or GDP) of about 1 percent in 1990, and cumulative inflation of between about 3 percent (as measured by the GDP deflator) to 4 percent (as

TABLE 10. NATURAL GAS MARKET FACTORS UNDER THE NGPA, THE SENATE BILL, AND THE GEPHARDT BILL, USING HIGH OIL PRICE ASSUMPTIONS (By calendar year, in trillions of cubic feet)

Alternative	1983	1984	1985	1986	1987	1988	1989	1990
NGPA High Oil Case								
Total reserves	181.0	179.0	180.0	180.0	180.0	179.0	177.0	175.0
Reserve additions	14.3	14.3	16.0	15.9	15.5	15.0	14.5	14.0
Domestic consumption	17.8	17.6	17.2	17.2	17.2	17.4	17.4	17.3
Domestic production	16.9	16.6	15.6	15.5	15.6	15.9	16.0	16.0
Gas imports a/	1.0	1.0	1.6	1.7	1.6	1.5	1.4	1.3
	Changes from the NGPA High Oil Case							
Senate Bill								
Total reserves	0	0.9	1.2	2.3	5.1	8.0	10.5	12.9
Reserve additions	0	1.0	0.8	1.8	3.5	3.8	3.8	3.7
Domestic consumption	0	0.0	0.1	0.0	-0.2	-0.3	-0.1	0.0
Domestic production	0	0.1	0.5	0.7	0.7	0.9	1.3	1.3
Gas imports a/	0	-0.1	-0.5	-0.7	-0.9	-1.2	-1.4	-1.3
Gephardt Bill								
Total reserves	0	-0.9	-3.7	-7.4	-8.5	-9.0	-8.9	-8.7
Reserve additions	0	-0.8	-2.6	-3.4	-1.4	-1.0	-0.6	-0.6
Domestic consumption	0	0.3	0.7	0.9	0.5	0.3	0.2	0.2
Domestic production	0	0.1	0.2	0.3	-0.3	-0.5	-0.7	-0.8
Gas imports a/	0	0.2	0.5	0.6	0.8	0.8	0.9	1.0

a. Changes in natural gas imports are equal to changes in natural gas consumption minus changes in natural gas domestic production. Numbers may not equal total because of rounding.

TABLE 11. MACROECONOMIC EFFECTS OF THE NGPA, THE SENATE BILL, AND THE GEPHARDT BILL, USING HIGH OIL PRICE ASSUMPTIONS (By calendar year, expressed in percentage changes in level) a/

	1983	1984	1985	1986	1987	1988	1989	1990
NGPA Low Oil Case b/								
Real gross domestic product (GDP)	-0.19	-0.69	-1.21	-1.25	-1.17	-1.13	-1.12	-1.13
GDP deflator	0.18	1.28	1.93	2.22	2.33	2.45	2.55	2.66
CPI	0.28	1.63	2.54	2.98	3.19	3.39	3.57	3.72
Changes from the NGPA High Oil Case								
Senate Bill								
Real gross domestic product (GDP)	0.0	0.02	0.06	-0.07	-0.23	-0.16	-0.09	-0.05
GDP deflator	0.0	-0.03	-0.09	0.19	0.56	0.55	0.31	-0.12
CPI	0.0	-0.03	-0.09	0.15	0.54	0.58	0.44	0.04
Gephardt Bill								
Real gross domestic product (GDP)	0.0	0.31	0.49	0.47	-0.21	-0.15	-0.08	-0.02
GDP deflator	0.0	-0.62	-1.08	-1.20	-0.01	0.02	0.04	0.03
CPI	0.0	-0.59	-1.10	-1.31	-0.22	-0.09	-0.02	0.01

a. It should be noted that these effects are presented as changes in levels, as opposed to rate of growth. This is particularly relevant in measuring inflation. An inflation effect of "x" percent in any one year means that the price level is x percent higher, not that the price level is growing x percent more rapidly. Changes in the rate of growth in the price level can be calculated by comparing the price level in any one year to its value in the previous year.

b. Expressed as changes from the estimates derived using base oil prices. Base oil prices appear in the center columns of Table 8.

measured by the CPI) under the NGPA. The effects of the Senate and Gephardt bills when measured from this base are negligible. While the Gephardt bill leads to lower price levels and real output gains in the mid-1980s, when the NGPA has already decontrolled much of the nation's gas, these effects are reversed when decontrol occurs in 1987 under the Gephardt proposal. Similarly, the Senate bill leads to higher price levels and lower real output in the late 1980s, but these losses are reversed when prices fall under the Senate bill in 1989 and 1990.

SIMULATION RESULTS UNDER THE LOW OIL PRICE CASE

Under the low oil price assumptions, oil prices fall to a level of $21.23 (in constant dollars) in 1986, and remain at that level through 1990. Under these price assumptions, oil is cheaper than gas, and continually exerts downward pressure on gas prices. The results in this section, therefore, depend on assumptions regarding gas contracts. Specifically, it is assumed that prices for controlled gas, under the Gephardt bill and the NGPA, remain at the levels specified by those measures until that gas is decontrolled, at which time they reach the oil-equivalent level. (Again, the equilibrium price of gas is taken as the heat-equivalent price of oil purchased in the manufacturing sector minus an allowance for transmission costs). Section 107 gas (high-cost gas) is phased down from a price of $4.50 in 1985 to the oil-equivalent level in equal increments over the 1985-1990 period.

One alternative assumption would have all gas prices immediately fall to the oil-equivalent level despite ubiquitous contract provisions calling for prices as high as the law allows. Such an assumption would ignore the contentious nature of renegotiation in the absence of legislated across-the-board relief. A second alternative assumption would call for pricing all gas under current contract provisions, such as those calling for wellhead price parity with the price of distillate oil or for wellhead prices equal to the average of the three highest prices found in the region. As was done in the previous chapter, prices reflecting these contract provisions were not assumed, given the chaos they would create in the gas market. Thus, the assumption used here is a middle ground between the two extremes of complete and instantaneous renegotiation and no renegotiation whatsoever.

Gas Prices

Table 12 presents wellhead and city-gate gas prices under the NGPA, the Senate bill, and the Gephardt bill, both in current and constant dollars. Average constant dollar wellhead and city-gate prices fall by 27 and 13

TABLE 12. AVERAGE WELLHEAD AND CITY-GATE NATURAL GAS PRICES UNDER THE NGPA, THE SENATE BILL, AND THE GEPHARDT BILL, USING LOW OIL PRICE ASSUMPTIONS (By calendar year)

Alternative	1983	1984	1985	1986	1987	1988	1989	1990	Percent Change 1983-1990
NGPA Low-Oil Case									
Wellhead price (In current dollars)	2.63	2.67	2.15	2.05	2.15	2.16	2.15	2.11	-20
Wellhead price (In constant dollars)	2.54	2.51	1.98	1.82	1.82	1.76	1.67	1.57	-38
City-gate price (In current dollars)	3.98	4.11	3.74	3.78	4.00	4.14	4.27	4.41	11
City-gate price (In constant dollars)	3.85	3.86	3.43	3.34	3.39	3.36	3.32	3.28	-15
Senate Bill									
Wellhead price (In current dollars)	2.63	2.29	1.93	1.83	1.85	1.92	2.00	2.08	-21
Wellhead price (In constant dollars)	2.54	2.16	1.77	1.63	1.57	1.57	1.56	1.55	-39
City-gate price (In current dollars)	3.98	3.77	3.55	3.60	3.74	3.95	4.19	4.41	11
City-gate price (In constant dollars)	3.85	3.56	3.27	3.19	3.18	3.22	3.26	3.28	-15
Gephardt Bill									
Wellhead price (In current dollars)	2.63	2.45	2.47	2.49	2.06	2.07	2.06	2.02	-23
Wellhead price (In constant dollars)	2.54	2.30	2.26	2.19	1.75	1.68	1.60	1.50	-41
City-gate price (In current dollars)	3.98	3.91	4.06	4.21	3.95	4.09	4.23	4.38	10
City-gate price (In constant dollars)	3.85	3.68	3.71	3.70	3.35	3.33	3.29	3.26	-15

percent, respectively, in 1985 under the NGPA. They continue to decline thereafter, reflecting the ongoing renegotiation of Section 107 prices. Prices under the Senate bill fall more rapidly, given the flexibility created by that bill's decontrol provisions. Following 1987, both wellhead and city-gate prices remain roughly level in constant dollars. In 1987, when the Gephardt bill's decontrol provisions go into effect, prices under that proposal fall to levels comparable to those under the NGPA and Senate bills. By 1990, both the wellhead and city-gate prices under all three cases are roughly equal.

Natural Gas Market Effects

Table 13 presents the effects of the NGPA, the Senate bill, and the Gephardt bill on natural gas markets under the low oil price assumptions.

Gas reserve and annual reserve additions are lower under the NGPA when using the low oil price assumption because lower oil, and in turn, gas prices discourage domestic exploration. Production is also lower, reflecting the lower price signals. Consumption, however, is marginally lower despite lower gas prices. This occurs because gas prices must catch up with falling oil prices. Thus, lower oil prices divert some gas demand to oil. Since the decline in production is greater than the smaller decline in consumption, gas imports increase slightly.

Since prices fall more rapidly under the Senate bill using the low oil price assumption, reserves and, in the later 1980s, domestic gas production, are slightly lower than under the NGPA. Thus, decontrol can lead to a reduced supply response if oil prices fall substantially. Moreover, gas consumption rises under the Senate bill, reflecting its lower prices. Given the higher consumption and marginally lower production levels that occur under the Senate bill, gas imports are slightly higher in this case. The Gephardt proposal has comparably small effects on the natural gas market. Reserve additions are slightly lower, as are both domestic production and consumption. Gas imports are virtually unchanged.

It should be noted that the effects of the Senate and Gephardt bills, when compared to the NGPA case, are very small when low oil prices are assumed. By 1990, the state of the gas market under the NGPA, the Senate bill, and the Gephardt bill is far more similar than it is when these three measures are compared using base or high oil price assumptions. In short, lower oil prices make the different provisions found in the three measures irrelevant. Their effects are determined largely by how flexible gas prices are. If they can fall rapidly, as they are assumed to do to varying degrees in

TABLE 13. NATURAL GAS MARKET FACTORS UNDER THE NGPA, THE SENATE BILL, AND THE GEPHARDT BILL, USING LOW OIL PRICE ASSUMPTIONS (By calendar year, in trillions of cubic feet)

Alternative	1983	1984	1985	1986	1987	1988	1989	1990
NGPA Low Oil Case								
Total reserves	182.0	179.0	178.0	176.0	174.0	171.0	168.0	165.0
Reserve additions	14.2	14.1	13.7	13.3	12.6	12.1	11.7	11.4
Domestic consumption	17.8	17.1	16.8	16.7	16.7	16.8	16.8	16.8
Domestic production	16.8	16.2	15.4	15.0	14.9	14.9	14.7	14.4
Gas imports a/	1.0	0.9	1.4	1.7	1.8	1.9	2.1	2.4
	Changes from the NGPA Low Oil Case							
Senate Bill								
Total reserves	0	0.2	0.5	0.3	-0.2	-0.7	-1.1	-1.6
Reserve additions	0	0.1	0.3	-0.2	-0.5	-0.6	-0.6	-0.6
Domestic consumption	0	0.2	0.3	0.3	0.3	0.3	0.3	0.2
Domestic production	0	-0.1	0.0	0.0	0.0	-0.1	-0.2	-0.1
Gas imports a/	0	0.3	0.3	0.3	0.3	0.4	0.5	0.3
Gephardt Bill								
Total reserves	0	-0.4	-0.8	-1.2	-1.2	-1.0	-1.1	-1.4
Reserve additions	0	-0.6	-0.5	-0.6	-0.2	0.0	-0.3	-0.5
Domestic consumption	0	0.1	-0.1	-0.4	-0.2	-0.1	-0.1	0.0
Domestic production	0	-0.2	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2
Gas imports a/	0	0.3	0.0	-0.2	0.0	0.1	0.1	0.2

a. Changes in natural gas imports are equal to changes in natural gas consumption minus changes in natural gas domestic production. Numbers may not equal total because of rounding.

the three measures, then they will converge at an oil-equivalent price far below the average price levels contemplated under regulation.

Macroeconomic Effects

Table 14 presents the macroeconomic effects of the NGPA under low oil prices and then shows the effects of the Senate bill and the Gephardt bill when compared to the NGPA low oil price case. Under the NGPA, lower oil prices raise real output (by about 0.5 percent in 1990) and reduce inflation (by about 6 to 7 percentage points in 1990). The macroeconomic effects of the Senate and Gephardt measures are negligible when compared to the NGPA low oil base. Once again, low oil prices, rather than the pricing provisions found in the bills, are the primary influence on these results.

TABLE 14. MACROECONOMIC EFFECTS OF THE NGPA, THE SENATE BILL, AND THE GEPHARDT BILL, USING LOW OIL PRICE ASSUMPTIONS (By calendar year, expressed in percentage changes in level) a/

	1983	1984	1985	1986	1987	1988	1989	1990
NGPA Low Oil Case b/								
Real gross domestic product (GDP)	0.0	0.32	0.88	0.81	0.59	0.47	0.45	0.47
GDP deflator	-0.11	-1.04	-3.30	-4.21	-4.62	-4.97	-5.28	-5.54
CPI	-0.08	-1.20	-3.55	-4.72	-5.37	-5.92	-6.39	-6.79
Changes from the NGPA Low Oil Base Case								
Senate Bill								
Real gross domestic product (GDP)	0	0.21	0.10	0.08	0.13	0.08	0.02	-0.02
GDP deflator	0	-0.44	-0.28	-0.26	-0.35	-0.26	-0.14	-0.03
CPI	0	-0.41	-0.31	-0.31	-0.39	-0.33	-0.22	-0.10
Gephardt Bill								
Real gross domestic product (GDP)	0	0.13	-0.21	-0.25	0.07	0.06	0.04	0.02
GDP deflator	0	-0.27	0.36	0.50	-0.05	-0.07	-0.09	-0.09
CPI	0	-0.25	0.29	0.48	0.02	-0.03	-0.07	0.08

a. It should be noted that these effects are presented as changes in levels, as opposed to rate of growth. This is particularly relevant in measuring inflation. An inflation effect of "x" percent in any one year means that the price level is x percent higher, not that the price level is growing x percent more rapidly. Changes in the rate of growth in the price level can be calculated by comparing the price level in any one year to its value in the previous year.

b. Expressed as changes from the estimates derived using base oil prices. Base oil prices appear in the center columns of Table 8.

APPENDIX

APPENDIX. NATURAL GAS REGULATORY HISTORY AND CONTRACT PROVISIONS

Understanding the effects and implications of the Senate and Gephardt bills requires some background in the history of natural gas pricing policy and in the nature of contract provisions found in the natural gas market. To assist in providing such an understanding, this appendix has been reproduced from CBO's report Natural Gas Pricing Policies: Implications for the Federal Budget (January 1983).

THE EVOLUTION OF NATURAL GAS POLICY

Natural gas regulation was established with the enactment of the Natural Gas Act of 1938 (NGA). Judicial interpretation of the NGA determined the format of subsequent federal gas regulation and the types of problems that would eventually arise under it. Knowledge of the history of federal regulation under NGA is, therefore, a necessary first step in understanding current natural gas policy issues.

The Natural Gas Act of 1938

The justification for federal intervention in the natural gas market was based on a series of Federal Trade Commission (FTC) reports that documented numerous abuses, including monopoly control over prices by pipelines in the gas market. As a result, the FTC recommended federal regulation of interstate natural gas prices. Natural gas bills were introduced in the Congress each year from 1935 to 1937, generally as proposals to regulate interstate pipelines in the same fashion as electric utilties. A bill was finally approved by the Congress and signed into law by President Roosevelt as the Natural Gas Act of 1938.

The NGA was designed to deal with pipeline monopoly in order to protect consumer interests. The act introduced the use of price ceilings for the resale of interstate gas from pipelines to consumers. These prices were calculated according to the traditional public utility method, in which prices were set to cover actual costs plus a reasonable rate of return and depreciation.

Federal Regulation Under the NGA

The Federal Power Commission (FPC), which administered the NGA, first focused its attention on the regulation of pipelines. The scope of NGA, however, was expanded in 1954 with the Supreme Court's decision in Phillips versus Wisconsin. The Court interpreted the NGA as requiring the FPC to regulate rates charged by natural gas producers and pipelines in the sale of interstate gas. Thus, the FPC was given the authority to regulate natural gas producers' wellhead prices.

Initially, the FPC attempted to set wellhead prices for producers on an individual basis. This procedure required the commission to study the rate base and operating costs of each producer in order to calculate individual cost-based prices and led to a huge backlog of cases. As a result, the FPC set producer prices for entire geographic regions based on regional average production costs and allowed rates of return. The Supreme Court upheld the concept of area-wide pricing in the Permian Basin Area Rate Case of 1968.

Recognizing a growing imbalance between natural gas supply and demand, the FPC attempted to increase price incentives for gas production. In 1974, it set a national price for gas from wells drilled on or after January 1, 1973. In addition to allowing a higher price, the FPC included an annual price escalator and excluded certain state and federal taxes and allowances from the calculation of wellhead prices.

The FPC also recognized that the interstate-intrastate market distinction had become a problem. The regulated interstate market price did not provide adequate incentive to draw supplies from the unregulated intrastate market in which prices were higher. Furthermore, interstate demand remained artificially high because the price of new, high-cost gas was averaged with old gas prices. Thus, the average price paid by consumers did not reflect the full marginal cost of new gas supplies. This disparity between intrastate and interstate demand led to gas shortages in the interstate markets during the middle 1970s. This, in turn, led the Congress to reconsider natural gas policy.

The Natural Gas Policy Act of 1978

The Natural Gas Policy Act (NGPA) of 1978 was intended to provide incentives for new production through higher prices while preventing sharp price increases for gas already in production. Consequently, the act combined deregulation and price controls by allowing phased deregulation of certain categories of newly discovered gas and by creating nationwide price ceilings for all other gas. Also, the Federal Energy Regulatory Commission (FERC) was established to replace the Federal Power Commission.

An overview of NGPA is presented in Table A-1. As the table illustrates, the sections of NGPA can be classified into three major categories: supply incentives, consumer protection, and regulation of intrastate gas prices.

The supply incentive sections were designed to increase the nation's gas supply at the margin by allowing price increases that were rapid by historical standards and eventual deregulation. Section 102 includes gas found outside 2.5 miles of an existing well or gas found 1,000 feet below the completion depth of that well. In addition, Section 102 includes gas from outer continental shelf leases and production from new reservoirs. The price ceilings for these categories are allowed to increase at the rate of inflation plus a real growth premium. New onshore gas produced within existing fields is included in Section 103; its price increases at only the inflation rate. High-cost gas (Section 107--that is, gas that is costly to produce) includes gas from wells drilled below 15,000 feet, and gas produced from geopressurized brine, coal seams, devonian shales, and other high-cost sources. With the exception of gas produced from low-production wells (stripper wells), each of the supply incentive categories would be deregulated on January 1, 1985.

The NGPA was also designed to protect consumer interests through continued regulation of most gas already in production. Hence, the second major category of gas under NGPA includes old, low-cost natural gas. Section 104 sets the ceiling price for natural gas already dedicated to interstate commerce. The maximum lawful price in contracts that are renegotiated is determined by the provisions set forth in Section 106 of NGPA. The Section 106a price is the higher of either the price in the expiring contract or $0.54 per milion Btus, both escalating at the annual rate of inflation. Section 109 is a catch-all category. Each of these categories would not be deregulated in 1985.

The last major part of NGPA addressed the disparities between intrastate and interstate gas prices by imposing price controls on intrastate gas. For Section 105 gas, the price ceilings are tied to new gas prices (Section 102). Section 106b includes provisions for setting renegotiated intrastate prices that closely follow the methods employed in Section 106a. Some intrastate gas categories would be deregulated in 1985.

TABLE A-1. OVERVIEW OF THE NATURAL GAS POLICY ACT OF 1978

Sections	Description	Price Escalation Formula	Status as of 1/1/85
Supply Incentives			
102	New natural gas outside existing fields; new reservoirs; new outer continental shelf fields	Inflation plus real growth premium	Deregulated
103	New onshore wells within existing fields	Inflation	Deregulated
107	High-cost gas	Deregulated immediately	Deregulated
108	Stripper wells	Same as 102	Regulated
Consumer Protection			
104	Interstate gas	Same as 103	Regulated
106a	Renegotiated interstate contracts	Same as 103	Regulated
109	All other gas	Same as 103	Regulated
Intrastate Market			
105	Intrastate gas	Tied to new gas prices	Deregulated
106b	Renegotiated intrastate contracts	Same as 103	Deregulated if contract price is greater than $1.00 per thousand cubic feet

AN OVERVIEW OF CONTRACT PROVISIONS

This section provides additional information on contracts between gas producers and purchasers. The delivery of natural gas from the producer to the final user involves a large and complex network of pipelines. Each step of this process has been regulated by both federal and state regulatory authorities. In fact, under most suggested wellhead decontrol policies, including those considered in this study, the regulatory apparatus for the transmission and distribution of gas would remain in place. Therefore, the adaptability of these regulations and their influence on contract provisions, particularly those affecting producer-pipeline transactions, would be an important consideration in developing a policy to decontrol natural gas.

Contract Provisions

The sales contracts between producers and purchasers generally include four major components: duration, take-or-pay provisions, pricing provisions, and buyer-protection clauses. The following sections explain the nature of each of these provisions and present estimates of their prevalence in the natural gas market.

Contract Duration. Long-term contracts are often arranged in order to guarantee continued service and to justify capital investments in either gas turbines or pipelines. Contracts in the interstate market were historically written for 20 years or more. Long-term contracts also exist in the major intrastate markets, such as Texas and Louisiana. Recent contracts are for shorter time periods, reflecting producers' fears of being locked into fixed prices during inflationary periods. Thus, while the gas market is beginning to acquire more flexibility, the existence of long-term contracts will delay the adjustment of the gas market to new gas pricing policies.

Take-or-Pay Provisions. Take-or-pay provisions require the buyer to pay for certain quantities of gas at preset prices regardless of whether delivery occurs at the time of payment. The financial uncertainty associated with gas production is a major motivation for this provision. Because of the large cash investments required to drill and develop a well, producers often need payment for large amounts of gas during the first few years of a contract. These requirements lead producers to seek an assured market for their gas, though contracts tied to the production from a specific well or a particular field. Take-or-pay provisions are also sought by producers for protection against situations in which pipelines or other buyers could exert a disproportionate influence on prices and quantities sold once gathering equipment is in place.

Take-or-pay provisions may discourage buyers from minimizing the cost of gas. For example, a distribution company or pipeline may be forced to buy gas at a high price under a contract with a high take-or-pay provision and subsequently refuse cheaper gas or gas with a lower take-or-pay provision from another source. This phenomenon is partly attributable to the fact that profits by distribution and pipeline companies are regulated and, therefore, not influenced by any competitive bidding for gas supplies. Profits may be influenced, however, by any load loss. This problem is exacerbated since distribution companies purchase gas from pipelines at a single rate that is an average of old, low-cost gas and new, high-cost gas. Thus, this average cost pricing reduces the marketing risk associated with the purchase of high-cost gas to the extent that large volumes of low-cost gas are available.

Pricing Provisions. The pricing clauses in natural gas contracts are complex. There are three basic varieties of pricing provisions: definite escalation, highest allowed regulated-rate, and deregulation provisions. Definite escalation clauses set the price according to a fixed rate of growth or to a schedule of price increases in nominal or real dollars.

The latter two provisions set prices according to future external events, and are called indefinite escalator clauses. The highest allowed regulated-rate provision allows the producer the highest rate set by federal and state price regulations. Determining the overall price adjustments stemming from contracts that have this provision is difficult because of the uncertainty of regulatory actions. In addition, existing contracts reflect past responses to and expectations of federal and state regulation. For example, area rate clauses for both intrastate and interstate gas appeared after the adoption of area-wide, cost-based price regulation. The regulations changed again in 1974 when the Federal Power Commission adopted nationwide regulation. As a result of this change, and with the myriad of price ceilings under NGPA, the highest allowed regulated-rate provisions were written in even more general terms. Many recent contracts set prices according to the highest price allowed under current law.

Deregulation provisions are included in contracts to determine the price of gas when it is deregulated and to set the price of gas not currently regulated (such as high-cost gas under Section 107 of the NGPA). Ever since the Phillips decision in 1954, deregulation has been anticipated. Therefore, deregulation clauses were added to contracts. The most common deregulation provision sets the contract price at an average of the two or three highest prices being paid in a producing area. The price may also be the highest paid by the purchaser for similar gas sold under another contract. These options are called "most-favored-nation" clauses. Producers with contracts containing these clauses would receive preferential treatment upon deregulation over other producers who do not have such contracts.

Many recent contracts have several pricing options in the event of deregulation. Besides the most-favored-nation clauses, natural gas prices have been tied to the price of oil, usually that of crude oil or No. 2 fuel oil (distillate oil). Pricing clauses may also be based on a fixed percentage rate of increase. When more than one pricing option appears in a contract, the seller is usually allowed to choose the price. Another form of seller protection provided in some recent contracts is the minimum-price provision that prevents the price from falling below its previous level. The combination of this provision and the most-favored-nation clauses could lead to a situation in which prices could increase sharply yet could not easily be adjusted downward in response to market forces.

Buyer Protection Provisions. While some price provisions favor high gas prices, buyer-protection clauses introduce some flexibility into the marketing of natural gas. The "market-out" and "if-disallowed" provisions are two major types of buyer-protection clauses. A market-out provision allows the buyer to refuse delivery if the gas is determined to be unmarketable at the renegotiated price. In many contracts, the conditions for determining marketability are not clearly defined. Some contracts, however, leave the determination of marketability to the discretion of the buyer. The if-disallowed provision would not allow a new price to be passed through to the buyer if the FERC or a state public utility commission determined that the price was unjustified.

Effects of Contract Provisions on Gas Supplies

This section presents estimates of the relative importance of various contract provisions on total natural gas supplies. Several surveys of existing contract provisions have recently been conducted to estimate the magnitude of the "fly-up" problem--that is, the possibility that wellhead natural gas prices will increase sharply upon decontrol and not fall in response to market forces because of rigid contract provisions.[1] The key data requirement is the amount of gas associated with each type of contract provision. For example, there may be a large percentage of contracts with deregulation provisions that have most-favored-nation clauses; yet if these contracts

1. The data presented in this section are from U.S. Department of Energy, Energy Information Administration, Office of Oil and Gas, Natural Gas Producer/Purchaser Contracts and Their Potential Impacts on the Natural Gas Market (June 1982).

cover only a small faction of total gas supplies, then the fly-up problem may not occur.

The prevalence of take-or-pay provisions and buyer-protection clauses is also important. For instance, if contracts with maximum-price provisions also include market-out clauses, then there would be a greater possibility that prices could fall in response to market forces. On the other hand, widespread use of take-or-pay provisions would have the opposite effect. Another important aspect is contract age. Contracts signed after passage of the NGPA have different provisions. In addition, contracts governing interstate and intrastate gas also vary because of fundamental differences in the two markets and in their regulatory histories. These distinctions imply that the following discussion can best be divided into contract provisions for old interstate gas (NGPA Sections 104 and 106a), old intrastate gas (Sections 105 and 106b), and post-NGPA gas (Sections 102, 103, 107 and 108).

Old Interstate Gas. In 1980, the volume of interstate gas under contracts signed before enactment of the NGPA was estimated to be 6.18 trillion cubic feet (approximately 31 percent of total U.S. demand), with an average wellhead price of $0.89 per thousand cubic feet. About 8 percent of this amount is governed by contracts with definite price escalators, 26 percent is covered by highest allowed regulated rate clauses, and 66 percent has deregulation provisions. Roughly 92 percent of old interstate gas supplies have take-or-pay provisions. Only 6 percent have market-out clauses, and 14 percent have renegotiated prices that can be disallowed by FERC. For the contract volumes covered by deregulation clauses, 90 percent have most-favored-nation clauses that link the price to an average of the highest priced gas in specific producing areas. Thus, based on this information, there appears to be little downward flexibility in prices for old interstate gas.

Old Intrastate Gas. The volume of old intrastate gas (Sections 105 and 106b) has been estimated at 6.23 trillion cubic feet in 1980 (approximately 32 percent of U.S. demand). The average wellhead price for this gas in 1980 was about $1.17 per thousand cubic feet. On January 1, 1985, only Section 105 gas with a price that exceeds $1.00 per million Btus would be deregulated. Rollover contracts for intrastate gas (that is, contracts that expire and are extended) are included in Section 106b. Natural gas produced under Section 106b would be deregulated in 1985 if the price exceeds $1.00 per million Btus. Roughly 28 percent of the gas volumes under Section 105 will roll over between now and 1985.

It is estimated that 34 percent of intrastate gas under Sections 105 and 106b will be deregulated in 1985. Of this amount, 51 percent have only definite price escalator provisions. This is in sharp contrast to the 8 percent figure for old interstate gas and may reflect the fact that three-fourths of Section 105 gas is delivered under contracts signed before 1973. In addition, direct sales to final users, primarily large industrial customers, take a much larger proportion of intrastate sales. The large share of definite price escalator clauses may have been used to attract these customers. Twenty-two percent of the old intrastate gas supplies slated for decontrol in 1985 has most-favored-nation clauses. Close to 76 percent has take-or-pay provisions. Thus, prices for old intrastate gas may not increase as sharply as those for old interstate gas.

Post-NGPA Gas. Some overlap exists between contracts signed before and after the Natural Gas Policy Act of 1978. For instance, some long-term contracts have been amended to add additional wells. Consequently, a contract negotiated before enactment of the NGPA can apply to a well drilled after 1978. Recognizing this possible double counting problem, the 1980 volume of post-NGPA gas has been estimated at 6.23 trillion cubic feet (approximately 33 percent of total demand). The 1980 wellhead price for this gas was $2.19 per thousand cubic feet, considerably higher than prices for the two previously mentioned categories.

Deregulation clauses cover 59 percent of post-NGPA gas. Of these contract quantities, 76 percent have most-favored-nation clauses, 21 percent have market-out clauses, and 21 percent have oil parity price provisions. Roughly 80 percent of post-NGPA gas volumes are associated with contracts that have take-or-pay provisions. The price of post-NGPA gas, therefore, will quickly reflect any change in gas pricing policy.

Kansas Water Plan

Sub-section: Minimum Desirable Streamflows

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MINIMUM DESIRABLE STREAMFLOWS

INTRODUCTION

In 1980, the Kansas Legislature passed a law that would protect streamflows from encroachment by new appropriation rights. (See Glossary on Page 11.) Under terms of K.S.A. 82a-703a, the Chief Engineer of the Division of Water Resources of the State Board of Agriculture shall withhold an amount of streamflow from appropriation so that the minimum desirable streamflows can be maintained. The 1983 Legislature passed Senate Concurrent Resolution 1622, directing the Kansas Water Authority and Kansas Water Office to develop procedures for the administration of minimum desirable streamflows and to conduct field tests on the Marais des Cygnes and Neosho rivers.

This section describes the general procedures of establishing, monitoring, and administering minimum desirable streamflows. Priority streams considered for minimum desirable streamflows are listed and minimum desirable streamflow standards for the Marais des Cygnes, Neosho, Cottonwood, and Little Arkansas rivers are recommended.

CONCEPTS

Minimum desirable streamflows are meant to "preserve, maintain, or enhance instream water uses relative to water quality, fish, wildlife, aquatic life, recreation, and general aesthetics" according to K.S.A. 82a-928(9).

Under the terms of K.S.A. 82a-703a, the Chief Engineer shall withhold minimum desirable streamflows from appropriation. This can be accomplished either by denying future appropriation requests or by allowing future appropriations but making them subject to being shut off when minimum desirable streamflows are not met. Minimum desirable streamflows are thus somewhat analogous to water rights. Upon the effective date of any legislatively adopted minimum desirable streamflow, that flow would have a priority established in the "first in time is first in right" concept of the Kansas Water Appropriation Act. Thus, any appropriation filed after this date (junior right) could be cut off during periods of low flow. No rights filed prior to this date (senior right) would be affected. Figure 1 displays the relation of minimum desirable streamflows to senior and junior water rights at various stream levels.

In some ways water appropriations are restricted by minimum desirable streamflow. On the other hand, the protection of appropriated water flowing toward a destination in the lower reaches of the stream where a senior water right holder is waiting to use it contributes to maintaining a minimum desirable streamflow. Thus, the uses are not always competitive. Minimum streamflows may consist of unappropriated water, water returning from upstream diversions, releases from reservoirs, and water transported to downstream appropriators. This illustrates that in some cases water uses complement each other and the water can serve several purposes.

A minimum desirable streamflow plan can't create water where water doesn't exist or help streams that are over-appropriated. In fact, to provide water in some rivers like the Arkansas River in western Kansas, it would be necessary to buy water rights and supplement streamflow at considerable expense. What minimum streamflow planning can do is help those streams where there is still some water to protect. Minimum desirable streamflow can particularly be helpful for streams that have reservoirs in place, especially those reservoirs that have water quality storage which could be used.

Only a portion of the reservoir storage would be used for minimum desirable streamflow under the proposals outlined in this section. The highest priority for reservoir waters is for water supply and emergency water quality releases. Thus, as reservoir levels drop, water available for minimum desirable streamflows

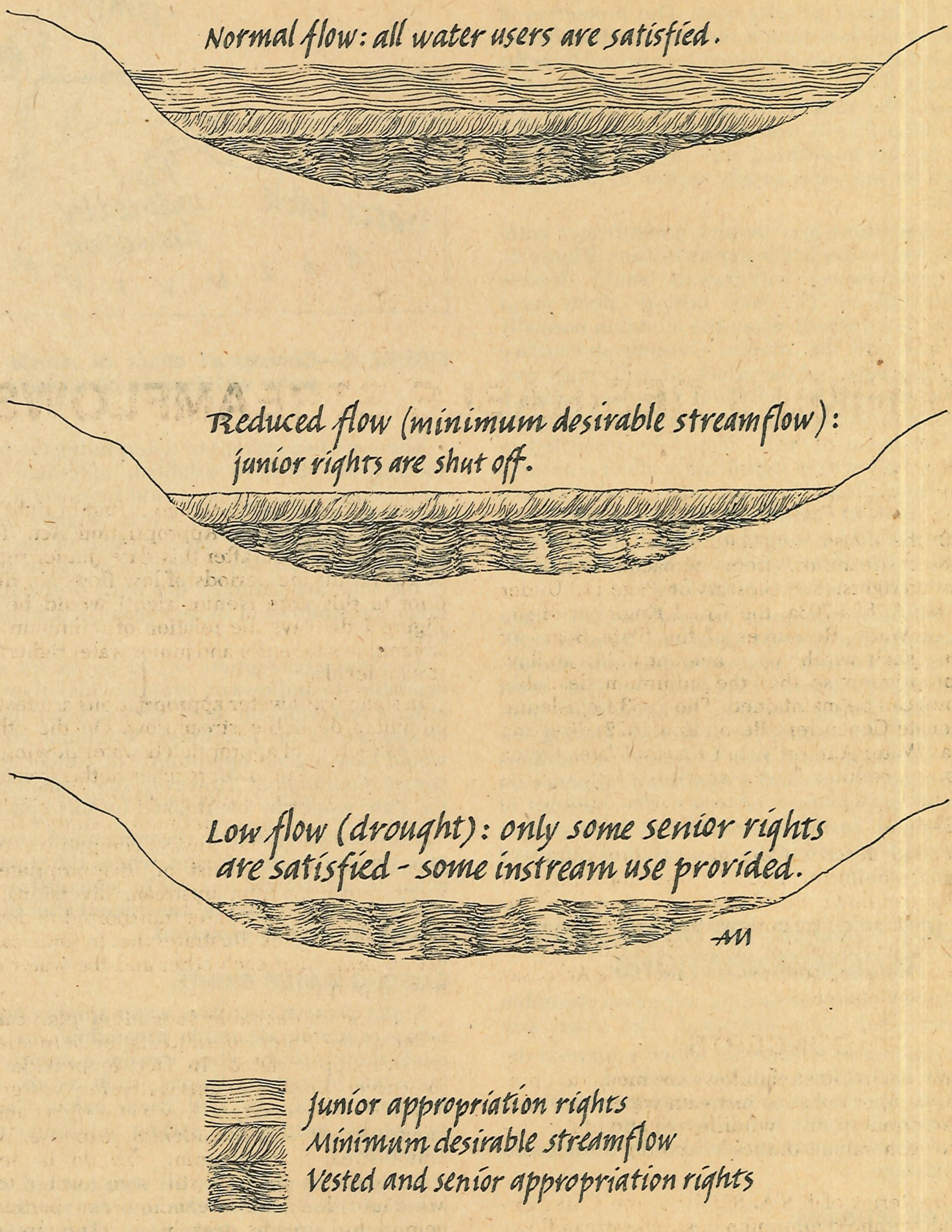


FIGURE 1.—Conceptual relations of minimum desirable streamflows and water rights at various stream levels.

would decrease so that the low flow releases would eventually cease and the remaining storage would be available for higher priority uses. The protection of water supply releases from a reservoir to their downstream point of use can also provide instream benefits to the stream. To fully realize the benefits from reservoir storage, the state must gain more control over their operation than is presently possible. A specific proposal for accomplishing this objective is being considered for the water supply section of the Kansas Water Plan.

Stream depletions may involve groundwater withdrawals as well as surface water diversions (Figure 2). Alluvial groundwater withdrawals could deplete nearby streamflows. The more critical effects occur during low flow periods when the alluvium normally supplies water to the stream. Groundwater/surface water relationships and the effects of wells must continue to be assessed by the Chief Engineer, groundwater management districts and the Kansas Geological Survey. Placement of wells should be restricted in areas where they would significantly affect minimum desirable streamflows. In some cases, wells that can be shown to exert significant direct influences on streamflow should be administered as if they were in the stream. Under these conditions, application of the alluvial corridor concept is suggested.

In establishing minimum streamflows, the state must recognize that in most situations, there is sufficient water for all uses; minimum desirable streamflows and appropriations. Likewise, the state must recognize that during droughts, recommended minimum streamflows cannot be achieved. During the transition between these two hydrologic conditions minimum streamflows exert a significant influence on the use and management of water. The purpose of these minimum desirable streamflows is to protect flow from depleted conditions as a result of extensive water appropriation.

POLICY ISSUES, OPTIONS, AND RECOMMENDATIONS

Three policy issues regarding minimum desirable streamflows need to be addressed. The issues are:

1. The number of streams on which minimum desirable streamflows will be identified;
2. The priority of existing water appropriations over minimum desirable streamflows; and
3. The enhancement of streamflows by using reservoir storage.

NUMBER OF STREAMS

The current statutes do not define the extent to which the minimum desirable streamflow concept should be applied in Kansas. Thus, minimum streamflows are not restricted only to the major streams nor are they mandated for every stream in the state.

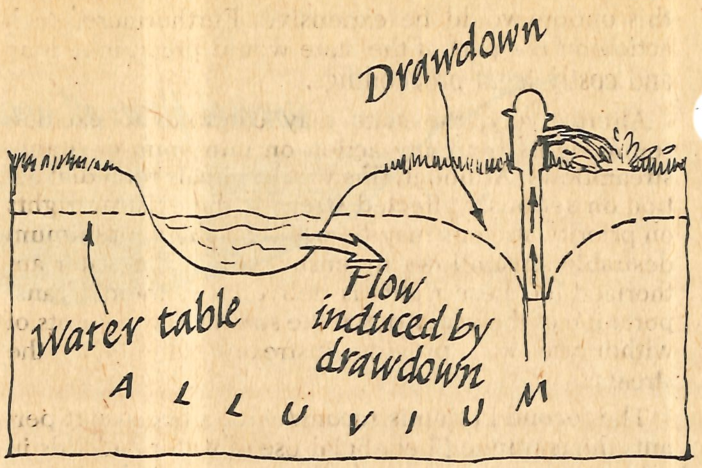


FIGURE 2.—Conceptual effect of alluvial groundwater withdrawals on streamflow.

There are two options in determining the number of streams in which to establish minimum desirable streamflows. One option would be to set a minimum desirable streamflow on every stream in Kansas, thereby protecting the surface water of the state from serious depletion. Many streams in the western third of the state are naturally dry most of the time. Minimum streamflows of those streams would be impractical.

An alternative option would be to set minimum desirable streamflows on streams which flow regularly or have reservoirs on them. This reduces the number of streams to be examined. Minimum streamflows would have a good opportunity to protect an existing stream environment. However, some small streams in the state would be overlooked by this option.

The second option is recommended since it will give priority to the streams where the possibility to achieve minimum desirable streamflows exists. Smaller streams could be considered after the priority streams have been protected.

EXISTING WATER RIGHTS

Under present state law, water appropriations filed before minimum desirable streamflows are approved retain their priority. Thus, streams currently severely impacted by appropriations, such as the Arkansas River or the Smoky Hill River below Cedar Bluff cannot be helped by setting minimum desirable streamflows.

An option would be for the state to condemn and/or purchase those senior rights in order to achieve some minimum desirable streamflows. This option would provide some streamflow by lessening the demand on that water. On some streams, such as the Upper Arkansas or Smoky Hill rivers, the buying out of existing rights might alleviate the serious lack of streamflow, although to what degree remains unknown. However, this option would be expensive. Furthermore, such action on the part of the state would precipitate long and costly legal proceedings.

Alternatively, the state may continue to exclude senior rights from any action on minimum desirable streamflows. Although this would impair remedial action on seriously affected streams, the existing rights on priority streams may be used to achieve minimum desirable streamflows by ensuring that the water authorized for these rights is delivered to them. Transportation of the water down the stream to the points of withdrawal will provide instream benefits to the stream.

The second option is recommended because it permits the continued beneficial use of water and aids in achieving minimum streamflows.

STREAM ENHANCEMENT

K.S.A. 82a-928(7) calls for "the inclusion in publicly financed structures for the conservation, management and development of the water resources of the state of reasonable amounts of storage capacity for the regulation of the low flows of the watercourses of the state." K.S.A. 82a-928(9) states one purpose of minimum desirable streamflows is to "enhance" instream uses. Reasonable amounts of storage have not been identified in Kansas reservoirs nor has the degree of enhancement to Kansas streams been addressed in terms of the public interest in use of that water.

One option would be to maintain minimum desirable streamflows through all conditions, including drought, by using existing reservoirs. This option would provide streamflow through very dry periods, such as the droughts of the 1930's and 1950's. However, release of water from reservoirs for instream benefits would deplete the reservoirs in such stressed times and preclude the use of that water for municipal uses. Thus, enhancing minimum streamflows with reservoir storage would be implied to be a higher priority than water supply to the general public.

An alternative option would not permit any enhancement of streams, thereby holding water in reservoirs until a critical public need for that water is expressed. Streams would dry up as they historically have. Precluding the use of stored water to supplement streams during low periods is not consistent with existing state policies. Furthermore, two uses of many federal reservoirs, water quality maintenance and flow regulation, would be neglected under this option.

A third option would consider enhancement of streamflows by reservoir releases through a moderate (one-in-ten year) drought, but would restrict any supplementation as conditions worsened. This option would follow K.S.A. 82a-928(7) in using some stored water for low flow regulation, but recognizes the higher priorities of public water supply and emergency water quality releases over instream benefits as water becomes scarce. Adoption of this option would still enhance streams beyond what historically would have flowed under similar conditions. Use of stored floodwaters to enhance flows is a possibility under this option.

The third option is recommended because reasonable amounts of storage would be used for low flow regulation, some stream enhancement is allowed, and higher public needs would take priority over minimum desirable streamflows under severe drought conditions. Stream enhancement can only occur on regulated streams.

SUMMARY OF POLICY RECOMMENDATIONS

In summary, the following three options are recommended.

(1) The state should identify minimum desirable streamflows on those streams with sufficient opportunity to achieve such streamflows and with real needs to be protected from future appropriation of water.

(2) The state should not subject existing water rights to the administration of minimum desirable streamflows, but should use those rights to help achieve the minimum streamflows.

(3) The state should attempt to enhance streamflows, using reservoir water, through moderate droughts, but should forego enhancing streamflows as drought conditions worsen in favor of providing water for water supply and water quality purposes, as those needs arise.

PLAN IMPLEMENTATION

ADMINISTRATIVE ACTIONS

Minimum desirable streamflows are based on specific instream needs on specific stream reaches. Before actual streamflow values are identified, state policy and procedures must be declared on three facets of minimum desirable streamflows; the methodology of selecting streams and identifying minimum streamflows, the process of monitoring minimum streamflows, and the administration guidelines for achieving minimum streamflows. The details of these three phases are provided in the Minimum Desirable Streamflow Background Paper, available from the Kansas Water Office. The general concepts for methodology, monitoring, and administration of minimum desirable streamflows are outlined below.

Methodology

The methodology of selecting a minimum desirable streamflow depends on the instream needs, availability of streamflows, and existing appropriation rights. Unfortunately, this dependence precludes the use of a single criterion for choosing a minimum streamflow on every stream in Kansas. Therefore, minimum streamflows must be chosen on a stream-by-stream basis. The methodology must define the operating principles and criteria for establishing minimum streamflows.

Minimum streamflow determinations should be based upon the following factors:

1. Defined hydrologic conditions under which minimum streamflows will pertain.
2. Maintenance of adequate water quality for public health and aquatic life to the extent possible under prevailing hydrologic conditions.
3. Under normal hydrologic conditions, maintenance of the aquatic habitat to support an adequate fishery biomass.
4. Maintenance of instream recreation potential under normal hydrologic conditions, recognizing the questions of trespass and limited access on many Kansas streams.
5. Protection of the wildlife and aesthetic characteristics of Kansas stream channels and their surrounding riparian areas.
6. Any proposed minimum desirable streamflow will be established with the technical advice and review of an interagency advisory committee.
7. The Kansas Water Office will recommend minimum streamflows based upon the following criteria:
   (a) the instream needs of aquatic life present in that reach,
   (b) the factors influencing the ambient water quality within the reach,
   (c) any indirect benefits such flows provide to recreation, aesthetics or the riparian ecology,
   (d) water appropriation rights which have been filed prior to the legislative session, including the quantities and location of their diversions,
   (e) availability of baseflows to meet the minimum streamflow,
   (f) expected streamflows resulting from direct runoff,
   (g) hydrologic effects of conservation and watershed projects,
   (h) the historic frequency of the minimum streamflow, reflecting the natural hydrologic capacity to meet that flow,
   (i) the relationship of existing interstate water compacts,
   (j) the effect on streamflow by significant appropriation of alluvial groundwater,
   (k) available storages in upstream reservoirs to aid in achievement of minimum streamflows, and
   (l) economic considerations of administration and future development.

Monitoring

The monitoring network for minimum desirable streamflows serves three purposes. First, the network provides adequate warning of critical flow conditions as those conditions occur. Second, the network accurately assesses the achievement of minimum desirable streamflows during those critical periods. Finally, the network produces reliable evidence to justify and support subsequent administrative actions and decisions.

The Kansas Water Office should be responsible for monitoring minimum streamflows. Gaging stations will be used as monitor sites because of their accessibility and continuous records. Telemetering and verbal reports from field personnel will be the primary source of data. The monitoring network will necessarily be modified on a stream-by-stream basis.

Administration

Administration to maintain minimum desirable streamflows is the responsibility of the Division of Water Resources. The Kansas Water Appropriation Act states in part:

> "Whenever the legislature enacts any section or amendment of the state water plan which identifies a minimum desirable streamflow for any watercourse in this state, the chief engineer shall withhold from appropriation that amount of water deemed necessary to establish and maintain for the identified watercourse the desired minimum streamflow." (K.S.A. 82a-703a)

Two situations are present in Kansas streams: natural flow in reaches unregulated by reservoirs and regulated flow in reaches below reservoirs. K.S.A. 82a-703a applies in either situation, however, reservoirs provide an additional option to supplement deficient streamflows by releasing stored water.

Administration of minimum desirable streamflows on unregulated streams would commence seven days after deficient flows were encountered, unless the deficiency in streamflow warranted immediate action. Administration would proceed as follows:

(1) Note deficiency of flows and upstream use by water appropriators.

(2) Prevent anyone not holding valid water appropriations from diverting water during this critical period.

(3) Limit diversions by water appropriators upstream of monitoring site in accordance with their water appropriations.

(4) Implement, for all users, water conservation measures that may be recommended or required by the state through policies or programs.

(5) Shut off surface water appropriations with priority dates after the date of enactment of the

minimum desirable streamflow.

(6) If necessary, restrict groundwater usage in the surrounding alluvium.

(7) Administer streamflows such that downstream vested and most senior appropriations are met, recognizing the complementary purposes of upstream instream benefits and the priority of the most senior appropriation.

Administration of minimum desirable streamflows on regulated streams would proceed as above, plus the following:

(8) Protect reservoir releases to the extent possible and provided by the agreements required in K.S.A. 82a-706b.

(9) Release and protect water quality and water supply flows, under K.S.A. 82-706b, as downstream needs dictate.

(10) Maintain administration until the situation is relieved.

FINANCIAL REQUIREMENTS

Funding for the minimum desirable streamflow program will be required for monitoring and administration. To the extent possible, the existing U.S. Geological Survey gaging station network will be used to monitor minimum streamflows. Some monitoring costs will be incurred by establishing additional gaging stations and the operation and maintenance of those stations. Establishment costs range from $1,500 to $12,000, depending on the type of gage. These are one-time costs. Annual operation and maintenance costs range from $550 to $5,500 per station. Costs will be shared by the state and the U.S. Geological Survey. For fiscal year 1985, a stream gaging station is needed for the Marais des Cygnes River near LaCygne. This station would include telemetry equipment for remote access of streamflow data. The monitoring costs for the state for the 1985 fiscal year comes to $8,700, $4,000 of which are ongoing operation and maintenance costs, including telephone usage.

Administration of minimum streamflows will incur costs to the Division of Water Resources. The actual expense incurred in administering minimum streamflows is dependent upon factors of hydrologic conditions such as drought, the number of water rights along a stream and the number of new applications to appropriate the stream water. While an accurate estimate of cost is difficult to determine, the Division of Water Resources did an analysis to simulate the effect of the drought conditions present in 1980-1982 on the four rivers with minimum streamflow recommendation. This analysis indicated that it would require approximately 24 man-months of time during a fiscal year to protect or augment minimum streamflows under these conditions. This situation would exceed present staffing capabilities of the Division. Therefore, additional personnel would be required to respond during these drought conditions. In addition, the Division of Water Resources indicated that the implementation of minimum streamflow requirements would necessitate other work such as the evaluation of the effect of new appropriations on established minimum streamflows and enforcement activities.

The total fiscal requirement for monitoring and administering minimum streamflows cannot be determined until minimum desirable streamflow standards have been established on the remaining streams. However, if minimum streamflow standards are developed similiar to those which have been established by this section, approximately 20 additional stations could be required on future streams with estimated start-up costs of $100,000 and annual operating costs of $60,000. Similarly, the Division of Water Resources estimated that administration would require approximately one man-year per major river basin under drought conditions. Assuming these factors, annual on-going expenditures for administration of minimum streamflows would be from approximately $250,000-$300,000.

TIME SCHEDULE

Recommended Minimum Desirable Streamflows

Recommendations for minimum desirable streamflows are submitted for four rivers: the Marais des Cygnes River; the Neosho River and its major tributary, the Cottonwood River; and the Little Arkansas River (Table 1). Separate technical reports for each stream are available detailing the considerations and data used in formulating the following minimum desirable streamflow recommendations.

Spawning flows for fisheries are presented on the regulated streams in April, May, and June. These flows will depend on the status of reservoir storage. If the reservoirs are in flood pool, the spawning flows will be released. When reservoirs are at conservation pool, the spawning flows will be foregone and the maintenance flows recommended during the remaining nine months will pertain to the spawning period.

MARAIS DES CYGNES RIVER

The Marais des Cygnes River is located in eastern Kansas and flows eastward into Missouri (Figure 3). Average annual flow on the river is 630 cfs at Ottawa and 1,900 cfs near the state line. The Marais des Cygnes River has been regulated since 1964 when Pomona Reservoir was completed. Two more reservoirs, Melvern and Hillsdale, have been constructed in the basin. Median flow at Ottawa has been 127 cfs since the reservoirs were completed and median flow near the state line has been 456 cfs. All three reservoirs have water quality storage currently totaling 160,000 acre-feet. Minimum streamflow recommen-

FIGURE 3.—Stream sites of recommended minimum desirable streamflows for 1984.

dations for the Marais des Cygnes are varied on a monthly basis and are keyed to stations at Ottawa and near La Cygne (Table 1). Administration of existing rights along with low flow water quality releases from Melvern, Pomona, and Hillsdale reservoirs will usually provide adequate instream benefits. Details of the minimum streamflow recommendations are provided in Minimum Desirable Streamflow Technical Report #1.

NEOSHO AND COTTONWOOD RIVERS

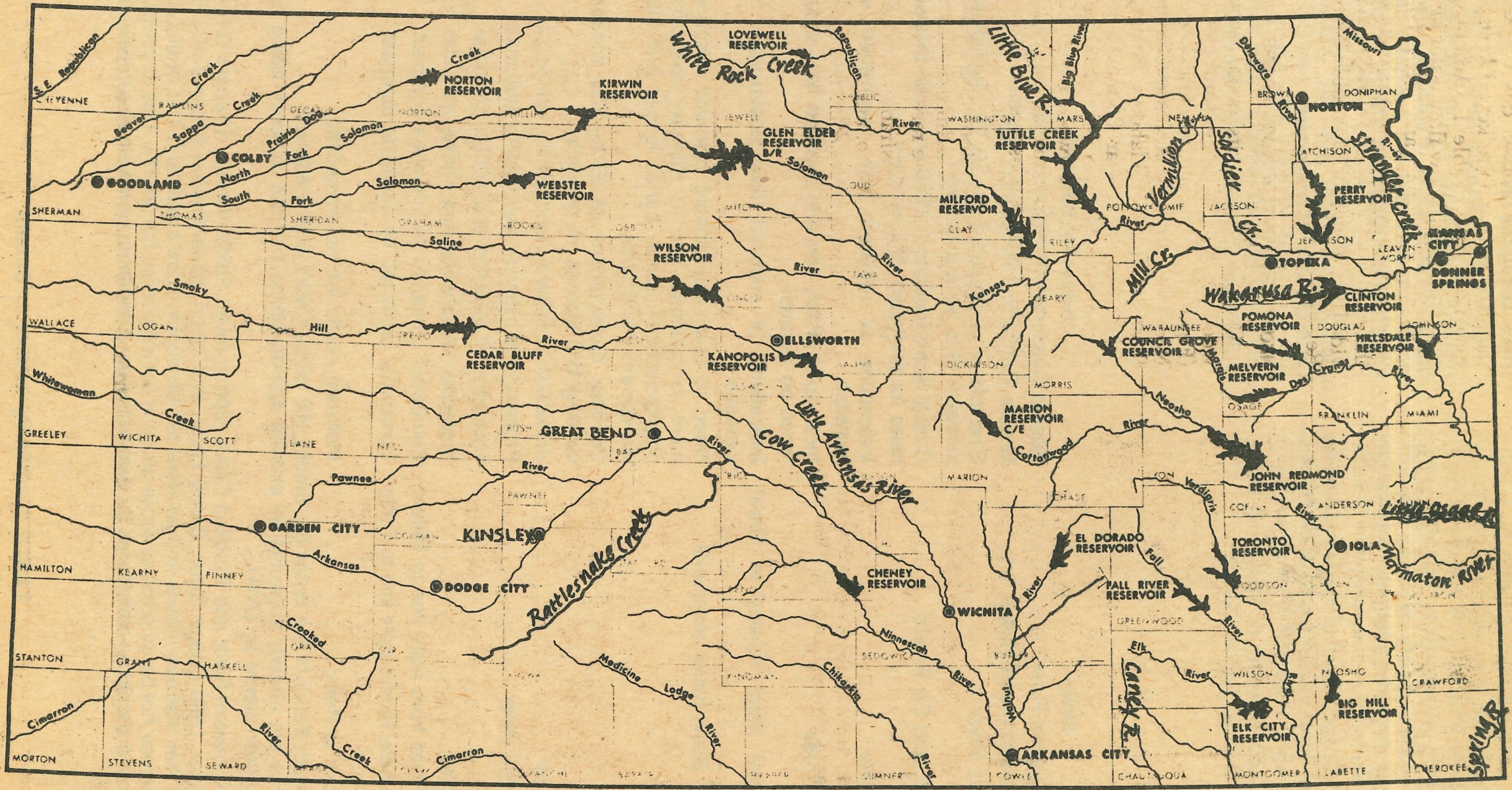
The Neosho and its major tributary, the Cottonwood, are located in the southeast portion of the state (Figure 3). The Cottonwood flows eastward into the Neosho above John Redmond Reservoir. The Neosho flows south into Oklahoma. Average annual flow on the Cottonwood near Plymouth is 830 cfs. Average flow on the Neosho near Americus, above the confluence of the Cottonwood River is 280 cfs. The Lower Neosho near Parsons averages 2,500 cfs annually. Median flows at these points have been 270, 68 and 710 cfs respectively. Three reservoirs are located on the Neosho and Cottonwood rivers: Marion, Council Grove, and John Redmond. Current water quality storage in these three reservoirs total 89,700 acre-feet.

The minimum desirable streamflow recommendations for the Neosho and Cottonwood rivers were made for five points: Florence and Plymouth on the Cottonwood, Americus on the Upper Neosho, and Iola

Marais des Cygnes	J	F	M	A (*)	M (*)	J (*)	J	A	S	O	N	D
Ottawa	15	15	15	15 (40)	20 (50)	25 (50)	25	25	20	15	15	15
LaCygne . . .	20	20	20	20 (50)	20(150)	25(150)	25	25	20	20	20	20
Neosho												
Americus . .	5	5	5	5 (20)	5 (30)	5 (30)	5	5	5	5	5	5
Iola	40	40	40	40 (60)	40(200)	40(200)	40	40	40	40	40	40
Parsons . . .	50	50	50	50(100)	50(300)	50(300)	50	50	50	50	50	50
Cottonwood												
Florence . . .	10	10	10	10 (30)	10 (60)	10 (60)	10	10	10	10	10	10
Plymouth . .	20	20	20	20 (60)	20(150)	20(150)	20	20	20	20	20	20
Little Arkansas												
Alta Mills . . .	8	8	8	8	8	8	8	8	8	8	8	8
Valley Center	20	20	20	20	20	20	20	20	20	20	20	20

* Spawning flows to be managed if reservoirs in flood pool, otherwise use lower flows.

TABLE 1.—Minimum Desirable Streamflow Recommendations (cfs)



Bureau of Reclamation projects.....................B/R   Corps of Engineers projects.....C/E

FIGURE 4.—Kansas streams and reservoirs.

and Parsons on the Lower Neosho (Table 1). Administration of rights to ensure they receive their authorized quantities of flow will achieve a large percentage of the minimum streamflow requirements. Additionally, some water quality releases from the three reservoirs will provide adequate streamflow benefits. In severe droughts, some instream benefits will accrue due to transportation of contracted water supply releases from Marion and Council Grove reservoirs to Iola and Emporia. Details of these minimum streamflow recommendations are in Minimum Desirable Streamflow Technical Report No. 2.

LITTLE ARKANSAS RIVER

The Little Arkansas River is an unregulated (no reservoirs) tributary to the Arkansas River, meeting that river at Wichita (Figure 3). The Little Arkansas River averages 280 cfs annually. Median flow has been 57 cfs. Significant effects on the streamflow are exerted by groundwater withdrawals from the surrounding alluvium and the Equus Beds Aquifer. Groundwater Management District No. 2 currently manages much of the Little Arkansas Basin groundwater and has instituted a "safe yield" policy on the withdrawal of groundwater, recognizing the recharge

	Stream	Reason for Placement	Completion
1.	Marais des Cygnes River	Senate Concurrent Resolution 1622	1984
2.	Neosho and Cottonwood Rivers	Senate Concurrent Resolution 1622	1984
3.	Little Arkansas River	Example of unregulated stream for Legislature, instream data were available	1984
4.	Verdigris, Fall, and Elk Rivers	Critical flow situations in 1980 and 1983 indicate need for protected WQ releases	1985
5.	Ninnescah River	Indications of reduced flow occurrence on increase	1985
6.	Rattlesnake Creek	Indications of fish kills and reduced flow occurrence on increase	1985
7.	Arkansas River (from Kinsley to Great Bend)	Indications of reduced flow occurrence on increase	1985
8.	Kansas River Basin below reservoirs	Need to begin coordinated reservoir management to maintain flow in Kansas, controlling chloride/sodium levels, transit losses and alluvial-stream interactions	1985
9.	Walnut River	Pending development of EPA—WQ models. Existing WQ storage in reservoir	1986
10.	Chikaskia River	Protection of fisheries and wildlife attributes	1986
11.	Medicine Lodge River	Protection of fisheries and wildlife attributes	1986
12.	Mill Creek	Protection of fisheries and wildlife attributes	1986
13.	Vermillion River	Protection of fisheries and wildlife attributes	1986
14.	Republican River from state line to Milford	Somewhat protected by interstate compact	1986
15.	Big and Little Blue Rivers state line to Tuttle Creek	Somewhat protected by interstate compact	1986
16.	Delaware River to Perry	Instream needs are not immediate	1986
17.	North and South Forks of the Solomon, Smoky Hill below Cedar Bluff Reservoir. These streams are already impacted by existing appropriations and are currently being assessed and administered by DWR.		1986
18.	Cow Creek, Cimarron River and Crooked Creek, Spring River, Soldier Creek, Stranger Creek, Marmaton River, Little Osage River, Caney River, and other natural-flowing streams may be considered if their instream needs and potential for development are significant. The availability of streamflow may not be as great as those streams considered as top priority. This secondary group of streams should be considered for administration of minimum desirable streamflows as needs dictate.		1986

TABLE 2.—Priority Listing of Stream

characteristics of the regional aquifer. As of yet, the quantified relation between streamflow in the Little Arkansas River and groundwater withdrawals has not been adequately assessed. Such an assessment is necessary and should be undertaken to address the effects of alluvial withdrawals and recharge on streamflows. Until then, the recommended minimum streamflows in Table 1 should be maintained, whenever possible. Minimum streamflows on the Little Arkansas will be assessed at Alta Mills and Valley Center. The minimum streamflows can be met through administration of existing rights and restriction of future diversions and well withdrawals exerting a significant influence on streamflow. Details of the recommendations for minimum desirable streamflows on the Little Arkansas River are contained in Minimum Desirable Streamflow Technical Report No. 3.

Consideration of Additional Streams

By the 1986 Legislative Session, major streams with significant instream needs should receive technical consideration on minimum desirable streamflows. Table 2 lists the significant streams in order of priority for consideration. Figure 4 shows the location of these streams. It is recommended the following streams be considered and submitted to the 1985 Legislature: Verdigris River and tributaries, Ninnescah River, Rattlesnake Creek, Arkansas River from Kinsley to Great Bend, and the Kansas River below the tributary reservoirs. Remaining streams in Table 2 would be considered for the 1986 Legislature.

GLOSSARY

Acre-foot. Volume of water needed to cover one acre with one foot of water. Equivalent to 325,851 gallons.

Aesthetics. Natural characteristics perceived as beautiful.

Alluvial Corridor. Zone of alluvium surrounding a stream where groundwater withdrawals are restricted during critical lowflow situations.

Alluvium. Zone of sediment deposited by flowing water, bordering an active stream channel, and to some degree, hydrologically connected to the streamflow within that channel.

Appropriation Right. Right to divert from a specific water supply a specific quantity of water at a specific rate of diversion to be applied to a specific beneficial use.

Aquifer. Rock or sediment in a formation, group of formations, or part of a formation which is saturated and sufficiently permeable to transmit economic quantities of water to wells and springs.

Baseflow. Sustained streamflow largely derived from groundwater seepage into the stream.

Concentration. Amount of a dissolved or suspended substance, such as sodium or oxygen, contained within a specific volume of water. Usually expressed as "milligrams per liter" (mg/l).

Conservation Storage. Storage of water in a reservoir for later release for useful purposes such as municipal and industrial water supply, water quality or irrigation.

Consumptive Appropriation. Use of water resulting in a large proportion of loss to the atmosphere by evaporation and transpiration by plants. Irrigation is a consumptive use.

Conveyance. Downstream transportation of water within the stream channel.

Cubic foot per second. Rate of discharge of one foot of water in an one foot wide channel moving at one foot per second. Equivalent to 448.8 gallons per minute.

Discharge. The flow of a stream. Usually expressed as "cubic feet per second" (cfs).

Diversion. The taking of water from a stream.

Drought. A period of deficient precipitation and runoff extending over an indefinite number of days.

Gaging Station. A particular site on a stream where systematic observations of stages or discharges are made and recorded.

Habitat. The area in which a biological population normally occurs.

Instream Uses. Uses of water such as water quality, fish maintenance, recreation, or aesthetics within the stream, requiring no diversion.

Junior Rights. Appropriation rights which are filed subsequently to a particular water right or minimum streamflow. Such rights may only appropriate water in excess of the requirements of the particular water right or minimum streamflows.

Median Flow. A discharge which is met or exceeded half of the time.

Minimum Desirable Streamflows. Streamflows that maintain or preserve instream uses of water quality, fish, wildlife, aquatic life, recreation, and aesthetics from unacceptable stream depletions by future consumptive appropriations. Minimum desirable streamflows will not be preferred to vested and senior appropriation rights filed prior to their enactment nor will they be maintained through all drought conditions.

Reach. A lengthwise section of a stream.

Reallocation. The act of designating a new purpose for a portion of reservoir storage previously used for another purpose.

Regulated Stream. A stream where flow is controlled by an upstream reservoir.

Riparian. Pertaining to the area around the banks of a stream.

Runoff. Portion of streamflow derived directly from precipitation. Distinguished from baseflow.

Senior Rights. Appropriation rights which have preference over those water rights subsequently filed or minimum streamflows subsequently adopted.

Spawning flow. Discharge necessary for fish to migrate and deposit eggs in stream.

Streamflow. The discharge occurring in a natural stream channel.

Vested Rights. Right to continue the use of water having actually been used for a beneficial use prior to June 28, 1945.

Water Quality Storage. Portion of reservoir storage federally controlled to maintain adequate downstream water quality through reservoir releases.

Water Supply Storage. Portion of reservoir storage that is sold through contracts for use by municipal, industrial, or irrigation entities.

Watershed. The area contributing runoff to a given point on a stream.

Yield. The amount of water an aquifer will release from storage upon pumping or gravity.

REFERENCES

1. Minimum Desirable Streamflow Background Paper
2. Minimum Desirable Streamflow Technical Report #1—Marais des Cygnes River
3. Minimum Desirable Streamflow Technical Report #2—Neosho and Cottonwood Rivers
4. Minimum Desirable Streamflow Technical Report #3—Little Arkansas River

(Kansas Water Office Publications)

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Senate Committee on Energy and Natural Resources
January 10, 1983

Elasticity of Demand

Elasticity of demand is a measure used to tell how much the quantity consumers buy of a commodity will change in response to a change in price. When the price of a commodity drops, it is generally true that consumers purchase more of it. But how much more? Conversely, when the price of a commodity increases, consumers tend to purchase less of it. How much less? The words demand elastic/inelastic are measures of how flexible consumer spending decisions are in face of price changes. If the response is small, we say demand is inelastic.

Demand tends to be inelastic when the need for a commodity is urgent and when good substitutes are not available. The consumer's purchasing position is not a very flexible one. Certain types of medicines are classic examples of inelastic demands. Overall natural gas demand is a relatively inelastic situation. This is particularly true for residential and small commercial gas consumers. When the price of natural gas increases, these consumers can reduce demand some, but not by enough to avoid paying a larger total natural gas bill.

Elasticity of demand as used here is an aggregate measure of demand behavior. It is the sum of many individuals' separate decisions. Elasticity is most often used as a marketing tool to answer aggregated questions. For example, if an interstate pipeline wants to consider contracting for more expensive Alaskan gas, the demand elasticity of the customers served by the pipeline will help in making a determination of what contract volume should be. One can also focus on elasticity of demand at an individual level. What would any one of us do if gas prices went up?

Atch. 3

And how would we react at different price inreases of $1,$2, or $5/Mcf.

Any particular individual uses natural gas both in an essential way and for convenience. When we say residential natural gas demand is inelastic, this is a combined statement of both uses. That portion of gas demand which is used to satisfy minimal essential needs is highly inelastic. Convenience use of gas is less urgent and individuals have more flexibility with respect to it.

Turning now to industrial users of natural gas, we find many plants have an established ability to switch from natural gas to fuel oil. A good substitute is available and is easy to use. This class of gas customers has a relatively elastic demand, as opposed to the residential users' inelastic situation.

Impact of Deregulation on the Kansas Economy

Price increases resulting from deregulation will have various impacts on different segments of the Kansas economy:

(1) Tax revenues

(2) Royalty owners

(3) End-users of natural gas

- small volume
- large volume

(4) Agricultural users