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GAS STORAGE:
STRATEGY, REGULATION, AND SOME COMPETITIVE IMPLICATIONS

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EXECUTIVE SUMMARY

As a combination of increasing demand and declining gas exploration and development, the gas deliverability surplus that characterized the gas market in the 1980s is not likely to continue into the future. In a more balanced gas market, the storage of gas can have important gas supply and cost implications. Not surprisingly, the use of gas storage in meeting future gas requirements received considerable renewed interest lately.

Gas storage is also becoming an important variable in the restructuring of the gas industry and its evolution toward a competitive gas market. As a result of the regulatory reforms initiated by the Federal Energy Regulatory Commission (FERC) since the early 1980s, the local distribution companies, electric utilities, and certain industrial and commercial end-users can all participate directly in the wellhead, spot, and (more recently) gas futures markets to procure gas rather than relying on the interstate pipelines. At the same time, gas is no longer supplied as a bundled product. The various components of traditional gas services such as acquisition, transportation, load balancing, storage, and standby service are increasingly offered and priced separately. The expanded availability of gas storage as an added option may contribute to more competition in the gas market. But it is also conceivable that, as gas storage is provided separately, the denial or provision of access to gas storage facilities can be used as a tool to increase the market power of a particular party in a gas transaction. Thus, the workings of a competitive gas market may be hindered.

A broad range of gas storage options is available. The most common and economical one is underground storage using depleted gas and oil reservoirs and aquifers. At the present time, underground storage accounts for the vast majority of gas stored, capacity developed, and amount of daily gas sendouts. The operation of an underground storage reservoir consists of injecting gas into the reservoir during periods of low demand and withdrawing it during period of high demand. Other less-used storage technologies include storage in mined caverns, above-ground liquefied gas storage tanks, and temporary storage in pipelines. In addition to the physical storage of gas, several "nonstorage" storage options can be used by the gas companies to achieve similar purposes. These options include the curtailment of well development in confirmed gas fields, the shut-in of gas-producing wells, the buying and selling of gas futures contracts, and the strategic use of take-or-pay provisions in long-term gas purchase contracts. Of these alternative gas storage options, the shut-in of gas wells is the one most often used currently (around 6 billion cubic feet of gas is shut-in daily during the summer months). Gas futures contracts (viewed one way) have some potential as an important gas "storage" tool in the future.

The benefits and costs of gas storage depend on the prevailing and projected demand and supply conditions in the gas market. Each individual storage option has its own unique cost and benefit considerations. The benefits and costs discussed in this report relate mainly to the physical storage of gas. In general, the benefits and costs are affected by variations in seasonal gas prices, the availability of transportation capacity, the geological and technical characteristics of the storage

facilities, the location of the storage facilities within the gas transportation network, and the cost of capital.

The benefits of the extensive use of gas storage include reducing capital investments required for new transportation and distribution facilities to meet peak gas requirements, and decreasing peak-demand-related costs in acquiring system gas supplies. In addition, the availability of storage allows the gas companies to take advantage of the gas price variations by increasing gas purchases when price is low and reducing purchases when prices are high, and to avoid the curtailment and reduced reliability of gas service in the case of a prolonged supply shortage.

The main cost items of storage are the capital investments incurred in installing and building compression equipment, injecting and withdrawing wells, and interconnecting pipelines. The cost of acquiring and injecting base (cushion) gas to be kept permanently in the reservoirs is another significant cost item. The amount of base gas required for the proper operation of a storage facility typically accounts for more than half of the size of the storage reservoirs. Then there are the costs of operating a storage facility and the financing of gas being injected for future use.

In addition to the traditional function of shifting gas to help assure reliable supply and lower gas cost, the use of storage has new implications as the traditional gas industry structure is altered and several new unbundled gas services are established. In essence, a four-market structure has replaced the traditional three-market structure (wellhead market, wholesale market, and distribution market). The "new" four markets are the gas acquisition market, the gas transportation market, the core gas sales market, and the noncore gas sales market. Since the gas acquisition market is already highly competitive with many buyers and sellers, the effects of the extensive use of storage on the competitive relationship in the gas acquisition market are limited. As for the core gas sales market, the separate provision of storage service is not a viable option for captive customers, and the provision of storage is not likely to make the competitive supply of core gas service an efficient arrangement. Consequently, gas storage will not change the noncompetitive nature of the core gas service market. Gas storage has only very limited effects on the noncore gas sales market since this market shares several features similar to those of the gas acquisition market.

Given the limited number of participants and the options available to each, the gas transportation market at its present stage cannot be characterized as competitive. Compared to its use in the gas acquisition and core sales markets, gas storage does have some potential for altering the competitive structure of the gas transportation market. But the exact impact may not always be clearly identified at the present time. Gas storage service can be a substitute as well as a complementary service to gas transportation. The use of storage can reduce the demand for additional transportation capacity that is used primarily for delivering gas at peak periods. But the use of storage also increases the amount of gas to be transported in the nonpeak period as a result of delivering more gas to be injected into the storage reservoirs. At the same time, the demand for transportation service can increase at some locations (typically, those pipelines leading into the storage reservoirs and facilities) and decrease at others as new gas supply loops are created by adding storage reservoirs. Few general patterns can be identified about the reallocation of the demand for transportation service as a result of the

increasing use of gas storage. Storage may make parts of the transportation market more competitive. But undue market power may be created in other parts of the transportation market if gas storage induces a higher demand for transportation service provided by one or two strategically located transporters.

A survey of state public service commissions regarding state regulatory policies and practices was conducted for this study during the spring of 1990. The main findings are that most state commissions do not treat gas storage differently from other aspects of gas distribution service, and that they tend to rely on traditional forums and means of oversight, mainly rate cases and purchased gas adjustment proceedings.

There are several regulatory options that the states can adopt to enhance the role of gas storage in providing economic and reliable gas service. Both firm and interruptible storage service need to be made available and there appears to be no justification to allow differences in terms of service, scheduling, and curtailment priorities between a "simple" storage service and storage service connected with gas acquisition and transportation services. A market-based tariff for allocating storage capacity to end-users is preferred because of the difficulties in ascertaining storage-related costs and the advantage of such a tariff in providing competitive price signals.

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FOREWORD

Somewhat neglected in regulatory review is the matter of gas storage. This report identifies some of the benefits of gas storage and explains its possible workings in a restructured market with unbundled services. Whether and when gas storage can add or subtract from the competitiveness of the market are also explored. Finally, an Institute survey of state PSCs regarding their policies and practices is presented along with several options for enhancing the role of gas storage in the public interest.

Douglas N. Jones
Director
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We wish to express our sincere thanks to the staff of the public service commissions, listed in appendix A, who responded to the survey conducted for this report. We would also like to thank Tom Kennedy of the Illinois Commerce Commission, John Borrows of the Ohio Public Utilities Commission, and Doug Jones, Ken Costello, and David Wirick of NRRI for providing valuable comments that have improved the report. Finally, we express our gratitude to David Wagman for editing, and Marilyn Reiss for typing this report.

CHAPTER 1

INTRODUCTION

The storage of gas for future use is an effective way of balancing stable gas supply with volatile gas demand that is often characterized by significant seasonal, daily, and sometimes hourly variations. A gas company, whether it be a producer, an interstate pipeline, or a local distribution company, can adopt various gas storage strategies to help assure the continuous supply of gas at peak demand periods or to reduce the cost of gas supplies. A broad range of mature gas storage technologies is available, and their technical and operational characteristics can be determined and verified.

At the present time, underground gas storage is the most common and the most economical method of gas storage. Under this mode of storage, gas is injected into depleted oil and gas wells or certain geological formations when demand falls below available gas supply. Gas is withdrawn when demand exceeds supply. In addition to underground storage, several other kind of storage options can be used, such as using under-utilized pipelines to store gas temporarily, and storing liquefied gas in above-ground storage tanks.

The importance of storage in the gas delivery system is likely to increase with projections of a tight gas market in the future. Faced with the combination of increasing demand and declining supply, the gas deliverability surplus that characterized the gas market through the 1980s is not likely to continue.[1] The proper use of gas storage can play a critical role in balancing gas demand and supply.

On the one hand, heightened environmental concerns have prompted the Congress and regulators to consider and adopt more stringent environmental legislation and regulations. For example, the Clean Air Act Amendment of 1990 currently being considered in the Congress will make gas an environmentally

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[1] There are various projections of future gas supply and demand, and these projections range widely. The more important ones are the *Annual Energy Outlook* prepared by the Energy Information Administration of the U.S. Department of Energy, the *Gas Energy Supply Outlook* compiled by the American Gas Association, and the *Baseline Projection of U.S. Energy Supply and Demand to 2010* published by the Gas Research Institute.

attractive fuel and may significantly increase the future demand for gas.[2] On the other hand, an extended period of low crude oil and gas prices since the early 1980s has depressed oil and gas exploration activities. According to the American Gas Association, the amount of proven reserve additions (the amount of new gas discovery plus adjustments to existing proven reserves) declined from 14.5 trillion cubic feet (Tcf) in 1980 to 10.4 Tcf in 1988.[3]

As the gas market moves toward a more balanced demand/supply relationship, gas storage can have important economic implications. These include the continuing supply of gas in periods of extreme weather or unexpected cutoff in gas production, and the delay or cancellation of building new transportation pipelines and distribution facilities that are required, in the absence of storage, to meet gas requirement at peak periods. It is estimated that the greater utilization of current and planned storage facilities could provide 4 to 5 billion cubic feet of gas withdrawal from storage per day during peak periods.[4]

Not surprisingly, the use of gas storage in meeting future gas requirements has received renewed interest lately. For example, recently introduced legislation in the United States Senate would require the Department of Energy to recommend gas storage levels before each winter heating season so that enough gas inventory would be ready to prevent substantial disruptions in supply or drastic price increases.[5] Also, the Federal Energy Regulatory Commission, aiming at getting more information about the December 1989 gas curtailment, has proposed a data collection effort which would ask the twenty-three largest interstate pipelines about their daily

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2 For example, the Gas Research Institute estimated that the incremental gas requirement in the year 2010 due to tightened environmental regulations could range from 1.4 to 5.3 quadrillion BTU.

3 American Gas Association, *Gas Facts 1988 Data* (Arlington, VA: The American Gas Association, 1989), table 2-2.

4 Cambridge Energy Research Associates, *Natural Gas Trends* (Cambridge, MA: Cambridge Energy Research Associates, 1988), 2.

5 See "DOE Would Recommend Gas Storage Levels And Survey Gas Prices," *Inside F.E.R.C.*, 26 March 1990, 8.

storage levels from November 1989 to February 1990 and whether the curtailment experience would indicate a need for expanded storage capacity.[6]

In the meantime, gas storage is also becoming an important variable in the restructuring of the gas industry and in the continuing development of a competitive gas market. As a result of the regulatory reforms, primarily open access to pipeline-owned transportation facilities initiated by the Federal Energy Regulatory Commission (FERC) since 1983,[7] there have been dramatic transformations in both the gas industry structure as well as in the provision of gas services. The local distribution companies, electric utilities, and certain industrial and commercial end-users all can participate directly in the wellhead and spot gas market rather than relying on the interstate pipelines to procure gas for them.[8] At the same time, gas is no longer exclusively supplied as a bundled product by the pipelines to the local distribution companies (LDCs) and by the LDCs to the end-users. Various components of traditional gas service such as acquisition, transportation, load balancing, storage, and standby service are offered and priced separately by more and more gas companies.

Because of the added option of obtaining gas from storage as backup supplies, a pipeline, an LDC, or an end-user is afforded an expanded opportunity to use a broad range of gas procurement alternatives such as bypassing, transportation-only service, and spot market purchases to meet their requirements. The availability of gas storage as an additional procurement option can potentially increase the number of participants in part of the gas market and, hence, the extent of competition facing each participant. In this regard, gas storage may contribute to the development of a more competitive gas market. Evidence suggests that a close

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6 See "FERC Wants Information on December 1989 Curtailments To Understand," *Inside F.E.R.C.*, 28 May 1990, 11.

7 An extensive discussion of the development of FERC gas transportation policy and its implications can be found in Robert E. Burns et al., *State Gas Transportation Policies: An Evaluation of Approaches* (Columbus, OH: The National Regulatory Research Institute, 1988), 87-155; and J. Stephen Henderson et al., *Natural Gas Producer-Distributor Contracts: State Regulatory Issues and Approaches* (Columbus, OH: The National Regulatory Research Institute, 1988), 5-37.

8 See Daniel J. Duann et al., *Direct Gas Purchases by Gas Distribution Companies: Supply Reliability and Cost Implications* (Columbus, OH: The National Regulatory Research Institute, 1989) for a detailed discussion on the rationales, mechanisms, costs, and reliability implications of direct gas purchases by local distribution companies.

relationship appears to have developed between gas prices and levels of gas in storage.[9] A 1989 Energy Information Administration study indicated that since 1987 gas prices had been at their highest level when the amount of storage gas was lowest, and vice-versa.

It is also conceivable, however, that as gas storage is provided as a separate service, the denial or provision of access to gas storage can be used as a tool to increase the market power of a particular party in a gas transaction. Thus, the workings of competitive forces in the gas market may be hindered. In a recent FERC proceeding, one FERC commissioner emphasized that the continued availability of storage service was essential to those pipeline customers who converted from sales to transportation service and that the FERC should have a say in the provision and abandonment of storage service.[10]

Definition of the Problem

The use of storage to match supply with demand is widely used in many industries, especially for those with great seasonal variations in demand, with significant fluctuations in production costs, with extremely adverse effects of supply shortage, and with inflexible production schedules due to immobile and expensive production facilities. Indeed, the economics and business literature on storage and inventory control has identified demand variations, production cost variations, and the constraint in maintaining a minimum amount of supply at hand as the main rationales for using storage.[11]

A key element in defining the amount of storage and storage capacity needed is the ready availability of the stored goods to meet sudden changes in demand. The storage of gas is no exception. In defining the capacity and amount of gas storage, the gas being stored must be available within a short period of time, preferably within days. In a broader sense, all unexplored and undeveloped gas is

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9 See "The Historically Close Relationship Between Gas and Crude-oil," *Inside F.E.R.C.*, 27 November 1989, 9.

10 See "Storage Programs Approved Despite Moler's Abandonment Concerns," *Inside F.E.R.C.*, 19 March 1990, 1,2.

11 See, for example, James A. Kahn, "Inventories and the Volatility of Production," *American Economic Review* 77 (1987): 667-79.

already being "stored" naturally. But the gas "stored" in the field cannot be delivered quickly to users to meet their gas demand during peak periods, and thus fails to achieve the purposes of having storage facilities. So the capacity and amount of gas storage should be limited to what can be delivered to meet demand at the next peak period. The gas contained in reservoirs in the production fields is "stored," but it cannot be counted as storage gas.

The demand and supply (including production, transportation, and distribution of gas) characteristics of natural gas make it an ideal candidate for the extensive use of storage. Specifically, once a gas well has been developed, a steady rate of gas production, usually determined by the amount of proven gas reserves, is always preferred to a fluctuating production rate. What's more, for operational and economical reasons it is more advantageous for interstate pipelines and distribution companies to operate their facilities at full capacity all the time. Consequently, the gas companies prefer to supply gas at a relatively stable rather than at a widely fluctuating rate.

But the demand for gas (especially among residential end-users and electric utilities) is weather-sensitive, and can show significant variations during the heating and nonheating seasons. For example, the latest data show that the 1989 monthly gas consumption nationwide ranges from 1,201 billion cubic feet (Bcf) in September to 2,178 Bcf in December.[12] In other words, the gas requirement at nonpeak periods is only about half that of peak periods. A comparison of the nationwide gas production, consumption, and storage injections and withdrawals in 1989 is shown in table 1-1.

In the face of this significant mismatch of gas supply and demand, two broad categories of strategy can be applied. First, the gas company can adopt demand-related strategies such as seasonal rates, time-of-use rates, or interruptible gas sales, or can install direct-control devices on end-users' gas-using appliances to reduce the gas requirements at the peak period. Second, the gas companies can use storage to shift supply from nonheating to heating seasons. Many gas companies have been actively pursuing this strategy. For example, Transcontinental Gas Pipe

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12 Energy Information Administration, *Monthly Energy Review* (Washington, D.C.: Energy Information Administration, February 1990), table 4.2.

TABLE 1-1

MONTHLY NATURAL GAS PRODUCTION, CONSUMPTION, AND STORAGE IN 1989
(Billion Cubic Feet)

Month	Production	Consumption	Storage Withdrawals	Storage Injections
January	1,516	2,047	404	49
February	1,401	2,031	546	28
March	1,484	1,981	314	96
April	1,416	1,608	124	170
May	1,434	1,370	62	279
June	1,372	1,222	19	332
July	1,395	1,241	24	321
August	1,381	1,224	27	321
September	1,321	1,201	34	283
October	1,393	1,288	85	192
November	1,436	1,563	198	91
December	1,555	2,178	729	51
Total	17,102	18,956	2,566	2,213

Source: Energy Information Administration, *Monthly Energy Review*, February 1989, table 4.2.

Line Corp. has several new storage fields planned, and Tennessee Gas Pipeline Co. used to balance its load by selling to other pipelines with large excess storage capacity.[13]

It should be noted, however, that a gas company's ability to store gas is rather limited compared to other goods and services despite the presence of a

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13 See "Off-peak Sales Will Be Vital to Load Balancing, Pipeliners Agree," *Inside F.E.R.C.*, 1 February 1988, 11-12.

significant mismatch of gas demand and supply and an extremely large amount of sunk investment in production and transportation facilities. This is due primarily to the two physical characteristics of gas, namely its tendency of free movement and its extremely low heat content in a fixed volume at atmospheric pressure. Because of its tendency of free movement, gas must be stored in tight containers, either naturally formed or man-made. Due to its extremely low heat value per unit of volume at atmospheric pressure, gas is always pressurized (compressed) before being stored and transported. This increases the heat content of a fixed volume of gas which in turn reduces the unit cost of transporting it. As a result, gas is transported predominantly by pipelines, and can only be stored in tight underground geological formations, specially equipped tanks, and in pipelines for a brief period of time. The amount of gas injected or withdrawn from a particular storage facility is also restricted by the location of the facility in the gas transportation system and the current flow of gas within the transportation pipelines. The implication is that the development of gas storage facilities depends heavily on the geological characteristics of the area and its location within the interstate gas transportation network. The importance of this geological consideration can be illustrated by the fact that underground storage (the most important storage option) is found only in twenty-seven states in the United States. Of these, nine states have only minimal amounts of underground storage capacity.[14]

Another important feature affecting the use of gas storage is the recurrence of peak (heating) and nonpeak (nonheating) periods in every twelve-month period. Because of the recurrence of peak and nonpeak periods, it is generally unnecessary and uneconomical to store an amount of gas that is more than the projected excess gas demand for the next twelve-month period. In other words, the amount of gas stored at the current nonpeak period is projected to be used up at the next peak period rather than at any peak period after that. Similarly, the capacity of a gas storage facility is determined primarily to meet the projected *yearly* maximum supply deficiency instead of the expected *cumulative* supply deficiency over a several-year period in the future. Accordingly, any multi-year storage option, such

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14 American Gas Association, "Underground Storage of Gas in the U.S. and Canada-1989 Data," *Engineering Technical Note*, May 1990.

as the take-or-pay provision in a gas purchase contract,[15] is not likely to be considered as a viable storage option by most gas companies.

The third feature of storage is its mixed status as both a public-utility facility and a private-use facility. Two commonly accepted criteria in deciding whether a business enterprise or a facility should be regarded as a public utility or a public-utility facility are the necessity of the service performed and the cost advantages of providing the service by a monopoly.[16] Based on these two criteria, in the gas delivery system a gas production facility is usually classified as a private-use facility while a transportation pipeline is a public-utility facility. As for a storage facility, it cannot be unequivocally defined as a public-utility facility. This is especially true if the storage facility is owned by an independent company not involved in the transportation and distribution of gas.

Obviously, most gas storage facilities are part of an integrated gas delivery system, and the operational and economical benefits of storage often are shared by the entire system of an interstate pipeline or a local distribution company. In many instances, the capacity of a gas storage facility is shared by many different entities. Several pipelines or storage companies currently are offering gas storage as a separate service to every local distribution company and end-user willing to purchase such a service. As indicated previously, the provision of storage service is also viewed by some as indispensable to the provision of transportation service. So a storage facility indeed may perform certain functions usually performed by a typical public-utility facility such as a gas-transporting pipeline.

However, storage in most cases does not occupy as critical a position in the delivery of gas as transportation and distribution facilities. Specifically, the flow of gas usually can continue even if access to storage facilities is denied although the flow of gas cannot continue if access to transportation facilities is denied. The denial of access to storage facilities is less likely to create a bottleneck in gas delivery than the denial of access to transportation facilities. Storage is not always an "essential" service in delivering gas. At the same time, there is no clear

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15 Of course, the original intent of a take-or-pay provision is to assure a steady revenue stream for the seller, and it has nothing to do with gas storage. But it can be used by the buyer in a way that is very similar to a multi-year gas storage arrangement. Further discussion of this can be found in chapter 2.

16 James C. Bonbright, *Principles of Public Utility Rates* (New York: Columbia University Press, 1961), 3-17.

indication about the cost advantages (economies of scale and scope) of providing storage service through a monopoly either in an LDC's service territory or in an interstate pipeline system. Accordingly, the function of a storage facility is closer to that of a gas production facility than to a transportation or distribution facility. The implication here is that a sound public policy concerning gas storage can be formulated only after the exact nature of gas storage in delivering gas at a particular gas market is clearly understood and defined. Otherwise, severe undesirable economic effects may occur. For example, the imposition of public-utility type regulation on the production of gas (which did not clearly exhibit the economies of scale and scope and essentiality of service required in imposing any public-utility type regulation) by the Congress, the Court, and the Federal Power Commission before enactment of the 1978 Natural Gas Policy Act is widely felt to have been unwise public policy in retrospect.[17]

Objectives of the Study

The objectives of this study are to provide a close examination of the role of gas storage in the gas delivery system and to suggest storage-related policy alternatives that state regulators can apply to enhance the provision of reliable and economical gas services. Such an examination of gas storage should include an analysis of the basic technical and engineering aspects of storing and moving gas, a review of existing gas storage technology and capacity, an explanation of the benefits and costs associated with the use of storage, and perhaps most important, an analysis of the ways gas storage can facilitate or hinder competition in the gas market.

An extensive amount of literature exists on the technical and engineering aspects of gas storage.[18] There are, however, only limited materials dealing with the costs and benefits of using gas storage in providing gas service. One of them

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[17] See, for example, Richard J. Pierce, Jr., "Reconstituting the Natural Gas Industry from Wellhead to Burnertip," *Energy Law Journal* 9 (1988): 1-11.

[18] See, for example, Chi U. Ikoku, *Natural Gas Reservoir Engineering* (New York: John Wiley & Sons, 1984); *Natural Gas Engineering* (Tulsa, OK: PennWell Publishing Company, 1980); and Wolfgang Dreyer, *Underground Storage of Oil and Gas in Salt Deposits and Other Non-Hard Rocks* (New York: Halsted Press, 1982).

is a study conducted by the Argonne National Laboratory on federal initiatives in maximizing the quantity of gas stored in reservoirs owned by interstate pipelines for the 1979-1980 heating season.[19] Another is a report published by the Policy Development Project at The Ohio State University that examines the benefits and costs of increasing the end-use efficiency of natural gas through gas storage facilities by distribution companies in Ohio.[20] Given the importance of mitigating gas supply shortages at that time, it is no surprise that these two studies focused mainly on the supply reliability aspects of gas storage.

Practically no studies exist addressing the role of gas storage in promoting or inhibiting the development of a competitive gas market. The lack of attention to this subject, up to now, is not unexpected given that the provision of a separate gas storage service is a new phenomenon. Also, the gas industry and federal and state regulators may still be grappling with the many difficult issues of defining and pricing transportation service fairly and efficiently, let alone developing concrete information on the less understood storage service.

Besides analyzing the role of gas storage in delivering gas, this study will consider the current status of state regulation on gas storage and the regulatory options available to state regulators in enhancing the proper use of storage. Given the emphasis on state regulation, this study is concerned primarily with the storage facilities owned or used by LDCs and end-users. Currently, the majority of storage capacity is owned and operated by interstate pipelines under the regulation of the FERC. It can be expected that with the prevalence of direct gas purchase, more and more LDCs and end-users are likely to use gas storage as a part of their gas procurement strategy to meet future gas requirements. Consequently, the role of state regulation in promoting the proper use of storage definitely will be enhanced.

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19 E. W. Walbridge et al., *Maximizing Natural Gas Storage Levels: An Assessment of The Costs and Benefits* (Argonne, IL: Argonne National Laboratory, 1978).

20 Daniel Z. Czamanski et al., *The Benefits and Costs of Gas Storage Development in Ohio* (Columbus, OH: Policy Development Project, The Ohio State University, 1977).

Organization of the Report

This report consists of seven chapters. Chapter 2 deals with the technical aspects of the conventional gas storage option and explains the functions of several "nonstorage" storage alternatives. A discussion of the geographical distribution and other characteristics of underground storage facilities in the United States is also included in this chapter. The costs and benefits associated with the use of gas storage are delineated in chapter 3. Following that, chapter 4 analyzes the relationship between the increased use of gas storage and the extent of competition in various components of the gas market. The current status of state regulatory oversight, derived from a recent nationwide survey conducted by The National Regulatory Research Institute, is provided in chapter 5. Several regulatory options which the states can consider adopting regarding gas storage are presented in chapter 6. Chapter 7 offers some concluding thoughts and possible directions for further study of gas storage. Appendix A contains the responses of state regulatory commissions to the NRRI survey. The specifications of a natural gas futures contract currently traded in the New York Mercantile Exchange are shown in appendix B. A list of references cited in this study is also included.

CHAPTER 2

CURRENT STATUS OF STORAGE TECHNOLOGY AND CAPACITY

An understanding of the technical aspects of gas production and movement is essential in defining and assessing the role of storage in the gas delivery system. Most gas storage technologies are well developed with reliable operational and cost information. In a sense, the gas has always been "stored" in certain tight geological formations, and the development and production of a gas field can be viewed as a "withdrawal" of gas from the natural "storage reservoirs." The storage of gas, in many aspects, can be considered as a "reverse" of the gas development and production process. Consequently, the technical expertise developed in identifying promising geological formations, measuring underground reservoir characteristics and capacity, and designing gas gathering and transportation facilities can all be applied in building and operating gas storage facilities.

Storage facilities consist mainly of underground reservoirs made of porous rock or sand formations which include depleted gas, oil, and coal fields and aquifers (water-saturated rock formations). Mined caverns in hard (nonporous) rock formations and above-ground storage tanks also can be used for storing gas. Pipelines, which are primarily designed for transporting gas, also provide a means of gas storage. The operation of underground storage reservoirs consists of injections of gas during periods of low demand and withdrawals during periods of high demand. During the intervening time, the storage reservoirs must have sufficient structural integrity to minimize the loss of gas due to leakage or migration. The operation of a pipeline storage facility consists of raising and reducing pressure during high and low demand periods, respectively.

There are also financial instruments such as a gas futures contract which, even though they do not involve the actual storage of gas, can perform some functions similar to those of storing gas physically, namely, the shifting of supply and the management of gas procurement to take advantage of fluctuating market prices and demand/supply balances.

This chapter provides an overview of various gas storage technologies and options. In addition, the geographical distribution and certain operational characteristics of underground storage currently available in the United States are

discussed. The reader who is fully familiar with the engineering aspects of gas delivery may turn directly to the section on alternative gas storage options.

The Gas Delivery System

The gas delivery system consists of three major components: gas production, gas transportation, and gas distribution.[1] The addition of gas storage does not change the basic technical structure of gas delivery except for the presence of additional supply loops. A schematic representation of a gas supply system which includes storage facilities and compressor stations is shown in figure 2-1. The figure shows a storage facility in combination with a compressor used by the pipeline between the production wells and the distribution system. Additional storage facilities and compressors may be located between each set of delivery and receiving points throughout the gas supply system. Therefore, production and distribution companies may also operate or lease storage facilities and compressor stations to regulate the pressure and flow rates at which the gas is delivered.

Gas Production

Natural gas is a mixture of hydrocarbon gases which includes methane, ethane, propane, butane, pentane, and small amounts of other hydrocarbons. Natural gas can be found in rock and sand formations, often in association with crude oil. When a geologic formation has sufficient porosity and permeability to allow desirable flow paths for gas and a relatively impermeable enclosure to prevent leakage, it forms a natural reservoir. Following preliminary exploration techniques such as aerial photography, soil sampling, and subsurface geological testing, wells are drilled to confirm the presence of gas, crude oil, and other associated fluids.

Gas is pumped from a reservoir through withdrawal wells into a system of pipes which constitute gathering lines. Before the gas can be transported it must undergo separation and purification processes to remove nongas hydrocarbon products, water vapor, and contaminants. The presence of these impurities in the

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[1] The discussions on the technical aspects of gas delivery and storage in this and following sections are based primarily on information available in several gas engineering publications. Interested readers are referred to these publications listed in the bibliography for details.

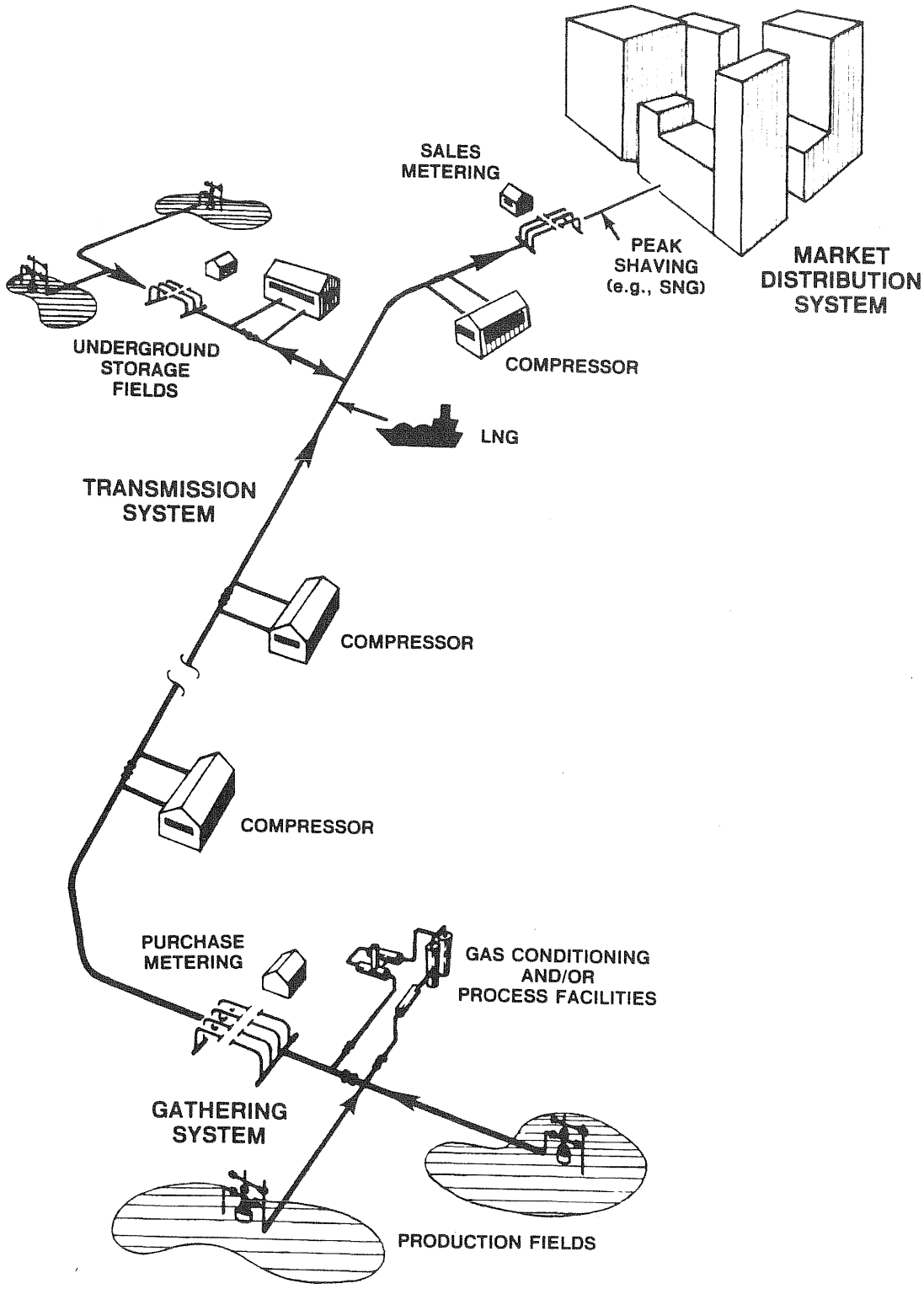

Fig. 2-1. A gas supply system with storage facilities and compressor stations as depicted in National Petroleum Council, *Petroleum Storage & Transportation*, Vol. 1 (Washington, D.C.: National Petroleum Council, 1990), 9.

gas to be transported can damage pipelines, inhibit the flow process, and cause environmental problems.[2] The gas is also deodorized by removing the poisonous gas hydrogen sulfide.

Gas Transportation

After the gas has been separated it is compressed and injected into a pipeline. Compression accomplishes two purposes: it reduces the volume of the gas and increases the speed at which the gas can flow through pipelines.[3] The movement of gas is controlled by compressor stations located fifty to one-hundred miles apart. The stations maintain the line pressure required for the transmission of gas. The compressor station's discharge pressure ranges from 600 to 1,200 pounds per square inch (psi) and the pressure decreases by approximately 3 psi per mile between stations. So the delivery capacity of a pipeline is correlated to the pressure at which gas is transported while the full gas transmission potential is determined by the structural strength of the pipeline and the initial construction standards for pressure and capacity.

The gas from a producer's wellhead is transported to the distributor's mains, other pipelines, or directly to a customer such as an industrial user. During its journey it may also be injected into and withdrawn from storage facilities operated by pipelines. The use of storage allows the pipeline to regulate the pressure and flow of the gas in response to varying loads. Besides using underground storage, the pipeline may also store the gas in the pipeline itself by raising its pressure, releasing the gas on demand by reducing the pressure.

Gas Distribution

A local gas distribution company supplies gas to end-users, which include residential, commercial and industrial customers, and electric utilities. The gas is delivered from the pipeline to one or more "city-gate" stations. At these stations,

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2 Congressional Research Service and The National Regulatory Research Institute, *Natural Gas Regulation Study* (Washington, D.C.: U.S. Government Printing Office, 1982), 97-8.

3 Ibid., 184.

the gas is measured and the pressure reduced from that of the pipeline to the operating pressure of the distribution system. Pressure reduction is achieved by using a device called pressure regulator. The gas also is usually passed through a cleaner to remove dust and entrained liquids. The gas may have very little odor at this stage and may need to be odorized. Odorization helps the detection of unburned gas at the end-user's premises before it can reach hazardous concentrations and is required by federal law.[4]

The gas from city-gate stations is transported to customers' premises by distribution pipelines. Figure 2-2 shows gas arriving at the distribution system from sources other than pipelines (through the city gate). These sources include underground storage facilities, liquefied natural gas (LNG) storage facilities, liquefied petroleum gases (LPG), LNG delivered by motorized transportation vehicles, and substitute natural gas plants (gas produced by gasification of coal, oil shale, hydrocarbon liquids, and organic wastes). Pressure regulators, valves, and meters are placed in the distribution system to regulate and measure the flow of gas from the city-gate station to the distribution network and from the distribution network to individual customer's premises. Gas dispatchers monitor customer loads and control the pressure and the flow of gas (either manually or with automatic control devices) to the distribution network.

Underground Gas Storage Technologies

The use of underground reservoirs to store gas is the primary and most common mode of gas storage. An underground gas storage facility typically consists of a porous rock formation to hold the gas, an impermeable cap rock to prevent leakage, a compressor station, and injection, withdrawal, and observation wells. To meet its intended purposes, an underground reservoir should meet certain requirements. It should be located near compressor stations and transmission lines.[5] If intended as a peak-shaving facility (to provide rapid delivery of a large volume of gas to meet peak demand), it should have a high deliverability

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4 Institute of Gas Technology, *Gas Distribution: IGT Home Study Course*, (Chicago, Institute of Gas Technology, 1986), 11.

5 Chi U. Ikoku, *Natural Gas Reservoir Engineering* (New York: John Wiley and Sons, 1984), 323.

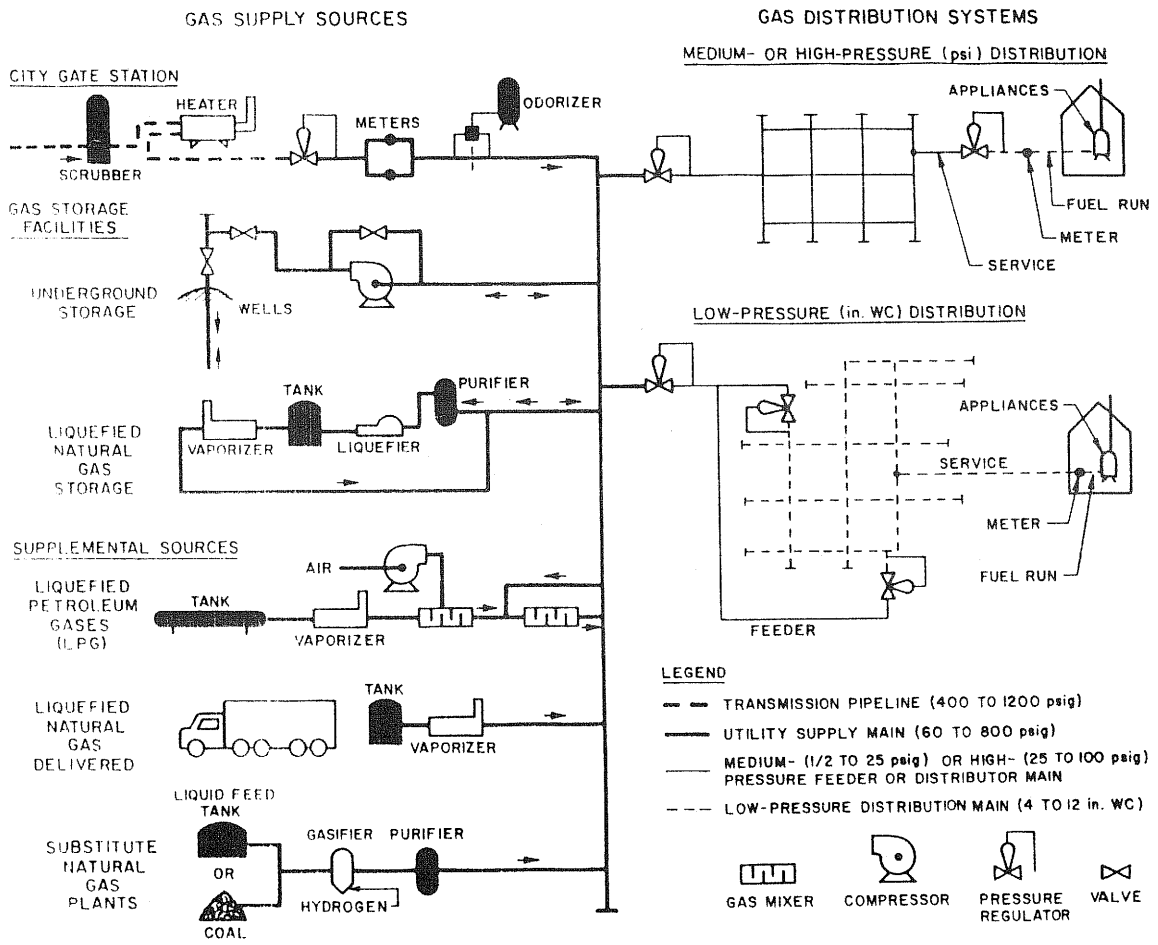

Fig. 2-2. The local gas distribution system as depicted in Institute of Gas Technology, *Gas Distribution*, 12.

characterized by high porosity and permeability of the structural formation.[6] If, however, it is expected to provide load-leveling (to provide sufficient amounts of gas to meet excess gas demand of an entire heating season), high capacity rather than deliverability is more important. This requires that the reservoir occupy a large area and depth with sufficient structural integrity to hold a large volume of gas over a long period of time. The function of load leveling is quite useful in a gas market with chronic supply shortages or with long-term contracts as the predominant form of gas procurement. With the deregulation of gas production and the prevalence of short-term spot purchase, load leveling becomes a less significant factor in developing storage reservoirs.

Usually, it is not possible to extract the entire volume of gas present in an underground reservoir. A certain volume of gas known as base gas (cushion gas) must be maintained at the bottom of the reservoir to provide sufficient pressure for withdrawal. Any gas available at discovery of the reservoir is known as native base gas. If an adequate supply of native base gas is not present in the reservoir, additional gas must be injected. Directly above the base gas is working gas, which is periodically withdrawn and replenished through withdrawal and injection wells. The composition of gas in an underground reservoir is shown in figure 2-3.

Observation wells are used to monitor levels of gas. Compressors are used to regulate the pressure at which gas is injected into the reservoir as well as delivered to supply lines. An underground storage facility is usually designed to accommodate specific injection and withdrawal cycles. For interstate pipelines, a two-hundred-day-per-year injection cycle, and a thirty-day withdrawal cycle any time within a one-hundred-day withdrawal season is usually used as the design criterion.[7] Several types of underground reservoirs are used for storage of natural gas. Table 2-1 shows the percentage of different types of underground gas storage currently in operation.

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6 Federal Power Commission, *National Gas Survey*, Vol. V (Washington, D.C.: U.S. Government Printing Office, 1973), 162-66.

7 E. W. Walbridge et al., *Maximizing Natural Gas Storage Levels: An Assessment of the Costs and Benefits* (Argonne, IL: Argonne National Laboratory 1978), 12.

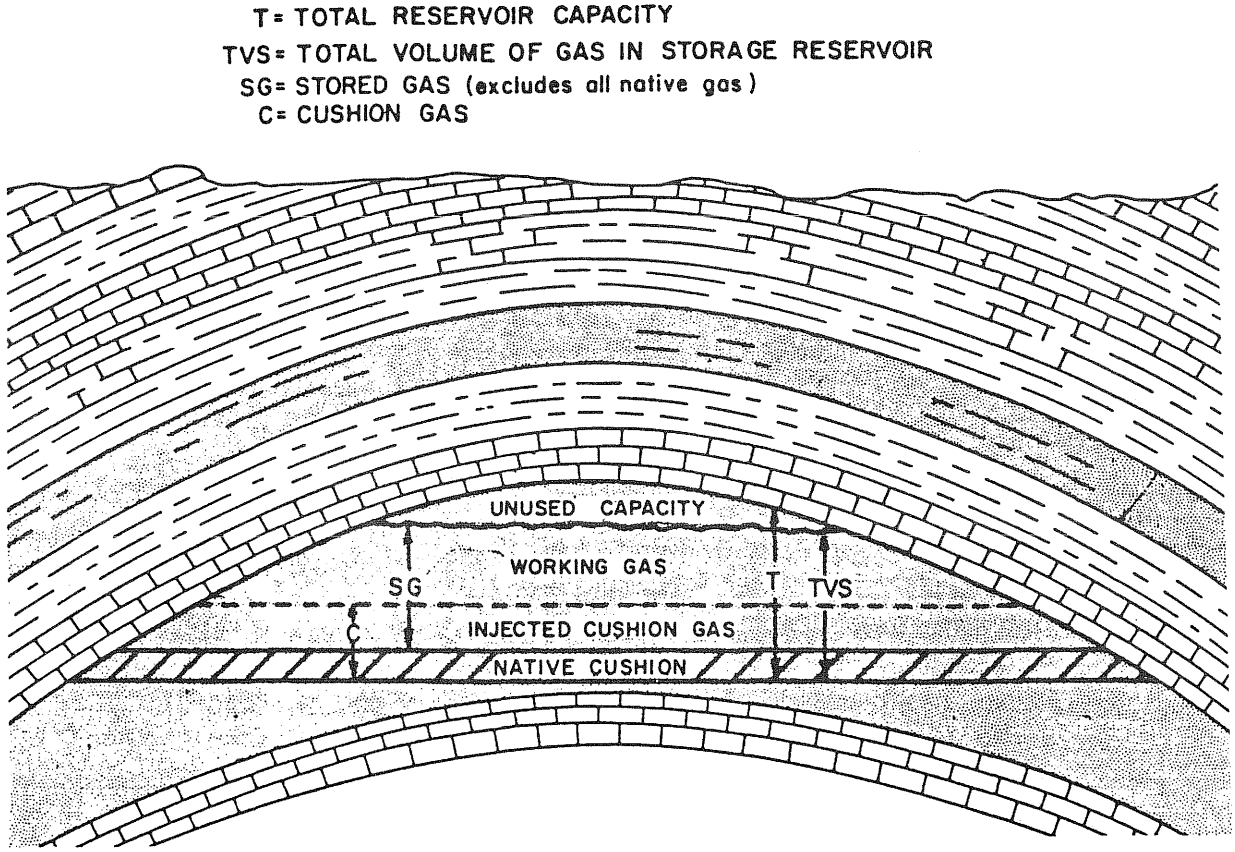

Fig. 2-3. Schematic diagram of a storage reservoir as depicted by George C. Grow, Jr., "Survey of Underground Storage Facilities in the United States," in *Drilling and Production Practice 1970* (Washington, DC: American Petroleum Institute, 1971), 271.

TABLE 2-1

GEOLOGICAL FORMATIONS OF UNDERGROUND STORAGE RESERVOIRS

Type of Formation	Number	Total Capacity (Million Cubic Feet)	Percent of Total Capacity (%)
Depleted gas field	295	5,220,007	67.40
Depleted oil field	8	185,051	2.40
Depleted oil/gas field	18	588,336	7.60
Aquifer	48	1,307,387	16.90
Mined salt caverns	7	30,663	0.40
Mined coal field	1	3,000	0.04
Other	6	405,820	5.20
Total	383	7,740,264	100.00

Source: Adapted from American Gas Association, *Survey of Underground Gas Storage Facilities in the United States and Canada* (Arlington, VA: American Gas Association, 1988).

Gas Storage in Depleted Gas Fields

Depleted gas fields are the most popular form of gas storage. The fact that gas had been trapped and held in them for millions of years shows that such fields are quite suitable for storing gas. Depleted gas fields are likely to have a significant volume of base gas left from previous production operations meaning,the need to inject additional cushion gas may be less than for other types of storage. The deliverability (rate of gas delivery in a short period of time) of the reservoir depends on the porosity and permeability of the formation. The deliverability also can be improved by drilling more wells and installing more compressors.[8] The rates

8 Federal Power Commission, *National Gas Survey*, 162-66.

of injection and withdrawal per well are limited by the reservoir rate characteristics which, in turn, are decided by the reservoir permeability and porosity; that is, the rate at which gas can migrate and attain equilibrium pressure within the reservoir structure.[9] The capacity (amount of gas that can be injected or withdrawn over an extended period of time) depends on the total volume of the reservoir and the pressure at which it is operated. Both the deliverability and capacity of a storage reservoir can be improved by operating it at pressure levels above the pressure when the reservoir was initially discovered.[10] However, the increase in injection and withdrawal pressures may be limited by operational and safety considerations.

Gas Storage in Depleted Oil Fields

Depleted oil fields are also a common form of gas storage and are used when depleted gas fields are not available at desirable locations. An oil field usually contains a gaseous layer at the top just below the cap rock. This layer is called the gas cap. Injection of additional gas into the gas cap increases the pressure throughout the reservoir. This process is called repressurization and can be used to recover more oil from a depleted oil field. This also converts the oil reservoir into a gas storage reservoir from which gas can be recovered when the oil has declined to uneconomic levels.

Figure 2-4 is a simplified representation of a depleted oil field being used as a gas storage reservoir. The gas cap initially contains a "wet" mixture of methane, ethane, butane, propane, and other hydrocarbons.[11] The methane (a dry gas) is injected into the gas cap to vaporize some of the liquid hydrocarbons from the oil it comes in contact with. When the gas is withdrawn, it must be processed to separate the liquid hydrocarbons from the gas. Oil is withdrawn simultaneously with gas and as the oil level declines, the gas cap moves downward and the gas storage capacity increases.

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9 E. W. Walbridge et al., *Maximizing Natural Gas Storage Levels*, 10.

10 C. U. Ikoku, *Natural Gas Reservoir Engineering*, 326.

11 Federal Power Commission, *National Gas Survey*, 166-67.

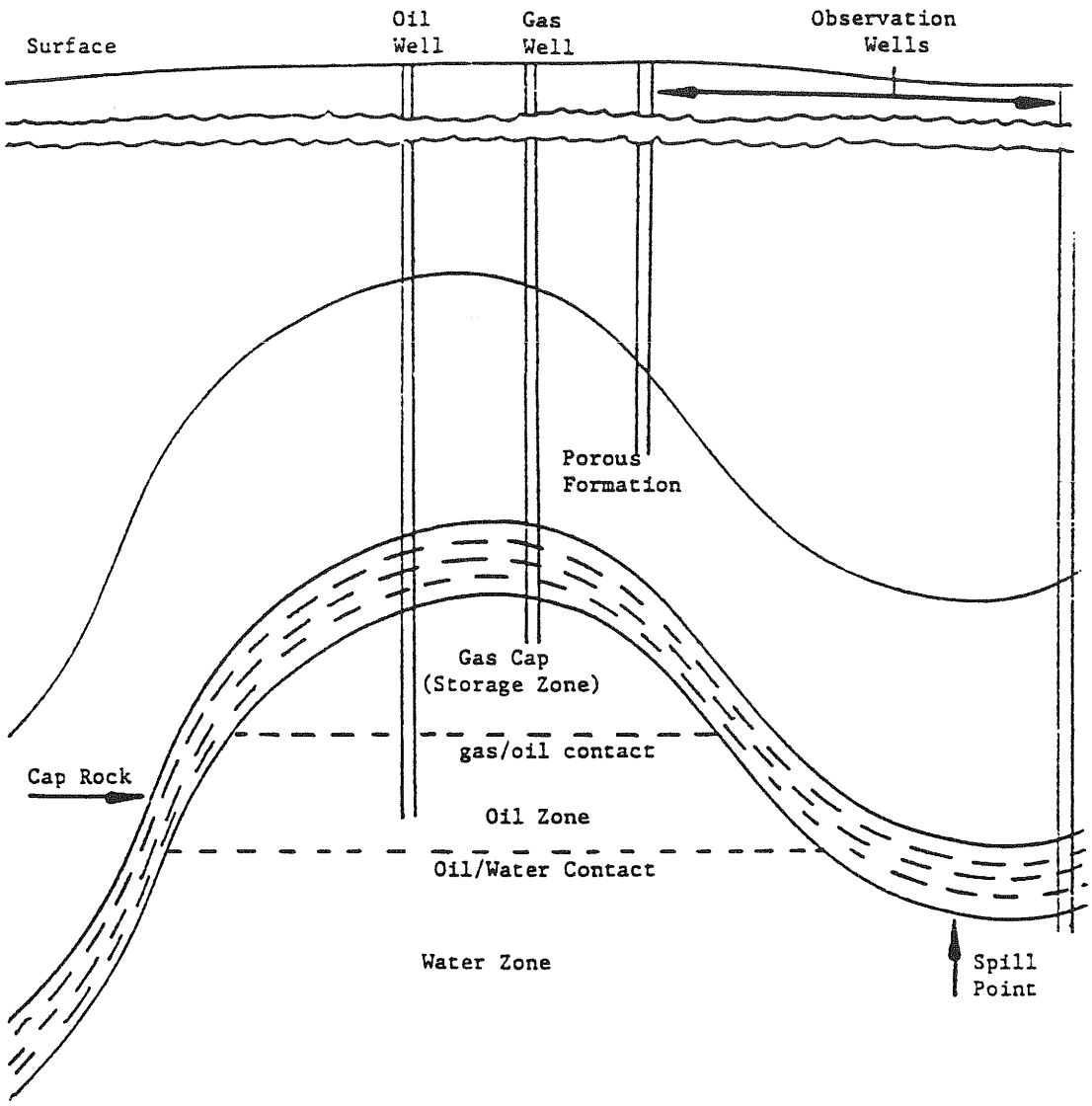

Fig. 2-4. A depleted oil field reservoir of gas as depicted in Federal Power Commission, *National Gas Survey* (1973), 168.

For this type of storage, high deliverability can be achieved as the injected gas continues to vaporize hydrocarbons from the oil and saturate the gas cap. The deliverability depends on the level of saturation of the gas cap. Capacity also increases as more and more oil is removed. Adequate separators, a high-pressure gas gathering system for injecting and producing gas, and a low-pressure system for carrying the separator gas to the treatment plant are needed for the fullest possible recovery of gas and oil. Later in the production process, as high gas saturations develop in the reservoir, gas can be delivered directly to the transportation pipelines without the separation treatment.

Gas Storage in Aquifers

Aquifers are porous water-bearing rock formations. The porous zones are the same as in oil and gas reservoirs. Unlike the latter, however, aquifers do not have a history of trapping and safely storing natural gas and must be subjected to exploratory tests to establish their viability as storage reservoirs.[12] One of the most important tests is to determine leakage properties of the cap rock, which include permeability (low permeability is desired to prevent leakage) and pressure thresholds. The structure below the cap rock is also tested for porosity and permeability (the higher these are, the better for flow of gas and water). Both geological structure tests and pumping tests are conducted. In the first, holes are drilled to collect and analyze rock samples at different depths. In the latter, water is pumped out and its level is observed in observation wells. Finally, gas is pumped into the reservoir and its flow is measured in observation wells.

After the viability of an aquifer has been established by tests, the injection of gas starts. Initially, the gas is injected slowly to form a small gas "bubble." As more gas is injected, the gas expands into zones of high permeability. These gas "wafers" travel into neighboring wells while the bubble continues to grow[13] (see figure 2-5). The neighboring wells are now ready for more gas and the process is repeated. As the storage fills up with gas, both injections and withdrawals can be done more rapidly than at the initial stage.

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12 Ibid. ,170.

13 C. U. Ikoku, *Natural Gas Reservoir Engineering*, 330-31.

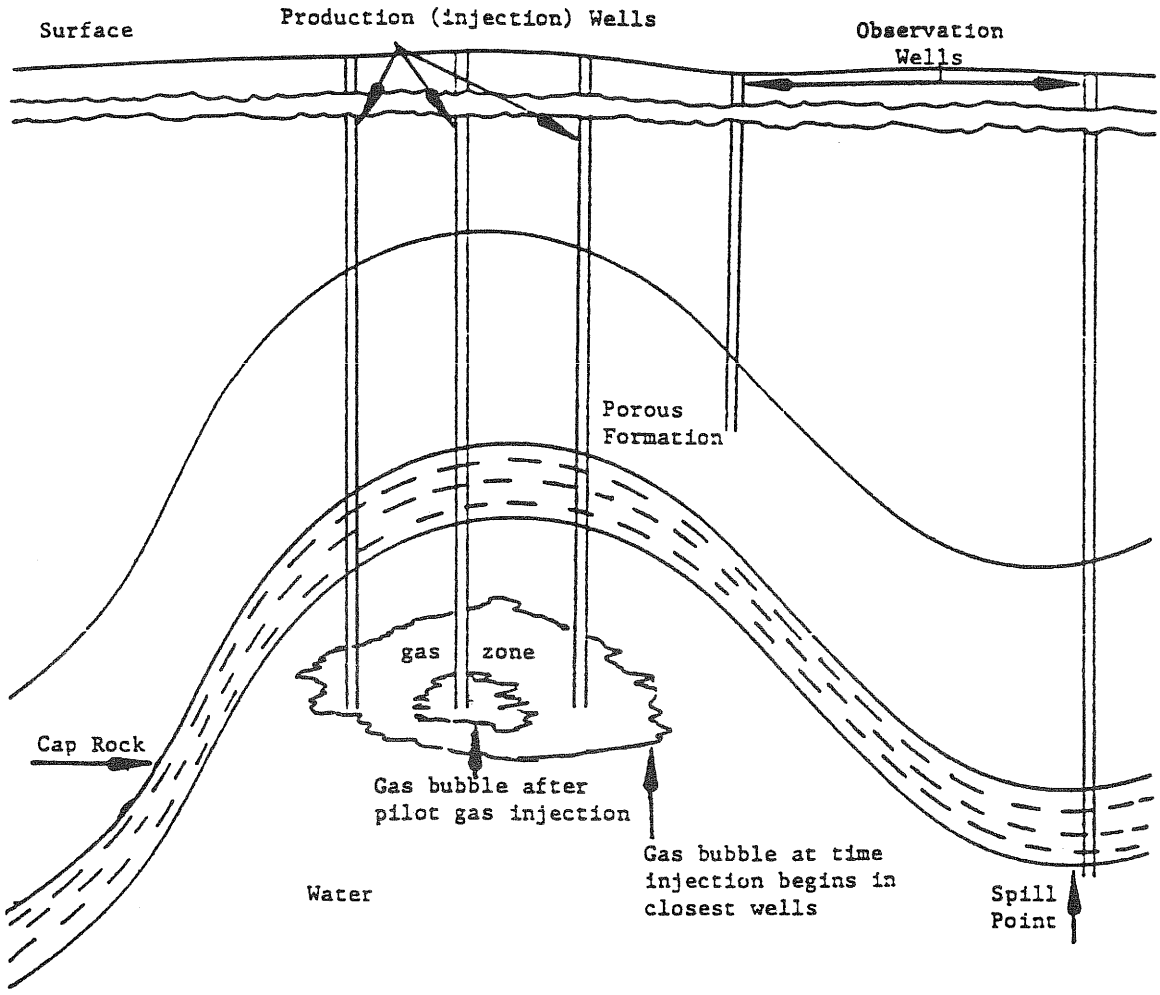

Fig. 2-5. An aquifer storage of gas as depicted in Federal Power Commission, *National Gas Survey* (1973), 171.

Gas Storage in Mined Caverns

Gas can also be stored in caverns created by mining formations of relatively impermeable rock such as salt, shale, or granite. Such caverns are essentially underground gas tanks consisting of cavities rather than porous geological structures. The caverns to be used for storage can be created either by solution mining or conventional mining techniques. Such caverns may also be developed by converting existing cavities used for mineral production.

Solution mining is commonly used on salt formations (see figure 2-6). It consists of injecting water to dissolve the salt and withdrawing the brine (salt solution in water). As more and more salt is dissolved and removed, a cavity develops. The cavern resulting from a salt production process may not necessarily have the particular shape and size desirable for developing a gas storage cavern. For example, it would require a greater number of injection and withdrawal wells to operate a wide but shallow storage reservoir than one that is narrow but deep even if both occupied the same volume. Consequently, additional leaching (the process of dissolving and carrying salt deposits) may be required to construct a salt cavern to store gas.

In conventional mining, standard underground excavation techniques such as drilling and blasting are used to develop caverns of desirable size and shape. Either vertical shafts or inclined ramps are used to gain access to the caverns. If suitable cavities already exist as a result of previous mineral production, they also can be used for underground storage of gas. It is generally easier to convert brine production mines than conventional mines for gas storage.

All forms of cavern storage of gas are essentially high-pressure tanks since the gas does not have to flow through porous media. For that reason, their deliverability is governed primarily by the operating pressures. The capacity depends directly on the size of the cavern and the operating pressure.

Other Conventional Storage Technologies

Underground storage is the most economical form of gas storage. However, factors such as nonavailability of natural reservoirs at desired locations and the need to have short-term (hourly) peak-shaving facilities may necessitate alternative forms of storage. Such storage facilities usually have low capacities and high

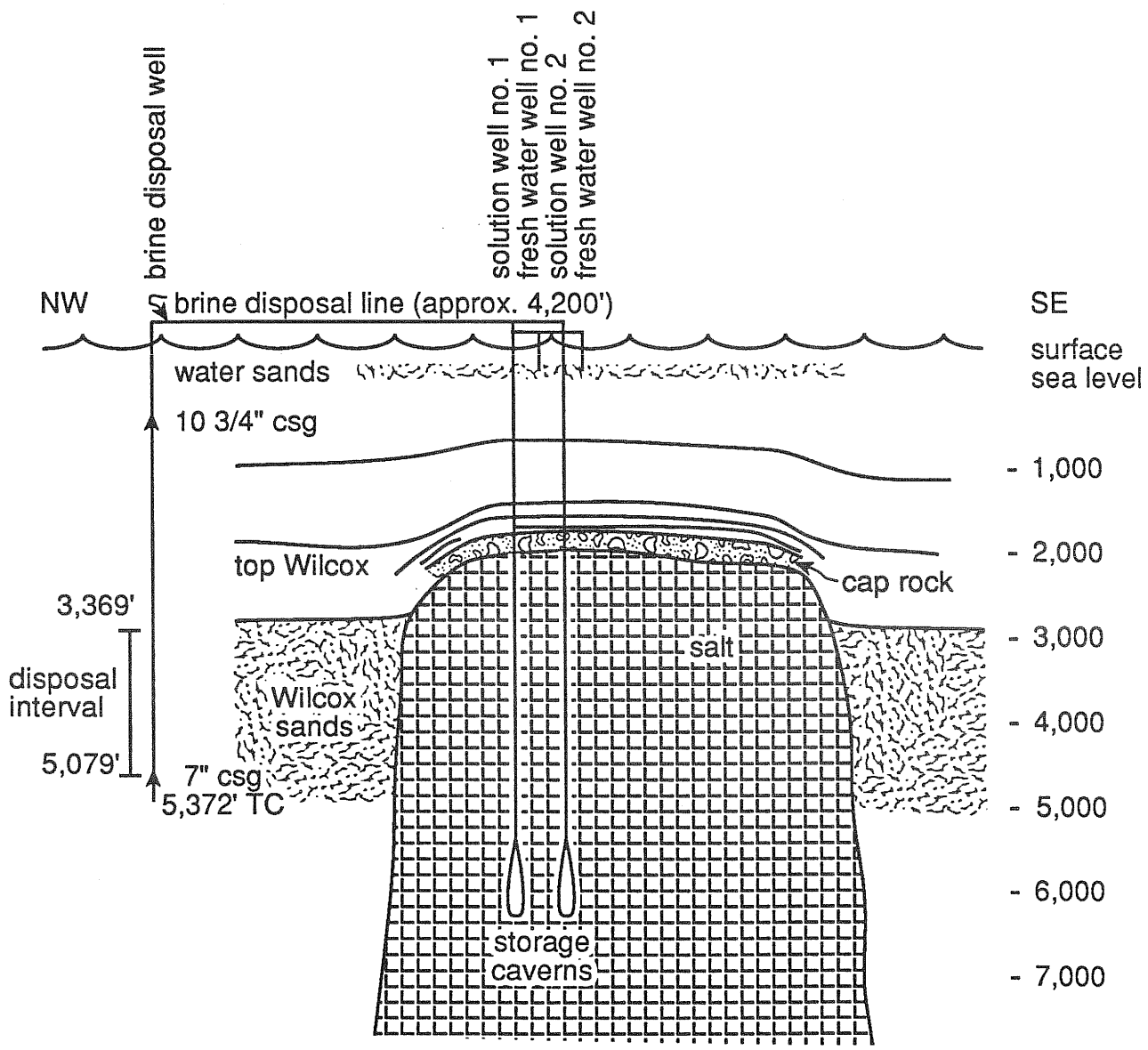

Fig. 2-6. Gas caverns in a salt dome as depicted by Kermit Allen, "Eminence--Natural Gas Storage in Salt Comes of Age," *Transactions of the Society of Mining Engineers of AIME* 250 (December 1971): 279.

rates of deliverability. They include gas storage in pipelines and liquefied natural gas (LNG) storage in mined caverns and tanks.

Gas Storage in Pipelines

Temporary pipeline storage exploits the relationship between the pressure and the quantity of gas that can be stored in a fixed volume of a container. The quantity of gas that can be held in a given segment of a pipeline increases as the pressure is increased.[14] When demand is low, the pressure is increased and the withdrawal rate is decreased until the flow rate matches demand. When the demand (and therefore the withdrawal) rate is at a minimum and the pressure is at a maximum, the pipeline is said to be "packed."[15] As the demand increases, the withdrawal rate is increased and the pressure is lowered. Under conditions of maximum withdrawal rate and minimum pressure, the pipeline is said to be "unpacked." The storage capacity of a pipeline is given by the difference in the quantity of gas held in the pipeline between packed and unpacked conditions.

LNG Storage in Mined Caverns and Frozen Holes

Liquefaction, storage, and subsequent vaporization of natural gas is an efficient means for short-term peak-shaving. It is frequently used by the distribution companies in colder areas such as the New England states. In its liquid form, natural gas occupies a much smaller volume. For example, at a typical liquefaction temperature of -260^{o}F liquefied natural gas (LNG) occupies about 1/600th of its volume in the gaseous form.[16] When needed for peak-shaving, the LNG is revaporized by heating.

Caverns mined in rock and sand formations, traditionally used for storing liquefied petroleum gases (LPG) may be used for storing LNG. The mining

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14 The pressure can be raised from about 300 psi to about 1,000 psi with a corresponding rise in the quantity of gas stored. See C. U. Ikoku, *Natural Gas Reservoir Engineering*, 318.

15 For a detailed discussion of packed and unpacked conditions and their relationship to the storage capacity of a pipeline, see Ibid., 319-22.

16 Institute of Gas Technology, *Gas Distribution*, 287.

technique normally consists of driving a vertical shaft through the formation. The shaft is used both for excavation and to seal the cavern. The shaft is filled with water to balance the hydrostatic pressure head of the cavern. Concentric annular pipes are used for withdrawal and injection operations. The inner pipe is used to withdraw and inject LNG into the cavern. The outer annulus is used to maintain pressure equilibrium by injecting and withdrawing gas. Although mined caverns are an attractive storage concept, they may require high initial capital investments and substantial operating costs for liquefaction, refrigeration, and vaporization of gas.

Frozen earth cavities also may be used for storing LNG[17] (see figure 2-7). First, concentric rings of vertical freeze pipes are placed in the soil. A refrigerant is injected through the pipes to freeze the soil. Then roof supports are installed and excavation is started. Prefreezing stabilizes the walls during excavation and prevents water from seeping into the cavity. To initially cool the cavity, LNG is sprayed into the vapor space. It should be noted that, to the best of our knowledge, no LNG has been stored in natural formations up to now.

LNG Storage in Tanks

Prestressed concrete tanks also can be used for storing gas.[18] A prestressed tank for LNG storage is shown in figure 2-8. The walls of the tank are made of reinforced concrete which have been prestressed horizontally by steel wire wrapping and vertically with tension tendons. Insulation is provided inside the tank and is protected from mechanical damage by a spring-loaded framework. The boil-off or vaporization rate is controlled by centrifugal blowers. Boiled-off gas is subsequently reliquefied.

Double wall metal tanks provide another form of LNG storage. The inner wall usually consists of aluminum or 9 percent nickel steel and the outer wall of a lower-grade metal. The annular space between the walls is filled with insulation and dry nitrogen gas. This form of above-ground storage has several advantages: the availability of a more developed technology, the absence of geographical

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17 C. U. Ikoku, *Natural Gas Engineering, A Systems Approach* (Tulsa, OK: PennWell Publishing Company, 1980), 684-86.

18 Ibid.

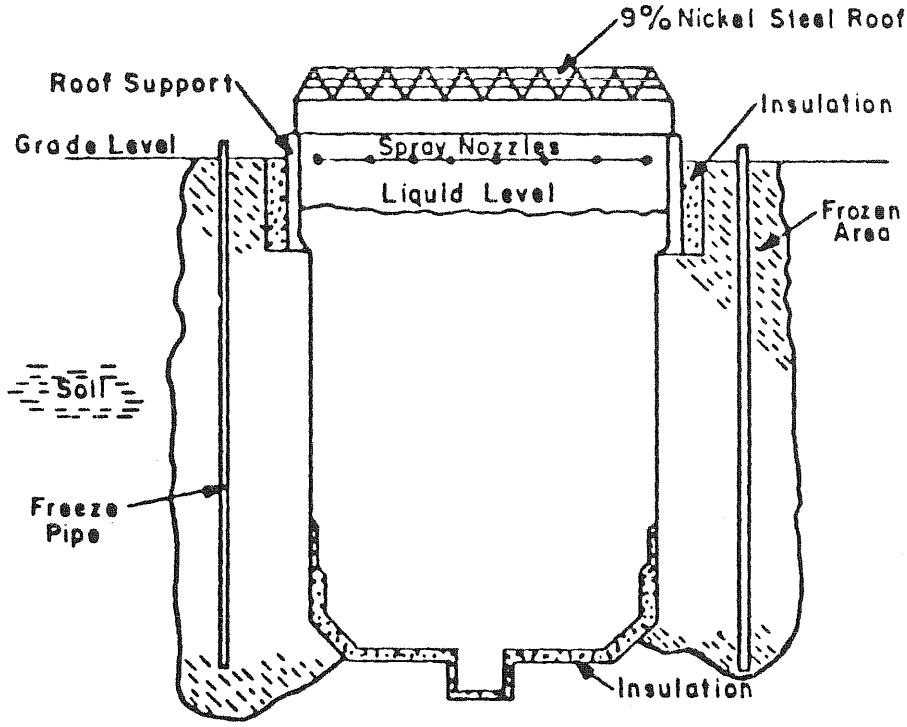

Fig. 2-7. LNG storage in a frozen hole as depicted by A. J. Kidnay, "Liquefied Natural Gas," Colorado School of Mines Mineral Industries Bulletin No. 15, March 1972, reprinted in C. U. Ikoku, *Natural Gas Engineering*, 684.

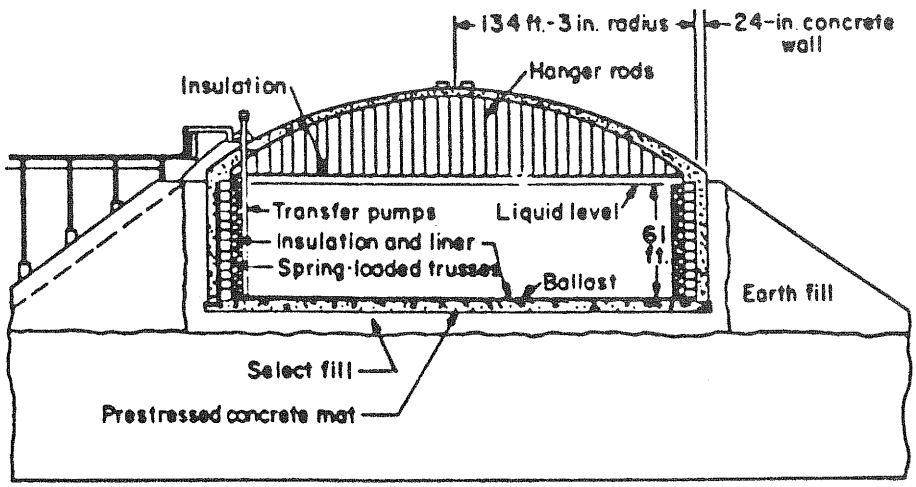

Fig. 2-8. LNG storage in a prestressed concrete tank as depicted by A. J. Kidnay, "Liquefied Natural Gas," Colorado School of Mines Mineral Industries Bulletin No. 15, March 1972, reprinted in C. U. Ikoku, *Natural Gas Engineering*, 685.

limitations, better insulation, accessibility for inspection, the near absence of contamination, good measuring capabilities, long life, and low maintenance.

Alternative Gas Storage Options

In addition to the conventional storage technologies mentioned above, several alternative storage options can be used. Some involve the actual storage of gas for future use, others are merely forms of financial transactions which can secure gas delivery at a later date, or can be used as a tool to hedge against future gas supply and price risks. They include the curtailment of gas field development, gas well shut-in, buying and selling gas futures contracts, and the strategic use of take-or-pay provisions in long-term gas procurement contracts.

Curtailment of Gas Field Development

One of the most basic forms of gas storage is simply not to develop a confirmed gas field. A confirmed gas field is a gas reservoir that has been explored and identified, and whose gas reserves have been determined (estimated) with a high degree of confidence. If the current market price of gas is too low or the producer is expecting some significant increase in future gas prices, the producers may decide not to develop a confirmed gas field. This is probably the most economic form of storage since no injection, withdrawal, or connecting facilities are required. Strictly speaking however, the nondevelopment of a gas field cannot be characterized as storage since gas in the reservoir is not readily available to serve the customers of the gas company within a short period of time.

Furthermore, several factors can limit the use of nondevelopment of a gas field as a viable storage option. First, the availability of gas for future delivery is not secured since the gas production and gathering facilities are not yet installed, and the time and costs required for installing gas production facilities can vary significantly from projected figures. Second, the estimated amount of gas reserves and thus the optimal rate of production can change significantly as actual gas production starts and more information about the exact size and structure of the gas reservoir is obtained.

Third, since the underground reservoir may not lie solely under the land owned by the producer, the gas may migrate to nearby gas fields owned by other

producers. These producers may not share the same view about future gas market conditions and may decide to develop their fields now. By doing so, the gas reserves of a confirmed but undeveloped gas field may be drained, and the value of the specific gas-producing property (a confirmed but undeveloped gas field) of the particular producer declines. A gas producer will be hesitant to keep the gas field undeveloped for an extended period of time.

Fourth, there is great uncertainty involved in predicting future gas price and demand/supply balances. The direction of the gas price movement can be quite different from the producer's own projection. The price may go down further before recovering from depressed levels. As the gas price decreases, the value of the producer's undeveloped gas property also declines. In curtailing the development of a confirmed field, the producer is undertaking a significant risk (the possibility of large financial loss due to gas price movements). For the reasons outlined above, the curtailment of gas field development may not be a feasible or widely used gas storage option. This does not mean that gas field development does not respond to the movement of gas price. It does. But the curtailment of gas field development cannot be characterized as gas storage.

Shut-in of Gas Wells

A related gas "storage" option that can be used by the producer is to shut in an existing gas-producing well. A gas-producing well is different from a confirmed but undeveloped field. A gas-producing well is likely to have all gas production, gathering, and delivery facilities already in place. Shutting in a gas well is a temporary suspension of the gas production activities of a particular well. The principle reason for shutting in a gas-producing well is similar to the curtailment of gas field development: a depressed gas price.

The shut-in of gas-producing wells is a more viable storage option than curtailing gas field development since the well can be put into production and start delivering gas in a relatively short period of time. Also, the amount of gas that can be produced and delivered at a future date is quite certain. The gas company thus can plan its gas operation accordingly. The factors limiting the use of shut-in as a gas storage option are primarily of an economic nature. Typically, a producer can set a shut-in threshold based on this confidence about the projection of current and future gas prices, and the expected gas price *differentials* between current and

future gas markets. If the market price of gas falls below the threshold price, he will shut-in the wells. It is estimated that currently around 6 billion cubic feet of gas are shut-in nationwide during the summer months, compared to typical January production levels.[19] This is about 15 percent of the nationwide daily gas consumption (around 40 billion cubic feet) in summer months.

Gas Futures Contract

Besides the actual storage of gas in natural formations, storage tanks, or pipelines, two financial instruments can also be used by the gas companies to achieve similar purposes of the physical storage of gas.

The first instrument is the gas futures contract currently traded at the New York Mercantile Exchange (NYMEX). A futures contract is a transferable, legally binding agreement to make or take delivery of a standardized amount of a commodity with standard minimum quality requirements during a specific month under terms and conditions established by the federally designated contract market where trading is conducted.[20] A common forward contract, on the other hand, is a private agreement to deliver a commodity from a seller to a buyer of specified quality and quantity at a specified future date at a specified or yet-to-be-determined price.[21]

In addition to the feature of standardization (both the contract format and the trading mechanism) of the futures contracts, another difference between a futures contract and a forward contract is that the buyers and sellers of futures contracts rarely take physical possession of the underlying commodity while buyers and sellers to a forward contract usually take delivery of the goods. By some estimations, only 2 percent of the futures contracts ever mature.[22] Another feature of the futures contract is that only a margin (a cash deposit that is usually a fixed percentage of the total value of the futures contract) is required to

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19 Cambridge Energy Research Associates, *Natural Gas Trends* (Cambridge, MA: Cambridge Energy Research Associates, 1988), 3.

20 Raymond M. Leuthold et al., *The Theory and Practice of Futures Markets* (Lexington, MA: D. C. Heath and Company, 1989), 394.

21 Ibid.

22 Ibid., 23.

guarantee contract performance. Consequently, it is relatively easy to engage in gas futures transactions and the cost is small in buying and selling futures contracts. The establishment of a futures market can provide a convenient tool in managing the price and quantity risks of the underlying commodity.

Currently there are many futures contracts (such as those for wheat, corn, soybeans, cotton, orange juice, potatoes, heating oil, crude oil, live hogs, pork bellies, live cattle, lumber, silver, gold, U.S. Treasury notes, Canadian dollars, Deutsche marks, and Japanese yen) being traded in various exchanges (for example, the Chicago Board of Trade, the Chicago Mercantile Exchange, the Kansas City Board of Trade, the MidAmerica Commodity Exchange, the New York Futures Exchange, and the New York Mercantile Exchange). The futures contract with the closest relationship with natural gas is crude oil futures being traded in the NYMEX and the London-based International Petroleum Exchange (IPE).

The NYMEX started trading of gas futures contracts on April 3, 1990.[23] Currently, the size of a gas futures contract is 10,000 million Btu. The month of delivery can be any month of the year and the trading can start twelve months before the month of delivery (maturity). For example, the NYMEX can start trading the August 1991 gas futures contracts (that is, gas that will be delivered in August 1991) in August 1990. The delivery point is the Henry Hub (a gas processing plant owned by the Sabine Pipe Line Company) in Erath, Louisiana. Two interstate pipelines, seven intrastate pipelines, and the Texaco Gathering Company can provide interchange service at Henry Hub and are responsible for the delivery of gas traded under futures contracts. A schematic diagram of the Henry Hub is shown in figure 2-9.

At the present time, there are no restrictions (except for the typical credit and margins requirements imposed by the NYMEX and individual brokers) on the participation in the gas futures market. Producers, pipelines, local distribution companies, gas marketers, industrial end-users, commodity traders, speculators, and ordinary investors all can buy and sell gas futures contracts. But proof of adequate transportation arrangements (firm transportation contracts or interruptible

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23 The following information was gathered through a telephone conversation with Jacquelyn Mitchell of the New York Mercantile Exchange on June 14, 1990. More detailed information can be obtained from the NYMEX. The NYMEX also publishes two brochures, *NYMEX Natural Gas Futures,* and *A Practical Guide to Development and Management of a Hedge Program* to provide detailed explanations about the trading of gas futures.

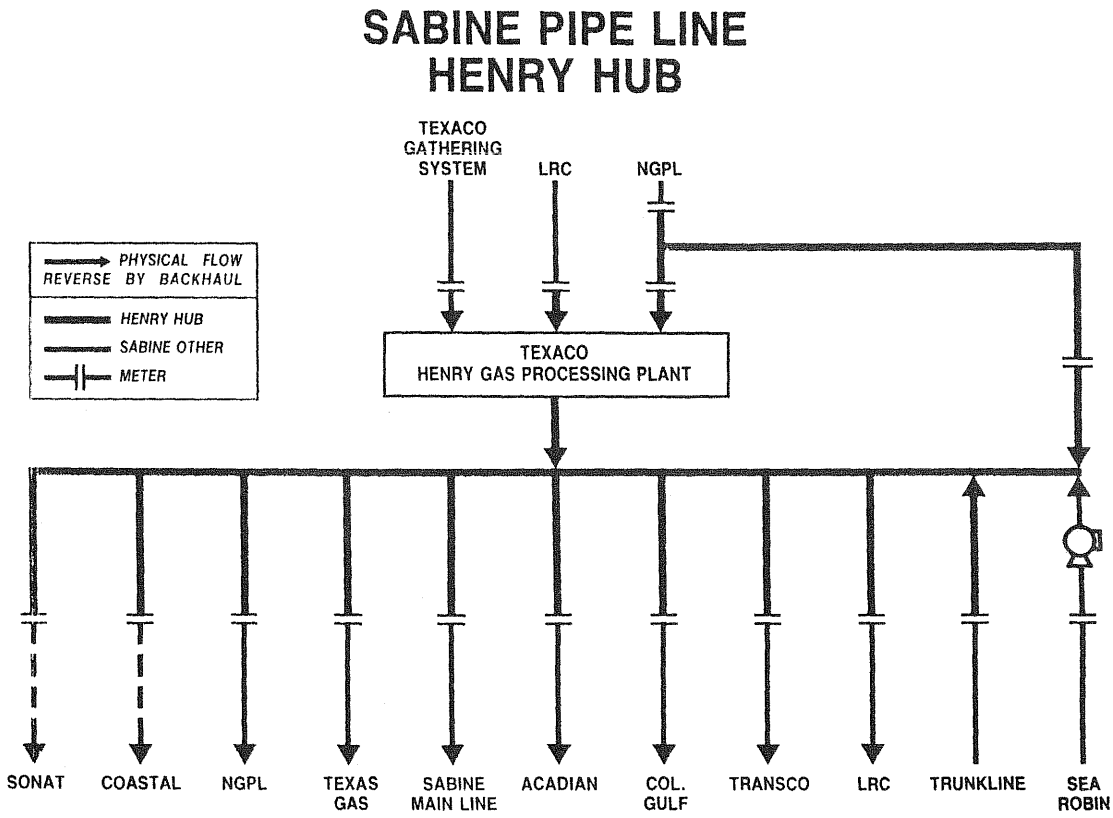

Fig. 2-9. Schematic diagram of Sabine Pipe Line Henry Hub in Erath, Louisiana as provided by Sabine Pipe Line Company.

transportation contracts with backup transportation arrangements) to and from the Henry Hub for the delivery of gas must be demonstrated ten days before the month of delivery. A fee of 2 cents per million BTU is levied on the seller for using the interchange service in Henry Hub. At the present time, the margins required to guarantee the performance of the futures contract ranges from 5 to 15 percent of the value of the underlying contract. The specifications of the NYMEX gas futures contract are shown in appendix B.

The number of gas futures contracts traded in the NYMEX is around five-hundred per day and the number of open transactions (the total number of futures contracts that have been entered into and not yet offset by opposite futures transactions nor fulfilled by delivery of the gas) averages about four-thousand on any given day.

A futures market can perform many important economic functions for its participants, including the discovery of forward prices, the provision of additional operating funds, the facilitation of risk management, and the exchange of information for business decision making. There are several studies detailing the functions of the futures market in general and the crude oil and gas futures in specific.[24]

For a gas company, buying and selling of gas futures contracts can achieve certain functions similar to the physical storage of gas. Actually, one of the classic common characteristics of commodities traded on the futures market is the storability of the underlying commodity.[25] Similar to other commodities, the gas futures market is an extension of the cash gas markets (the wellhead market and the spot market).

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24 See Jeffery Williams, *The Economic Function of Futures Markets* (Cambridge, U. K.: Cambridge University Press, 1986); and Raymond M. Leuthold et al., *The Theory and Practice of Futures Markets*, for a general discussion about the futures markets. Specific discussions about the crude oil futures market can be found in Peter J. W. N. Bird, "Futures Trading and the European Oil Market," *The Energy Journal* 8 (1987): 149-55; and James A. Overdahl and H. Lee Matthews, "The Use of NYMEX Options to Forecast Crude Oil Prices," *The Energy Journal* 9 (1988): 135-47. Also see John A. Rosenkranz, "Risk Management Principles in Natural Gas Marketing," *Public Utilities Fortnightly*, 13 October 1988, 27-31, on the application of gas futures as a tool in managing price risk by gas companies.

25 Raymond M. Leuthold et al., *The Theory and Practice of Futures Markets*, 20. However, it should be noted that storage is no longer a required condition for futures contracts. Several futures contracts (such as S&P 500 Index or Value Line Index) currently traded cannot be stored at all.

For a gas company, the buying of a gas futures contract, compared with spot purchase, wellhead purchase, and other storage options, can be a relatively easy and economical way of managing gas supplies required at a future date. It is easy since the gas futures market is highly organized and the contract itself is standardized. No extended efforts are required to investigate the capability, reliability, credit, and idiosyncracies of the potential sellers. It is economical since only a relatively small amount of capital is required for buying a gas futures contract and the commission expense typically accounts for a small percentage of the value of the contract.

If the gas obtainable under a futures contract turns out to be unnecessary to meet the peak demand as originally projected, or if the market price of gas decreases significantly, the gas company can simply sell the futures contract in the open market. Obviously, the price of gas at a future date can change significantly and the gas company is still responsible for the loss or profit resulting from price changes between the time of buying and selling the gas futures contracts. Sometimes, such losses can be substantial.

On the other hand, establishing a futures market may encourage the efficient utilization of existing storage facilities and possibly the expansion of storage capacity. It has been argued that a well functioning futures market can induce the gas companies to fill their gas storage fields and tanks on the basis of anticipated seasonal cost savings rather than on their own projected operational needs.[26] This is the case since the gas stored (which may be more or less than the gas company's own operational requirement) can be sold by the gas company in the futures market to increase its operating capital (cash on hand for operating purposes) and to make a profit if the movement of price follows the gas company's own projection.

Given the relatively short history of the operation of a gas futures market, it is difficult to project its eventual success and full potential as a gas storage option. There is no assurance that gas futures will be actively traded over an extended period of time. It is estimated that over 90 percent of all futures (commodity, currency, financial, and stock market indices) ever developed eventually failed. There is a long list of commodities once actively traded, but are no longer. (They include butter, egg, lard, cottonseed oil, turkey, broilers, wine, scrap iron,

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26 See "Marketers Embrace Future Trading; Munis, Producers Have Doubts," *Inside F.E.R.C.*, 1 February 1988, 12-13.

boneless beef, diamonds, apples, and some petroleum products.[27]) Even though the eventual success of the gas futures cannot be predicted with confidence, there is some possibility that it may eventually develop into an actively traded futures based on the history of other energy-related futures. According to NYMEX, for example, of the five futures contracts and three option contracts listed on the exchange, No. 2 Heating Oil Futures has been traded since 1978, Light Sweet Crude Oil Futures since 1983, and Unleaded Regular Gasoline Futures since 1984.

Also, the buying of a gas futures will only assure the availability of a fixed amount of gas at the delivery point (Henry Hub in Louisiana) at a future date. It still is up to the buyer to arrange for gas transportation service from the delivery point to its own gas transportation and distribution facilities. The problems encountered in arranging transportation for direct gas purchases still have to be resolved. If gas is stored at the storage facilities that are close to the gas company's own transportation and distribution facilities, there is less need to arrange transportation service and gas delivery can be assured.

Finally, buying and selling of gas futures does not directly contribute to an increase of total gas storage capacity, it is mainly a reallocation of risk between the buyers and sellers of gas futures. Even though the reallocation of risk from those who can least bear it to those who can best bear it can improve economic efficiency, the use of gas futures contracts may not contribute too much in reducing the cost of gas or improving service in a situation of market-wide supply shortage in peak periods.

Take-or-Pay Provision in Gas Procurement Contracts

Another possible option for "storing" gas is the strategic use of take-or-pay provisions already incorporated in many long-term gas purchase contracts. These provisions can be used as a multiyear storage option. Under a typical take-or-pay provision, the buyer agrees to take a minimum percentage of the gas produced from a particular well, or alternatively, pay for that particular volume even if the gas is not taken. The buyer is usually allowed to make up for the volume of gas paid but not taken over a future period--usually three to five years. Such take-or-pay

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27 Raymond M. Leuthold et al., *The Theory and Practice of Futures Markets*, 19.

provisions have appeared both in the contracts between producers and pipelines and between pipelines and local distribution companies.

The take-or-pay provision has been a prevalent feature of most long-term gas procurement contracts. There are various explanations about the prevalence of the take-or-pay provisions in gas procurement contracts. The take-or-pay provision has been viewed as essential in assuring the seller a stable cash flow, and the pipeline capacity is being operated at capacity most of the time. Some also argue that the take-or-pay provision is a useful mechanism for effecting appropriate incentives for contract performance.[28]

The usefulness of a take-or-pay provision, however, is significantly reduced under the emerging gas industry structure that is characterized by almost universal access to pipeline transportation facilities by producers, local distribution companies, and end-users, and the prevalent use of short-term spot gas contracts.[29] It is difficult to predict the exact degree of prevalence of the take-or-pay provision in future gas procurement. It still may be used in certain gas procurement contracts or may be replaced by some types of gas inventory charges.

The use of the take-or-pay provision as a storage option works in the following way. A gas buyer can enter into a gas purchase contract specifying a higher take requirement than what is projected to be needed. Thus, a gas-take deficiency is created intentionally. Because this deficiency can be made up at a future date if and when the buyer's demand for gas is higher, the gas buyer is essentially using the seller's facility to store gas. The buyer may get an additional advantage if the price of gas is scheduled to be adjusted upward in the future. The storage cost to the buyer is the financing cost of the prepayment for gas not taken at the present time.

For most take-or-pay provisions, the gas-take deficiency is calculated on a yearly basis. In other words, any take deficiency created in the nonpeak period can only be taken in the next year rather than at the peak demand period in the same year. There is no supply shifting from nonpeak to peak periods. At the same

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28 Scott E. Masten and Keith J. Crocker, "Efficient Adaption in Long-term Contracts: Take-or-Pay Provisions for Natural Gas," *American Economic Review* 75 (1985): 1083-93.

29 Daniel J. Duann et al., *Direct Gas Purchases by Gas Distribution Companies: Supply Reliability and Cost Implications* (Columbus, OH: The National Regulatory Research Institute), 40-43.

time, additional gas-take deficiencies are created in next year's nonpeak period. A huge cumulative gas-take deficiency can create significant financing difficulties for the gas company, so the yearly load-balance feature of the take-or-pay provision makes it a less used storage option. Only when strong evidence suggests an extended period of higher prices or supply shortages well into the future, can the take-or-pay provision become a viable storage option.

Status of Current Underground Storage Capacity

From the above discussion, it is clear that storing gas in underground reservoirs at present is the most developed and economical form of gas storage. A comparison of the capital costs of various gas storage options is shown in table 2-2. Though these cost figures were derived a long time ago (1974) and represent only part of the total cost of storage, the relative rankings of the costs of storage options might not have changed much. Various industrial trade groups have been contacted about any recent estimations of the costs of various gas storage options, but no satisfactory data could be obtained. As for the capacity and maximum daily sendout for storage options other than underground storage, only fragmentary information on aquifer storage (which is part of the underground storage) and liquefied natural gas storage is available. The total capacity of aquifer storage is around 1,400 billion cubic feet while the liquefied gas storage capacity is 81 billion cubic feet.[30] There are reasons to believe that storage options other than underground storage only account for a very small portion of the total capacity and maximum daily sendout. One indirect indication is the comparison of maximum daily sendouts among those made possible through underground storage (39 billion cubic feet), gas well shut-in (around 6 billion cubic feet), and liquefied natural gas storage (10.6 billion cubic feet) in 1988. Consequently, an overview of the main characteristics of underground storage can provide a good approximation about the status of gas storage in the United States.

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30 American Gas Association, *Gas Facts 1988 Data* (Arlington, VA: The American Gas Association, 1989), tables 4-2, 4-3.

TABLE 2-2

CAPACITY COSTS OF VARIOUS GAS STORAGE TECHNOLOGIES

Type	Cost in 1988 Dollars per Cubic Feet*
Underground storage in depleted fields	0.042 to 0.106
Gas storage in water layers	0.114
Gas storage in salt formations	0.303
LNG storage	27.870
Gas storage in propane	68.466
Natural gas storage in pipelines at 1,600 psi	103.000

Source: C. U. Ikoku, *Natural Gas Engineering*, 592.

* The cost figures were originally expressed in 1974 dollars per cubic meter. They are adjusted to 1988 dollars through the Consumer Price Index. It should also be noted that the heat contents per cubic foot of gas can be vastly different for various storage options as the gas is highly compressed, thus a much higher heat value can be found in some storage options.

There are various sources on the capacity, utilization, and operational characteristics of underground storage.[31] Certain minor differences do exist in the results reported by these sources. For example, the total underground storage figures reported by the Energy Information Administration in the *Monthly Energy*

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31 They include *Gas Facts*, and *Survey of Underground Gas Storage Facilities in the United States and Canada* published by the American Gas Association, the *Monthly Energy Review*, and *Natural Gas Monthly* published by the Energy Information Administration. All monthly data concerning underground storage are collected from Forms FPC-8 and EIA-191. The annual data on liquefied natural gas storage are collected from Form EIA-176, and the monthly data are estimated figures.

Review are slightly higher than those reported by the American Gas Association. Even among the various AGA publications, slight variations in the reported figures occur. But the information provided by various sources is generally compatible and no attempt is made here to completely reconcile the differences. The data on underground storage presented in this section are derived from surveys conducted by the Underground Storage Committee of the American Gas Association.[32]

Based on the computer diskette of individual underground storage reservoirs provided by the AGA, there are 383 underground storage sites located in twenty-five states with a total capacity of 7,740,264 million cubic feet (MMcf), and a designed maximum daily sendout of 37,846 MMcf. The distribution of the years in which these storage sites were developed initially is shown in table 2-3. No clear trend can be identified about the historical development of underground storage facilities. It seems, however, that the development of underground storage reservoirs has slowed since 1976.

The utilization of underground storage indicates a similar trend. The rate of utilization has declined from 88 percent in October 1978 (usually the month of maximum injection) to 71 percent in 1987[33] (see table 2-4). This decline in the development and utilization of gas storage capacity appears to coincide with the period of substantial deliverability surplus in the gas market. As the gas is widely available and no significant price increases are projected, the need and incentive for gas companies to store gas for use at peak periods is reduced.

The geographical distribution of the number of sites, total capacity, and maximum daily sendout is the next item to be examined. In addition to the typical breakdown by individual states, a regional breakdown is also included. The regional breakdown used here follows that used by the Gas Research Institute in its regional

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32 The first survey of underground storage facilities was undertaken during the fall and winter of 1965-1966. Thereafter, an extensive revision was done roughly every five years and an update was published every year. The data were disseminated in aggregate form by the AGA in several of its publications. The latest detailed data on individual storage sites was contained in a 1988 publication, *Survey of Underground Gas Facilities in the United States and Canada* (hereafter referred to as the *Underground Storage Survey*). The detailed data are also provided to us by the AGA in a computer diskette.

33 Cambridge Energy Research Associates, *Natural Gas Trends*, 30-31.

TABLE 2-3

DEVELOPMENT OF UNDERGROUND STORAGE RESERVOIRS

Years	Number of Sites	Initial Capacity* (MMcf)	Total Capacity** (MMcf)
pre-1941	32	93,231	347,391
1941-1945	19	504,160	412,082
1946-1950	48	457,110	659,502
1951-1955	60	628,726	1,024,875
1956-1960	42	495,921	784,857
1961-1965	50	519,132	1,374,840
1966-1970	39	403,355	912,515
1971-1975	58	490,224	1,173,337
1976-1980	23	529,989	777,905
1981 and later	12	313,757	272,760
Total	383	4,435,605	7,740,264

Source: AGA, *Underground Storage Survey* (1988).

* Initial capacity is for those storage reservoirs which were originally gas reserves. This represents the original gas reserve.

** Total capacity is the maximum designed reservoir capacity, or if aquifer, the total developed capacity.

TABLE 2-4

STORAGE CAPACITY UTILIZATION
(Billion Cubic Feet)

Year	Working Gas Storage Capacity	Working Gas in Storage*	Percent Utilization (%)	Total U.S. Consumption	Working Gas Storage Capacity as a Percent of Consumption (%)
1978	3,380	2,964	88	19,627	17
1979	3,420	3,086	90	20,241	17
1980	3,810	3,187	84	19,877	19
1981	4,040	3,248	80	19,404	21
1982	4,110	3,364	82	18,001	23
1983	4,160	3,270	79	16,835	25
1984	4,210	3,175	75	17,951	23
1985	4,240	3,204	76	17,281	25
1986	4,328	3,199	74	16,221	27
1987	4,381	3,097	71	16,680	26

Source: Energy Information Administration as reported in Cambridge Energy Research Associates, *Natural Gas Trends*, 30.

* Measured in October of applicable year.

gas supply and demand projections.[34] Those states which do not have underground storage facilities are not included. The reason for providing regional data is to better compare regional storage capacity with regional gas demand/supply balance and thus have a better understanding about the role gas storage can have in matching gas supply with gas demand. After all, the storage facilities available within a state are not necessarily limited to providing gas within the particular state. The storage facilities currently underutilized can be leased to the gas companies or end-users in a neighboring states. The geographical distribution of underground storage reservoirs is shown in table 2-5. The table indicates that the East North Central, West North Central, West South Central, and Middle Atlantic regions have the largest number of sites, capacity, and daily gas sendout. These regions tend to have higher gas consumption and, with the exception of West South Central, import substantial amounts of gas from other regions. This indicates that, in addition to the availability of suitable geological formation, the presence of demand exceeding supply at peak periods is a powerful impetus for gas storage development.

The operational characteristics of underground storage sites are summarized in table 2-6. For the United States as a whole, the amount of working gas is only around 78 percent of the amount of base gas maintained in the reservoir. The Mountain 1, Mountain 2, and East South Central regions have higher ratios of working gas versus base gas, indicating that underground storage facilities in those regions have better utilization of the storage capacity. The potential for further improvement in the utilization of existing storage facilities can be measured by the difference between the design capacity (total capacity) and the current capacity (the sum of base gas and working gas). Not surprisingly, those regions with the largest design capacities have the largest amount of potential storage for utilization

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34 See Gas Research Institute, *The Long-Term Trends in U.S. Gas Supply and Prices: The 1988 GRI Baseline Projection of U.S. Energy Supply and Demand to 2010* (Chicago: Gas Research Institute, 1988). The states comprising the regions are: Pacific 1 (Oregon, Washington), Pacific 2 (California), Mountain 1 (Colorado, Idaho, Montana, Nevada, Utah, Wyoming), Mountain 2 (Arizona, New Mexico), West North Central (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota), West South Central (Arkansas, Louisiana, Oklahoma, Texas), East North Central (Illinois, Indiana, Michigan, Ohio, Wisconsin), East South Central (Alabama, Kentucky, Mississippi, Tennessee), Middle Atlantic (New Jersey, New York, Pennsylvania), South Atlantic (Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia), and New England (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont).

TABLE 2-5

GEOGRAPHIC DISTRIBUTION OF UNDERGROUND STORAGE RESERVOIRS

	Number of Sites	Total Capacity (MMcf)	Maximum Daily Send Out (MMcf)
U.S. Total	383	7,740,264	37,846
Pacific 1	2	66,200	390
Washington	2	66,200	390
Pacific 2	9	507,637	2,823
California	9	507,637	2,823
Mountain 1	23	668,114	1,811
Colorado	9	91,658	771
Montana	5	373,960	374
Utah	3	106,049	400
Wyoming	6	96,447	266
Mountain 2	3	68,600	27
New Mexico	3	68,600	27
West North Central	30	1,758,069	12,050
Iowa	8	357,400	965
Kansas	19	319,102	2,117
Minnesota	1	988,255	8,820
Nebraska	2	93,312	148
West South Central	47	1,417,093	7,572
Arkansas	5	41,353	112
Louisiana	8	560,816	2,410
Oklahoma	13	374,163	2,369
Texas	21	440,761	2,681
East North Central	128	2,371,130	12,966
Illinois	31	888,213	3,172
Indiana	28	105,709	934
Michigan	47	988,255	8,820
Ohio	22	388,953	40
East South Central	24	310,502	2,335
Kentucky	20	206,594	1,571
Mississippi	4	103,908	764

TABLE 2-5--Continued

	Number of Sites	Total Capacity (MMcf)	Maximum Daily Send Out (MMcf)
Middle Atlantic	79	1,014,350	5,275
New York	21	179,363	961
Pennsylvania	58	834,987	4,315
South Atlantic	37	568,904	1,335
Maryland	1	64,770	300
West Virginia	36	504,134	1,035

Source: AGA, *Underground Storage Survey* (1988).

improvements. They are the West South Central, Middle Atlantic, and West North Central (see table 2-7).

Some caution must be exercised in interpreting the utilization data. First, even though the amount of potential storage capacity is large, the percentage of unused capacity in relation to the total capacity may not necessarily be high. Second, the rate of utilization at a specific reservoir could change significantly from one year to another. So utilization data for a particular year may not be indicative of previous years. Third, the utilization of storage facilities is not entirely dictated by local demand/supply conditions, especially for those facilities owned by interstate pipelines. The increased utilization may be due to demand increases at the other points on the transportation pipelines. A higher potential for utilization improvement shown for a particular region or state does not necessarily mean that policy or regulatory changes promoting better utilization are warranted.

The ownership distribution of underground storage facilities is shown in table 2-8. There are three categories of ownership: distribution and intrastate pipelines, interstate pipelines, and end-users, storage companies, and gas producers. This classification generally reflects the division of regulatory authority on underground

TABLE 2-6

OPERATIONAL CHARACTERISTICS OF UNDERGROUND STORAGE RESERVOIRS

	Number of Sites	Average Base Gas* (MMcf)	Average Working Gas** (MMcf)	Working Gas/ Base Gas Ratio
U.S. Total	383	8,591.85	6,727.89	0.783
Pacific 1	2	11,650.00	5,878.00	0.505
Washington	2	11,650.00	5,878.00	0.505
Pacific 2	9	26,938.22	12,819.50	0.476
California	9	26,938.22	12,819.50	0.476
Mountain 1	23	10,135.40	13,429.13	1.325
Colorado	9	5,177.33	3,494.11	0.675
Montana	5	21,914.00	44,068.60	2.010
Utah	3	15,843.67	5,644.67	0.356
Wyoming	6	4,903.00	6,691.00	1.365
Mountain 2	3	5,000.00	6,573.33	1.315
New Mexico	3	5,000.00	6,573.33	1.315
West North Central	30	12,422.00	7,488.43	0.603
Iowa	8	18,460.00	12,269.25	0.658
Kansas	19	10,163.90	3,263.74	0.321
Minnesota	1	4,600.00	6,700.00	1.456
Nebraska	2	13,656.00	28,894.00	2.116
West South Central	47	11,707.00	12,261.50	1.047
Arkansas	5	5,058.00	2,477.20	0.490
Louisiana	8	32,876.62	21,867.90	0.665
Oklahoma	13	15,220.70	8,489.70	0.558
Texas	21	3,049.95	13,266.50	4.350
East North Central	128	8,908.50	5,766.60	0.647
Illinois	31	18,125.80	8,271.20	0.456
Indiana	28	2,698.60	1,058.00	0.392
Michigan	47	8,464.30	8,556.80	1.011
Ohio	22	4,773.40	2,269.40	0.475
East South Central	24	6,194.75	6,118.87	0.988
Kentucky	20	5,183.60	4,700.80	0.907
Mississippi	4	11,250.50	13,209.25	1.174

TABLE 2-6--Continued

	Number of Sites	Average Base Gas* (MMcf)	Average Working Gas** (MMcf)	Working Gas/ Base Gas Ratio
Middle Atlantic	79	5,185.50	4,074.40	0.786
New York	21	4,520.62	2,790.05	0.617
Pennsylvania	58	5,426.22	4,539.40	0.837
South Atlantic	37	4,015.80	3,031.03	0.755
Maryland	1	44,402.00	17,031.00	0.383
West Virginia	36	2,893.94	2,642.14	0.913

Source:AGA, *Underground Storage Survey* (1988).

* The average amount of base gas maintained in each underground reservoir.
** The average amount of working gas maintained in each underground reservoir.

storage facilities. The underground facilities owned by distributors and intrastate companies are primarily regulated by state public service commissions, those owned by interstate pipelines are regulated by the Federal Energy Regulatory Commission, and the others are not regulated at least with respect to price and service terms. The number of underground storage facilities owned by distributors and interstate pipelines are about the same, but the average capacity of the facilities owned by interstate pipelines seems to be much larger than those owned by distributors. One possible explanation is that the interstate pipelines tend to own larger depleted gas and oil reservoirs that previously were used for gas production.

Summary

After examining various gas storage options available, it appears that underground storage reservoirs using depleted gas and oil fields (the most common and economical options) are likely to remain the most important storage option in terms of its overall effect on gas availability and cost. The shut-in of producing

TABLE 2-7

POTENTIAL FOR UTILIZATION IMPROVEMENT OF UNDERGROUND STORAGE RESERVOIRS

	Current* Capacity (MMcf)	Future** Capacity (MMcf)	Future Capacity/ Current Capacity Ratio
U.S. Total	5,854,901	1,357,114	0.23
Pacific 1	35,056	31,144	0.88
Washington	35,056	31,144	0.88
Pacific 2	357,820	149,817	0.41
California	357,820	149,817	0.41
Mountain 1	548,340	126,615	0.23
Colorado	78,043	12,344	0.15
Montana	329,913	44,047	0.13
Utah	64,465	43,341	0.67
Wyoming	75,919	26,883	0.35
Mountain 2	34,720	54,472	1.56
New Mexico	34,720	54,472	1.56
West North Central	594,199	193,189	0.32
Iowa	247,274	110,126	0.44
Kansas	255,125	61,551	0.24
Minnesota	6,700	13,300	1.98
Nebraska	85,100	8,212	0.09
West South Central	1,126,612	259,174	0.02
Arkansas	37,676	3,677	0.09
Louisiana	438,056	95,643	0.21
Oklahoma	308,235	64,377	0.20
Texas	342,645	95,477	0.27
Middle Atlantic	722,667	249,205	0.34
New York	144,852	33,163	0.22
Pennsylvania	577,815	216,042	0.37
South Atlantic	260,732	34,484	0.13
Maryland	61,433	3,337	0.05
West Virginia	199,299	31,147	0.15

Source: AGA, *Underground Storage Survey* (1988).

* Current capacity is the total of base and working gas.
** Future capacity is the difference between total capacity and current capacity.

TABLE 2-8

OWNERSHIP DISTRIBUTION OF UNDERGROUND STORAGE RESERVOIRS

Type	Number of Sites	Initial Capacity (MMcf)	Total Capacity (MMcf)
Distributor and intra-state companies	173	1,690,111	2,564,823
Interstate pipelines	167	2,248,123	4,555,612
End-users, storage companies	43	497,371	619,829

Source: AGA, *Underground Storage Survey* (1988).

wells and liquefied natural gas storage in tanks are two other storage options that may contribute significantly in terms of available capacity and maximum daily sendout. Liquefied gas storage is quite expensive, but can be an important gas supply management tool for certain gas companies where other forms of storage options are technically infeasible for various reasons, such as the lack of suitable geological formations or rapid and short-lived gas demand spikes in peak periods (where a rapid gas delivery rate is essential). The gas futures market is a new "storage" option, and the extensive buying and selling of gas futures may have substantial impact in gas supply management. However, the full potential and eventual success of a gas futures market is uncertain given its short trading history.

CHAPTER 3

TYPES OF COSTS AND BENEFITS OF GAS STORAGE

The costs and benefits of gas storage depend on the prevailing and projected demand and supply conditions in the gas market. Given the various forms of storage, the costs and benefits of one storage option may be quite different from another. For example, the costs involved in building an above-ground liquefied natural gas storage tank are quite different from those of developing a depleted gas field for storage. While not attempting to detail the costs and benefits associated with any particular storage option, this chapter identifies the generic types of benefits and costs associated with the addition and use of storage capacity. Benefits and costs are measured primarily in terms of their effects on an individual gas company rather than from the perspective of the gas market as a whole. The market implications of the increased use of gas storage will be discussed in the next chapter.

Gas Storage as an Economic Decision

A basic rationale for using gas storage as a supply management tool is to shift gas acquisition from nonpeak to peak periods to control the cost and risk facing the gas companies in meeting the gas requirements of its customers. From the perspective of an individual gas company, two kinds of risk are usually involved in the use of a specific gas supply strategy: quantity risk and price risk. Quantity risk refers to the possibility of having insufficient gas delivered during a peak period, which could be a particular day or a several-month period. Price risk refers to the possibility of facing significant price increases brought about by changes in gas market conditions.

Adding storage capacity and increasing the amount of gas stored affects a gas company's exposure to the two types of risk identified above. Thus, the benefit of gas storage is defined as the reduction of risk exposure. This risk reduction is generally embodied in a more reliable gas supply or a decrease in the cost of gas service. The cost of storage is defined as the resources expended in obtaining capacity and gas for storage.

A gas company will not engage in gas storage unless the expected benefits exceed the costs of doing so. In more specific terms, two conditions must be met before the gas company can develop and use a specific storage option. First, a storage option must be demonstrated as technically feasible. For example, in the case of underground storage, a site with suitable geological formations and proximity to existing transportation and distribution pipelines must be located. The determination of the technical feasibility is not the focus of this report and has been discussed in general terms in chapter 2. The second condition is that there should be a market requirement for gas storage. That is, the increase in peak period gas requirement cannot be met more cheaply by the expansion of current gas production and transportation facilities.

Several factors can influence the benefits and costs of gas storage, including the price variations between peak and nonpeak periods, the extent of gas shortage at peak period, the availability of extra transportation capacity to meet increased gas requirements, the geological and technical characteristics of the storage facility, the location of the storage facility within the gas transportation and distribution network, and the cost of capital.

The price differential between peak and nonpeak demand periods can affect the benefits and costs of storage. Where the demand of an individual gas company may not exhibit significant variation but market demand and gas price do exhibit significant variations, the gas company can use storage to reduce the cost of gas supplies. This is done through purchasing more gas than is needed during periods of low gas price and putting the gas in storage, and using the stored gas as a part of gas supply to reduce its purchase when the price of gas becomes higher.

The presence of a gas shortage at peak periods may be due either to insufficient production in the field or insufficient transportation facilities to deliver the gas. In the case of a supply shortage, the end-users may not be able to consume gas to the level they can consume economically. The economic level of gas usage is the level at which a gas customer (for example an industrial company) will consume to maximize its own objective (profit, in this instance). In other words, at this level of usage, the cost of an additional unit of gas consumed equals the benefit of doing so. If gas demanded exceeds gas supplied, any increase in gas supply can lead to an increase in the total benefit of gas consumption.

The availability of transportation capacity to meet an increased gas requirement at peak periods can determine whether the storage of gas can lead to

a reduction in the requirement for new transportation capacity. If the use of storage can delay or cancel construction of new transportation capacity, significant savings in capital cost can be achieved. An important consideration, as some members of the gas industry are realizing, is that the most critical element affecting future gas deliverability may not be production in the gas fields, but the availability of gas transportation pipelines connecting gas supplies to certain "gas-importing" regions of the nation.[1] Significant amounts of new transportation capacity may be required for certain regions (such as California and New England) if current projections of regional gas demand and supply patterns hold.

As discussed in chapter 2, the geological and operational characteristics of storage reservoirs can affect, among other things, the type of compression and pumping facilities required, the amount of gas stored, the amount of base gas needed to maintain the proper operation of the storage reservoir, and the highest pressure that can be exerted in gas injection and withdrawal. All these factors, in turn, can affect the costs and benefits of gas storage.

The location of the storage facility within the gas transportation and distribution system also affects the capital investment required and the operation of the storage reservoir. It is usually preferred to have a storage facility close to the load center since less transportation capacity is required and less gas is lost due to gas movement from storage reservoirs to the gas companies and end-users. Given that most storage facilities, especially underground storage, require specific geological formations, it may not always be possible to locate the storage facilities near the load centers.

Finally, since gas storage involves the purchase of gas at the present time to save for future use, the financing cost of holding the gas inventory should be considered. Similar consideration can be given to the financing of building new storage and storage-related facilities. The factors affecting the cost of financing are the general level of interest rate and the financial strength of the gas company. A debt-ridden gas company may need to pay high interest rates for the

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1 A discussion on the regional gas demand-supply projection and the regions that are vulnerable to future supply interruption can be found in Gas Research Institute, *The Long-term Trends in U.S. Gas Supply and Prices: The 1988 GRI Baseline Projection of U.S. Energy Supply and Demand to 2010* (Chicago: Gas Research Institute, 1988).

amount of money borrowed in purchasing gas for storage or for building storage facilities.

Benefits of Gas Storage

The benefits of using gas storage can be classified in two categories: operational and economic benefits. Operational benefits refer to those effects related directly to the production and physical movement of gas. Economic benefits refer to the improvement in resource utilization (usually typified by cost savings or increased revenues) as a result of using gas storage. Obviously, these two types of benefits sometimes cannot be separated completely. The operational benefits are meaningless unless they can improve gas service or reduce the cost of such service. Similarly, many economic benefits are derived from better operation and planning of the gas delivery system.

The first operational benefit of storage is to balance gas supply and sendout. This is probably the traditional function of storage. Specifically, it refers to the better utilization of pipeline transportation facilities so that a relatively constant pressure and amount of gas in the pipeline can be maintained during periods of low demand. Another operational benefit of storage is to maintain a relatively stable rate of production in the gas field. As indicated before, due to the physical characteristics of gas movement once a gas well is developed, a constant rate of production is always preferred.

As for the economic benefits of gas storage, they are derived from the improvement of operations by the gas companies as well as the improvements in gas consumption by the end-users. First, there is the cost reduction associated with the deferment or cancellation of the construction of new transportation and distribution facilities to meet the gas requirements at peak demand periods. Even though no estimates are available, this is an important consideration since a large portion (over 75 percent) of the construction expenditure spent annually by the gas utility industry is on transmission and distribution facilities.[2]

The second economic benefit refers to the several advantages that a gas buyer can achieve in gas procurement through the use of storage. Specifically, these are

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2 American Gas Association, *Gas Facts 1988 Data* (Arlington, VA: The American Gas Association, 1989), table 16-1.

the reduction in demand-related charges and the enhancement of bargaining position in contract negotiation. Current federal and state gas pricing regulations generally specify a demand charge applied to the peak-day gas requirement in addition to the commodity charge applied to the amount of gas sold or transported. Because of the additional gas made available from storage to meet gas requirements at peak periods, gas storage can reduce the peak-day requirement on pipeline suppliers, thereby reducing the demand charge. The possible implementation of gas inventory charges for interstate pipelines can further enhance the economics of using underground storage for peak-shaving purpose whether the gas inventory charges are demand-based or deficiency-based.[3] Additionally, as discussed previously, it is more advantageous for the producer to maintain a stable rate of production, and the use of storage can help to maintain an even level of gas purchase, which in turn could lead to more favorable contract terms for the buyer.

The third economic benefit is that the gas company can take advantage of a fluctuating gas market to increase gas purchases when the price of gas is low and reduce gas purchase when the price is high. This can be a significant factor as the monthly gas prices can vary significantly. The 1989 nationwide monthly wellhead price, city-gate price, and price paid by all consumers are shown in table 3-1. Based on this, a local distribution company can potentially reduce its gas supply cost 10 percent by storing gas in April and using it in December. For a gas company, the variation in its cost of providing gas service is due primarily to the variation in the cost of gas supply. The costs of the fixed transportation and distribution facilities are relatively stable. A recent study of the inventory adjustment behaviors of six industries (tobacco, rubber, food, petroleum, chemical, and apparel) has shown that the primary objective of a holding inventory (storage) is to shift production from periods in which production costs are relatively high to periods in which production costs are relatively low.[4] This tends to confirm that the use of storage can be an important strategy in reducing the cost of gas supply for most gas companies.

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3 Gloria L. Gaylord, "Assessing Responsibility for Long-Term Gas Supply: The Gas Inventory Charge," *Public Utilities Fortnightly*, 17 August 1989, 9-14.

4 Martin Eichenbaum, "Some Empirical Evidence on the Production Level and Production Cost Smoothing Models of Inventory Investment," *American Economic Review* 79 (1989): 853-64.

TABLE 3-1

MONTHLY GAS PRICES IN 1989
(Dollars per Thousand Cubic Feet)

Month	Wellhead	City Gate	Delivered to Consumers
January	2.00	3.16	4.65
February	1.82	3.11	4.58
March	1.70	2.89	4.42
April	1.57	2.83	4.13
May	1.62	2.94	3.91
June	1.65	2.98	3.67
July	1.66	3.08	3.52
August	1.62	3.04	3.53
September	1.59	2.99	3.60
October	1.62	2.84	3.83
November	1.72	2.97	4.24
December	1.91	3.09	4.58
Average	1.71	3.01	4.18

Source: Energy Information Administration, *Monthly Energy Review* (Washington, D.C.: Energy Information Administration, February 1990), table 9-11.

The fourth economic benefit is the avoidance of the curtailment and reduced reliability of gas service at peak periods. The undesirable economic consequences of gas curtailment include forgoing the comfort and convenience of using gas by the residential customers, and reducing production and employment by industrial and commercial customers. There have been various estimations of the cost of gas

shortage.[5] Specifically, a detailed discussion of the evaluation methodology and impact assessments of the increased availability of gas during the winter heating season as a result of gas storage was provided in a gas storage study done at the Argonne National Laboratory.[6] Three categories of impact were identified: economic (employment, production, material inputs, and costs of fuel substitution), social (health and safety, and comfort), and environmental (changes in the levels of certain pollutants).

The use of storage can reduce the cost of gas shortage in two ways. It can reduce the gas shortage by injecting additional gas into storage during nonpeak periods and withdrawing more gas during peak periods. The gas usage in nonpeak periods is not affected. Alternatively, in the face of prolonged gas shortage, no additional gas is available in the nonpeak period, the use of storage will allow the curtailment of gas in nonpeak periods where the gas is of low-priority use for high-priority use in peak periods. In this case, even though the total gas consumed over a year has not changed, the value of the gas usage has increased. It was suggested that a significant part of the benefits of storage is the increase in "consumer surplus" generated as a result of shifting gas supply from the period when the gas is valued less (usually the nonpeak period of summer months) to the period when gas is valued higher (usually the peak period of winter months).[7]

Costs of Gas Storage

In previous chapters, there was some discussion of the specific cost considerations associated with alternative storage options such as nondevelopment of gas fields, shutting-in of gas wells, and the buying and selling of gas futures contracts. These will not be repeated here. The costs of gas storage discussed

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5 See, for example, Stephen Breyer and Paul W. MacAvoy, "The Natural Gas Shortage and the Regulation of Natural Gas Producers," *Harvard Law Review* 86 (1973): 941-87; and Daniel Z. Czamanski et al., *The Benefits and Costs of Gas Storage Development in Ohio* (Columbus, OH: Policy Development Project, The Ohio State University, 1977).

6 E. W. Walbridge et al., *Maximizing Natural Gas Storage Levels: An Assessment of the Costs and Benefits* (Argonne, IL: Argonne National Laboratory, 1978), 27-40.

7 Daniel Z. Czamanski et al., *The Benefits and Costs of Gas Storage Development in Ohio*, 32-34.

here refer primarily to those associated with the construction and use of storage facilities.

Three categories of costs are associated with the storage of gas. There are the capital costs incurred in installing and building the required compression and pumping facilities and connecting pipelines. Then there is the cost of base gas that has to be maintained in the reservoirs all the time. As discussed in chapter 2, in addition to the amount of gas being injected and withdrawn from the storage facilities, a certain amount of gas is needed to be kept in the reservoir for the lifetime of the storage facilities to maintain proper pressure for the movement of gas in and out of the reservoir. The cost of the base gas, though not incurred as a result of installing fixed facilities, is usually categorized as capital cost since it is generally unchanged irrespective of the amounts of gas injected or withdrawn throughout the life of the storage facilities. The third category is the cost of operating and maintaining storage facilities and the financing cost of the gas being stored.

It should be noted that in the discussion about gas storage, the cost of gas storage is usually expressed in two ways.[8] The first is the unit capacity cost which is derived by dividing initial capital investments (including both equipment and base gas) by total storage capacity. The second is the storage cost per unit of working gas delivered from storage reservoirs. This cost is derived by dividing the annual cost (the sum of annual fixed and annual operating costs) by the amount of working gas delivered. The unit cost of working gas delivered is probably a more useful indicator of the actual cost of gas storage.

The first item of capital cost is the cost incurred in acquiring and installing the capital equipment required for the operation of a storage site. The equipment required for gas storage includes compressors, regulating equipment, housing, pumps, and measuring and control equipment. Then there is the cost of preparing the sites for storage operation, which includes leasing mineral rights and land, drilling wells, and building connecting lines from wells to pump stations and from pump stations to existing transportation and distribution pipelines. If it is a new field (a site not developed before), extensive geological surveys and testing, and reservoir engineering simulations and modeling needs to be done to quantify the geological and operational characteristics of the reservoir.

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8 Ibid., 16.

As indicated in chapter 2, the amount of base gas can be substantial, on average occupying 50 percent or more of the total storage capacity. It has been suggested that the main reason the cost of a new gas storage field is much higher than an old storage field is the cost of base gas. The amount of base gas required depends on the integrity of the container and the degree of porosity (the free movement of the gas) of the storage stratum. The integrity of the reservoir determines the amount of gas that might migrate or escape to nearby reservoirs. A poorly contained reservoir may simply be unsuitable for storage or may incur a substantial cost for the gas escaped. The porosity of the storage stratum determines the amount of pressure required in injecting and withdrawing gas from the reservoir. This in turn determines the amount of base gas required and the rating (usually in horsepower) of gas pumping machineries required.

The operating cost refers to the annual costs incurred in operating the storage facilities. The operation cost is usually proportional to the amount of working gas being injected or withdrawn from the storage reservoir. First, there is the cost of maintaining pump stations, wells, and connecting pipelines; of fuels used for running compressors; and possibly of royalties paid on storage wells. Then there is the cost of gas lost due to underground migration as well as the common gas loss incurred in transporting gas from storage fields to the connecting pipelines. This is usually not a significant loss unless the storage field is far away from the pipeline system. The third element of operating cost is the financing charges for maintaining an amount of gas injected and kept in the storage reservoir as well as the possible changes in the market price of gas. Since more gas is purchased than currently is required, the gas company is essentially maintaining an inventory of gas. Depending on the state regulations, it may be the case that the gas being put into storage has already been paid for but the recovery of cost will not come until the stored gas is withdrawn and sold. Then the interest paid for borrowing the money, or the interest forgone if the fund is generated internally, in maintaining the gas inventory is an operating cost of using gas storage. Furthermore, there is the possibility of incurring financial loss from the decline in the value of the gas being stored. Just as the storage of gas can provide some insurance against future price increases, it could also result in some loss to the gas company if the future market price of gas falls below the level when the gas was brought into storage.

Current Assessment

As the gas market goes through a continuing restructuring, the benefits and costs of storage may be quite different than what they were in the past. As indicated in chapter 1, the main rationale for promoting the use of storage ten or twenty years ago was to increase gas supply in the peak periods and to avoid gas curtailment. However, given the impending complete deregulation of the wellhead market, the prevalence of spot gas purchases, and the existence of a gas futures market, the response in gas production in the gas field is likely to be swift and market-driven. The possibility of a chronic supply shortage is unlikely unless there is a sudden and drastic increase in the demand for gas. But, the market price of gas will be more volatile than it used to be as a large portion of the gas market is no longer under any kind of price regulation and the extensive use of short-term gas procurement arrangements. At the same time, some have argued that the bottleneck for future gas delivery, especially for regions such as California, the Midwest, and New England, is the availability of transportation capacity rather than gas production.[9]

Under this scenario, it appears that the main benefits of the extensive use of storage are the costs that can be avoided in deferring or cancelling construction of new transportation pipelines, reducing demand-related charges in gas procurement, and the possibility of taking advantage of fluctuating market gas prices by purchasing more when the price is low and less when the price is high. The effect of reducing chronic gas deliverability shortage at peak demand periods is likely to be less of a concern as the wellhead market is deregulated and the use of spot market gas becomes prevalent.

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9 See Daniel J. Duann et al., *Direct Gas Purchases by Gas Distribution Companies: Supply Reliability and Cost Implications* (Columbus, OH: The National Regulatory Research Institute, 1989), 12-28 for a review of the various assessments of future gas supply and demand.

CHAPTER 4

GAS STORAGE AND A COMPETITIVE GAS MARKET

In addition to the traditional function of shifting gas supply to help assure reliable supplies and reduce gas cost, the use of storage has new implications as the traditional gas industry structure is altered and new unbundled gas services are established. As indicated in previous chapters, access to storage facilities may not be as essential and critical as access to transportation pipelines in delivering gas. But access to gas storage capacity, which is obtained either through its own construction or lease from other entities, may still affect a gas buyer's decision on whether to purchase gas directly or to rely on others for gas supplies, and may affect the comparability of gas sales and transportation services. A recent FERC ruling on two interstate pipeline storage programs stated that open-access storage service would further the efforts of achieving a fully open-access market by permitting transportation services that would not otherwise be feasible unless provided in conjunction with storage service.[1]

More importantly, the proper use of gas storage may increase supply reliability and reduce the cost of gas service provided by a gas company. Thus, decisions on gas storage become a part of the overall business strategy a gas company can use to compete with other gas providers or providers of competing fuels. In particular, an interstate pipeline or an LDC can use storage to reduce cost and improve service so that its noncaptive customers will not choose to bypass or purchase transportation-only service.

In the following sections, the transformation of the gas industry and the unbundling of gas service will be discussed first. Then the role of storage in the gas delivery system, the prospect of a market for storage, and the significance of a comparable gas storage service are presented. After that, the effects of storage on the various components of a restructured gas industry are delineated. The market implications of gas storage can be analyzed in two aspects. One aspect is the effect on the prevailing market price and quantity. Another is the effect on

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[1] See "Storage Programs Approved Despite Moler's Abandonment Concerns," *Inside F.E.R.C.*, 19 March 1990, 1-2.

the degree of competition and the relative competitive position of the market participants. This aspect is the emphasis in this chapter.

The Unraveling of the Traditional Industry Structure

In the past, the provision of gas service from wellhead to burnertip was done through a three-tier industry structure consisting of producers, pipelines, and local distribution companies. This structure corresponded closely to the main technical operations (production, transportation, and distribution) of the gas delivery system. Three distinct gas markets existed under this structure. The wellhead market set the price and quantity of gas produced from dedicated fields and sold to the interstate and intrastate pipelines. The wholesale market determined the quantities and prices of gas purchased by the local distribution companies from interstate or intrastate pipelines. In the distribution "market" the local distribution company acted as a monopoly in selling gas, subject to state public utility regulation, to all end-users within its service area.

At the same time, gas was provided as a bundled product from sellers to buyers in gas transactions. An interstate pipeline served as both a merchant and a transporter for the LDCs, which in turn served as a merchant and a transporter of gas for its residential, commercial, and industrial customers. Acquisition, transportation, storage, load balancing, and standby services were all provided in a complete package by the gas sellers.

With several far-reaching regulatory reforms initiated in the early 1980s by the Federal Energy Regulatory Commission, especially concerning access to pipeline-owned transportation facilities, there is no longer a clear distinction between wellhead and wholesale markets. Pipelines, LDCs, electric utilities, large industrial plants, commercial customers, and government entities all can purchase gas directly from the producers, marketer, and pipelines. In the interstate gas market, the latest data available indicate a continuing trend of steady decline in sales by interstate pipelines and steady increase in gas transportation. In 1989, sales accounted for only 25.3 percent of total pipeline throughput compared with 33.6 percent in 1988 and 38.7 percent in 1987.[2] It is expected that all major interstate

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[2] See "Carriage Gain Offsets Sales Drop in '89 As Familiar Pattern Holds," *Inside F.E.R.C. Special Report*, 28 May 1990.

pipelines (Florida Gas Transmission being the last one) will become open-access transporters very soon.[3]

Several factors can account for the decline of interstate pipelines as gas merchants. They include the cost advantages of spot market purchases over long-term purchases with pipelines, the wide availability of access to interstate transportation pipelines, the strong state regulatory oversight of least-cost gas purchases, and the intensive interfuel and gas-on-gas competition at the distribution level.[4]

The increase in demand for transportation-only service happened not only in the interstate gas market but in the local distribution markets as well. Even though a distribution company remains as the sole supplier within its own service territory to residential or other captive customers, it has experienced competition from others in supplying gas to commercial and industrial end-users, and to electric utilities. Some end-users either have switched to alternative fuels such as No. 6 oil, or have procured gas from other suppliers by bypassing the local distribution companies or using transportation-only service. No nationwide data are available on the extent of transportation-only service provided by LDCs for end-users. By one estimate, the gas transported on behalf of end-users averaged about 25 percent of throughput for major gas distributors in the Upper Midwest region.[5]

To assure the continuing supply of reliable and economical gas service to end-users, especially captive customers, state regulators have actively pursued various approaches regarding the transportation of gas on the LDC's transportation facilities. According to an NRRI survey conducted in the spring and summer of 1988, a majority of states (thirty-eight out of forty-five) have considered and adopted some type of gas transportation policy.[6] It is expected that the continuing trend toward open access to transportation facilities at the distribution

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3 See "Awaiting FERC Order, Florida Gas Set to Implement Open Access Aug. 1," *Inside F.E.R.C.*, 4 June 1990, 1, 5-6.

4 Daniel J. Duann et al., *Direct Gas Purchases By Gas Distribution Companies: Supply Reliability and Cost Implications*, (Columbus, OH: The National Regulatory Research Institute 1989), 33-39.

5 Cambridge Energy Research Associates, *Natural Gas Trends* (Cambridge, MA: Cambridge Energy Research Associates, 1988), 7.

6 Robert E. Burns et al., *State Gas Transportation Policies: An Evaluation of Approaches* (Columbus, OH: The National Regulatory Research Institute, 1989), 13-17.

level will accelerate the use of direct gas purchases and the unraveling of the traditional three-tier industry structure.

The Unbundling of Gas Service

In addition to the unraveling of the three-tier industry structure, another fundamental change currently underway in the gas market is the unbundling of gas service. For many gas companies, gas service is no longer provided as a complete package but is supplied as several distinct services such as acquisition, transportation, storage, load balancing, and standby service. Such an unbundling occurred not only in the pipelines' gas services to LDCs but also in the LDCs' services to end-users.

Extensive discussions have taken place on the unbundling of gas service provided by the interstate pipelines.[7] Some argue that the driving force of the current federal regulatory reforms in the gas area is the unbundling of gas service (particularly the provision of transportation-only service) with the intended goals of resolving the take-or-pay liability facing interstate pipelines and of increasing competition in the gas market. In many respects, these regulatory reforms have been quite successful based on the almost universal access to pipeline transportation facilities and the relatively stable gas prices and supplies in the interstate market for the past few years. Some have argued that the emphasis on access to transportation facilities, rather than on the price of gas produced in the field, should have been the focus of federal gas regulation all along.[8]

But the unbundling of gas service in the distribution market is a more thorny issue with the presence of many captive end-users who have no fuel-switching capability or who are inherently uneconomical to be served by competing suppliers. In developing public policies regarding transportation-only service provided by LDCs, an array of studies exists, but no universally applicable guidelines have been

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[7] See, for example, Anna Fay Williams and Leonard V. Parent, *New Opportunities for Purchasing Natural Gas* (Lilburn, GA: The Fairmont Press, 1988).

[8] See, for example, Richard J. Pierce, Jr., "Reconstituting The Natural Gas Industry from Wellhead to Burnertip," *Energy Law Journal* 9 (1988): 1-57.

established.[9] Some of these guidelines (such as preserving competitive price signals, avoiding drastic cost reallocation, and preventing the exercise of undue market power) may conflict with each other. Nevertheless, the unbundling of gas service with cost-based rates for each service has been proposed as the most effective way (compared with the options of flexible pricing (selective price discrimination) and deregulation of the noncore market) a local distribution company can use to prevent the erosion of its revenue base by competition from other fuels and to reduce the threat of end-user bypass.[10]

As discussed previously, the separation of transportation from bundled gas service is almost completed at the interstate level while the provision of separate transportation service at the state level is continuing to evolve. It is difficult to assess the eventual degree of the unbundling of transportation service in the distribution market given the presence of a large number of captive end-users.

There are only a few LDCs and interstate pipelines that are offering separate storage service at the present time. For the interstate pipelines, the FERC in March 1989 approved a pipeline's self-implementing storage program subject to a nondiscriminatory access condition and other restrictions.[11] Under this program, both firm winter storage service and interruptible storage, if capacity is available after firm storage, transportation and sales requirements are met, will be provided. The interruptible storage service as currently proposed would be available on a first-come, first-served basis. The tariff includes a capacity charge, a volume-injection charge, and a volume-withdrawal charge. The initial service period for the storage service is three years.

As for the separate storage service provided by the local distribution companies to end-users, California and Oregon have been two of the more active states. According to a policy statement issued by the Oregon Public Utility Commission (OPUC) on March 23, 1989, the gas distribution companies providing

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9 A discussion on the different approaches used by the states in dealing with gas transportation within the state, and the economic and legal criteria used in developing policies, can be found in Robert E. Burns et al., *State Gas Transportation Policies*, 13-71.

10 Louis R. Monacell, "Unbundling Natural Gas Service: Lessons from Virginia," *Public Utilities Fortnightly,* 11 May 1989, 9-15.

11 See "ANR Unbundled Storage Service Authorized, With Access Conditions," *Inside F.E.R.C.*, 3 April 1989, 3-4.

transportation service in Oregon were ordered to unbundle transportation rates and services as of November 1, 1989.[12] The OPUC recommended that transportation be unbundled into basic service, storage service, load balancing service, and standby service. Storage service is defined as the service to liquefy customer gas and hold it in insulated containers, or pressurize and inject customer gas into an underground reservoir for withdrawal at a later date.

The California Public Utility Commission (CPUC) ordered two California gas distribution companies (Pacific Gas and Electric Company and Southern California Gas Company) to provide their customers with gas storage banking service with the intent of helping the utilities' noncore customers benefit from seasonal fluctuations in the price of gas while ensuring the utility's own storage operations on behalf of core customers are unimpeded.[13] A competitive bidding mechanism was proposed to set rates for the reservation of natural gas banking service by customers.

A New Gas Industry Structure

As a result of the unraveling of the traditional gas market structure and the emergence of new unbundled services, a new gas industry structure has emerged. The role of gas storage in promoting or inhibiting competition must be analyzed in terms of its effects on the various components of the new industry structure. In essence, the traditional three-market structure has been replaced by a four-market structure. The new markets are the gas acquisition market, the gas transportation market, the core gas sales market, and the noncore gas sales market.

The gas acquisition market includes the wellhead market, spot market, and recently the gas futures market.[14] The gas acquisition market decides the overall level of gas production from gas fields and the price of gas made available at specific delivery points. As the increase in direct gas purchase has shown practically everyone can participate in the gas acquisition market. Gas producers,

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12 Oregon Public Utility Commission, *Re Natural Gas Transportation Services*, Order No. 89-406, 101 PUR4th, 21-27.

13 California Public Utilities Commission, *Re Natural Gas Procurement and System Reliability Issues*, Decision 88-11-034, 97 PUR4th, 389-431.

14 An explanation of the participants, contract terms, and typical contract provisions of the wellhead market, spot market, and gas marketers can be found in Daniel J. Duann et al., *Direct Gas Purchases by Gas Distribution Companies*, 39-48.

pipelines, and gas marketers (a market intermediary who buys and sells gas for others) all can act as sellers in this market while the local distribution companies, pipelines, industrial and commercial companies, electric utilities, and gas marketers are the primary buyers.

Core gas sales refers to the traditional gas sales service provided by local distribution companies to captive customers who are unable or find it uneconomical to switch to alternative fuels or another gas supplier. The typical example is the bundled gas service to residential, small commercial, and small industrial end-users. In the core gas sales market, the local distribution company is the only viable supplier. In exchange for a monopoly position within its own service territory, the LDC agrees to provide gas service to all customers who demand it and to subject the price and service terms to state public utility regulation. More importantly, a complete package of service is provided by the LDC, and captive customers do not need to arrange transportation, storage, load balancing, interconnection, and standby service. It should be noted that the customers of a core gas sales market could change over time as certain end-users with fuel-switching ability or back-up gas supply have the freedom to choose between core gas sales, noncore gas sales services, or transportation-only service.

The gas transportation market refers to both the interstate sector where the pipelines provide transportation-only service for local distribution companies and certain end-users, and the intrastate sector where the local distribution companies or intrastate pipelines provide transportation-only service for end-users. The development of the gas transportation market is still evolving and the definition and pricing of comparable transportation service have been the focus of many federal and state regulatory initiatives and court reviews. The key challenges in this market are how to assure that a comparable transportation service (in relation to the gas sales services) is provided for those customers who need only transportation service, how to set the price of transportation service, and how to efficiently and fairly allocate transportation capacity if the demand exceeds the supply of transportation service.

Noncore gas sales refers mainly to the firm gas sales to noncaptive customers and interruptible gas sales service provided by pipelines and marketers to LDCs and end-users or from LDCs and marketers to end-users. Buyers in this market either have the ability to switch quickly to fuels other than gas or have their own backup gas supplies. The buyer is willing to purchase a less reliable gas service provided

by the sellers in exchange for a lower price. This does not mean, however, that a noncore customer is less concerned about gas supply reliability. The customer may simply choose to make other arrangements (multiple pipeline connections or gas storage) to assure its supply in addition to purchasing in the noncore gas sales market. These customers may not want to bypass completely the merchant and transporter functions of their previous suppliers. In the case of a local distribution company, it is quite possible that some LDCs may still want to rely on the interstate pipelines for part of their gas supply, expecting the pipelines can strike a better bargain with the producers and other pipelines in acquiring gas. After all, compared to an LDC newly involved in gas procurement, the pipelines may be more experienced and knowledgeable in finding gas suppliers, in having more bargaining power by purchasing a much larger amount of gas, and in having more diversified supply sources.[15] It was suggested that in the long run the price advantage of spot purchase over pipeline purchase would disappear and the interstate pipelines, through the economies of scale and scope in transportation and hedging could recapture and then permanently retain all significant gas sales.[16] This relationship may also be true between an end-user and its LDC and pipeline suppliers.

The motive of the sellers in providing noncore sales service is to increase the utilization of their gas delivery capacity by increasing gas sales to interruptible customers while simultaneously leaving unaffected the capability of serving the captive customers. The seller understands that it cannot make the gas sales to these noncaptive customers unless it can offer a lower price than the gas offered by other providers or the price of competing fuels. In addition, the additional amount of gas sold through interruptible gas sales during the summer off-peak period has important operational benefits in balancing gas into and out of the pipeline delivery system and in maintaining stable and efficient operations.[17]

The development of the noncore gas sales market is closely related to that of

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15 Ibid., 51-58.

16 See Jeffery A. Born and James W. Freeman, "Natural Gas Rate Structure Determination in a Mandatory Carriage Environment: An Application of Option Pricing Theory, in *Proceedings of the Sixth NARUC Biennial Regulatory Information Conference*, Vol. 1, 285-300, September 14-16, 1988, Columbus, Ohio.

17 E. W. Walbridge et al., *Maximizing Natural Gas Storage Levels: An Assessment of The Costs and Benefits* (Argonne, IL: Argonne National Laboratory, 1978), 6.

the gas transportation market. Without the assurance of unbundled firm or interruptible transportation service, many LDCs and end-users will not be willing to take the risk of serious supply interruption by engaging in direct or interruptible gas purchases. In a sense, if largely unrestricted access to gas transportation facilities can be assured, the noncore gas sales market can be included as part of a broadly defined gas acquisition market. The key difference between the gas acquisition market and the noncore sales market is that in the noncore sales market certain gas suppliers (local distribution companies) still have an inherent obligation to serve the customers who choose to purchase firm gas sales service. Obviously, the participants of the gas market, whether they be producers, pipelines, LDC, gas marketers, electric utilities, or end-users, can sometimes participate actively in the buying and selling in more than one of these four markets at the same time.

A Market for Gas Storage Service

As the discussion of the storage technology indicated, gas storage facilities can be located near the pipeline transportation facilities as well as near the sources of supplies or load centers. According to AGA data on underground storage (as presented in chapter 2), interstate pipelines, local distribution companies, producers, storage companies, and end-users all own large amounts of storage capacity and the size of individual storage reservoirs varies significantly. This may imply that the construction or leasing from others of storage capacity is a viable option for most market participants, and that there are no apparent economies of scale and scope in building and operating storage facilities.

Specifically, three factors--decreasing long-term costs, high entry investment, and the small number of operators technically feasible--are usually considered as key factors in deciding whether a product or service can be competitively supplied.[18] For gas storage, less entry investment is usually required (as compared to the entry investment of building and operating pipelines), no limit is placed on the number of potential operators for the storage facilities within the gas delivery system, and little evidence (if any) suggests the presence of significant economies of scale and scope concerning the addition and use of storage capacity. From the

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[18] Congressional Research Service and The National Regulatory Research Institute, *Natural Gas Regulation Study* (Columbus, OH: The National Regulatory Research Institute, 1982).

technical aspect of a gas delivery system, as each participant has the option of acquiring its own storage capacity, gas storage is helpful but not necessarily essential in producing and moving gas. Consequently, the control of access to storage service by a pipeline or local distribution company does not physically preclude the provision of gas service by other parties to its customers. However, the availability and cost of gas storage do have some effect in determining whether the gas production and transportation facilities are used economically and reliably, which in turn effect the cost and reliability of gas service.

Currently, ninety-two companies own underground storage facilities. Of these, thirty-one are interstate pipelines, forty-five are distribution companies and intrastate pipelines, and sixteen are end-users, producers, and storage companies.[19] Certain other pipelines and local distribution companies may be leasing storage facilities from those who own storage facilities, but no exact number on the participants of the "gas storage market" can be provided here. As more firms are providing a separate storage service or storage banking service, the number of potential buyers and sellers in a storage-service market could be substantial and storage service could be competitively supplied. However, at the present time there does not appear to be an organized and developed market for storage as there is in the wellhead and spot markets for gas acquisition, or even in the still evolving market for transportation-only service.

One of the hotly debated issues in the unbundling of gas services is whether the sellers can, or have the incentive to, provide comparable services between sales (bundled) and nonsales (unbundled) services such as transportation, storage, and standby services. If no comparable services are provided, the seller can make the unbundled service a less attractive option for its current customers, keeping them "in the system" and effectively blocking the participation of new competitors. Obviously, the number of competing suppliers can directly affect the price paid by the end-users for gas service. For example, a study on the industrial sales of

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19 The data here are derived from the AGA *Underground Storage Survey*. But it should be noted that the AGA data only indicate the name of the company which owns the underground storage reservoirs. The classification used here is based on the main business of the identified companies obtained from various sources.

twenty-two interstate pipelines indicates that the prices on average are inversely related to the number of competitors that a pipeline faces.[20]

There are some instances where the pipelines are alleged to be tying storage service with gas sales services to increase gas sales.[21] The Associated Gas Distributors noted that a number of pipelines allowed customers to use only gas bought from the pipeline for contract storage service. In this circumstance, certain distributors might have no choice but to obtain gas from the particular pipeline for storage to meet peak demand at heating season, thus restricting the distributors' access to the less costly and more reliable gas supplies. A recent FERC decision did eliminate the requirement to put only pipeline gas into customer storage in the pipeline-owned facilities.

A coalition of producers, marketers, and distributors has suggested that the sales and firm transportation services provided by the Tennessee Gas Pipeline Company are not comparable.[22] With respect to gas storage, the coalition suggested that storage should be made available to transportation customers to alleviate difficulties occasioned by the pipeline's daily and monthly balancing and scheduling provisions and that the restriction that no more than one-third of storage capacity be occupied by third-party gas be eliminated.

One potential advantage of gas storage is to allow the gas companies to make sales (part of the gas may not be owned by the gas companies) at a higher price in the peak demand period and make up the gas supply deficit with gas purchased at a later day at a lower price. It was alleged that by allowing pipeline marketing affiliates to run up imbalances (this is in some ways similar to using a storage facility), the affiliate was afforded an unfair advantages in competing with other marketers.[23]

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20 John Richard Morris, *The Relationship Between Industrial Sales Prices and Concentration of Natural Gas Pipelines*, Working Paper No. 168, Bureau of Economics, Federal Trade Commission, 1988.

21 See "FERC Should Stop Pipelines from Tying Storage to Sales Gas," *Inside F.E.R.C.*, 7 March 1988, 13.

22 See "Coalition Suggests Way To Make Tennessee Services More Comparable," *Inside F.E.R.C.*, 7 May 1990, 11.

23 See "Tennessee Allowed Affiliate to Run Up Imbalance, Citizen Charges," *Inside F.E.R.C.*, 3 April 1989, 3.

In general, the competitiveness of a market (alternatively, the market power held by individual buyers and sellers) is usually determined by three factors. They are the number of market participants, the homogeneity (similarity) of the products or services being traded, and the number of alternatives facing each participant in the market. In using the perfect competition market as an example, there are many buyers and sellers, the products and services provided by the sellers are perfect substitutes for each other (essentially one product), and many alternatives are available to buyers. In such a market, all buyers and sellers are price-takers and individuals have no market power. Alternatively, in a monopoly market there is only one seller but many buyers. The products or services may or may not be homogeneous, and the buyers have no alternative but to buy from the seller. Under this circumstance, the seller has market power while the buyers have none. Not surprisingly, most markets fall between these two extremes. These three factors will be examined closely in the following analysis of the effects of gas storage on competition in the various components of the gas market.

Effects of Storage on Gas Acquisition Market

The gas acquisition market (in particular, the wellhead market) has been substantially free from government regulation since passage of the Natural Gas Policy Act in 1978, and will be completely deregulated by 1993 in accord with the timetable contained in federal legislation passed in 1989.[24] The buyers and sellers in the wellhead, spot market, and possibly the futures market are many. All spot purchase and futures contracts are perfectly homogeneous except for price, and in the case of futures contract the price and the maturity date. The cost of participating in these two markets is relatively small. Each buyer and each seller has practically unrestricted alternatives. So by the nature of the spot and futures markets, they are close approximations of a perfectly competitive market. Since the

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24 The Natural Gas Wellhead Decontrol Act of 1989 (NGWDA) was enacted in July 1989. It amends the Natural Gas Policy Act of 1978 to eliminate wellhead price and nonprice control by January 1, 1993. Decontrol is phased in for all expired, terminated, or post-NGWDA enactment contracts, for all expiring or terminating contracts, for certain renegotiated contracts, and for all newly spudded, post-NGWDA wells for gas delivery after May 14, 1991. The nonprice controls that are eliminated include the obligation to serve under the Natural Gas Act. See Natural gas Wellhead Decontrol Act of 1989, Pub. L. No. 101-60, 103, Stat. 157 (July 26, 1989).

spot gas and gas futures markets are already highly competitive, the increased use of storage and the provision of a separate storage service are unlikely to significantly enhance the degree of competition in these two markets.

As for the wellhead market, studies done in the past have tended to conclude that the wellhead gas market could be characterized as "structurally" competitive with no single participant exercising considerable market power.[25] For example, a 1983 study by the Energy Information Administration on gas producer revenue, price, and concentration indicated that there were no areas in the United States (excepting Alaska) in which a producer or a particular group of producers had a major concentration , as measured by the Herfindahl-Hirschman Index of gas ownership data, within the natural gas wellhead market.[26] The use of storage may increase the number of alternatives available to the buyers and sellers in this market. But given the highly competitive nature of the wellhead market at the present time, it seems that the use of storage will not significantly increase the degree of competition facing buyers and sellers in the wellhead market. In summary, the degree of competition in an already quite competitive gas acquisition market will not be significantly affected by the extensive use of gas storage.

This does not mean that the extensive use of storage will not affect price and availability in the gas acquisition market. The extensive use of storage in all likelihood may have a stabilizing effect on the wellhead and spot prices of gas as the seasonal swing in gas purchases is reduced when more gas is made available from storage during the winter heating season while more gas is injected for storage during the summer off-peak season. Nor does this indicate the options available to the buyers and sellers in this market (thus the bargaining power of the participants) will not be affected by the availability of storage capacity. The bargaining positions of individual participants in specific gas procurement transactions can be affected drastically by the use of storage. Due to the large number of participants, however, the opportunity for competitive gains within the gas acquisition market is limited.

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25 See, for example, Stephen Breyer and Paul W. MacAvoy, "The Natural Gas Shortage and The Regulation of Natural Gas Producers," *Harvard Law Review* 86 (1973): 941-87.

26 Energy Information Administration, *Producer Revenues, Prices, and Concentration in the Natural Gas Market* (Washington, D.C.: Energy Information Administration, November 1983).

Effects of Storage on Core Gas Sales Market

By definition, the customers in the core market of a local distribution company do not have the ability (or find it uneconomical) to switch to alternative suppliers or competing fuels, and thus are captive customers for the gas company.[27] For the core market, the gas service is best served in a bundled package (typically consisting of gas acquisition, transportation, storage, and backup service) by a monopoly local distribution company. The separate purchase of storage is not a viable option for these captive customers, and the provision of storage will not make the competitive supply of core gas service an efficient arrangement.

However, it is worth noting that certain customers may choose to be served as core customers even though the gas service required by them can be interrupted to a certain degree or they have some fuel-switching capability. As a result of the constraints and costs in contracting gas transportation service and acquiring gas, they have preferred to be served as captive customers in the past. If a separate storage service is provided to them, these customers may reconsider their decision and become transportation-only or interruptible sales customers. The provision of firm transportation service, in combination with storage and other standby services, may indeed prompt these customers to engage in direct gas purchase from sources other than the local distribution company. The availability of storage may increase the alternatives available to buyers in the core gas sales market. Under this circumstance, although the degree of competition may be increased slightly, the overall noncompetitive nature of the core gas service market remains.

Similar to the gas acquisition market, the absence of any significant direct effects on the noncompetitive nature of the core sales market does not mean the provision of storage service will have no impact on the price, gas availability, and gas requirements facing the local distribution company or its captive customers. For example, a customer may decide to contract for storage capacity provided by LDCs, pipelines, or others to shave its unusually high (but brief) peak during the winter heating months to reduce significantly its monthly demand charge paid to the

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27 The concept of core market generally does not apply to the interstate pipelines even though some customers (such as municipal gas utilities) of the pipelines can be categorized as full-requirement customers. These customers may have no other alternative but to purchase gas from the pipeline.

distribution company. More significantly, through purchased gas adjustments or other regulatory mechanisms, the core customers of the local distribution companies can benefit from the gas cost and supply advantages the LDCs obtain through the use of storage.

Effects of Storage on Gas Transportation Market

The gas acquisition and core gas sales markets are two extremes in the spectrum of the degree of competition in the gas industry. The degrees of competition exhibited in the gas transportation and noncore sales service markets are somewhere between these two extremes.

At the present time, the gas transportation market is not as developed and organized as the gas acquisition market. The details of the transaction mechanisms (such as competitive bidding; first-come, first-served; and capacity brokering) used for allocating gas transportation capacity efficiently and fairly are still to be determined. Also, the number of transportation service providers in a region is rather limited. For the interstate sector, the vast majority of the nation's interstate transportation capacity is owned and the majority of interstate throughput (the sum of gas transported for others and pipeline gas sales) is provided by twenty-three major interstate pipelines. Many local distribution companies and end-users, are connected with only one interstate pipeline. Consequently, for the interstate gas transportation market, at least, the number of potential transporters available to a particular buyer is limited. As for the transportation service within a state, the number of potential gas transporters for an end-user is even smaller, in most cases limited to one local distribution company.

The end-users and local distribution companies can build their own gas transportation facilities or the required interconnection themselves. But this usually is not an economical option given the economies of scale inherent in and required coordination associated with pipeline construction and operation, the enormous amount of capital required in building pipelines, and the widely fluctuating rate of utilization for a special-purpose (connecting only specific load centers and supply sources) gas transportation facility. Given the limited numbers of participants and the options available to each participant, the gas transportation market cannot be characterized as competitive at its current stage of development,

even though one may argue that the potential for a nationwide competitive transportation market does exist.

Storage service can be both a substitute as well as a complementary service to gas transportation. As discussed in chapter 3, one of the main advantages in using storage service is to reduce the amount of gas needed to be transported in the peak demand period. This, in turn, will lead to a reduction of the demand for additional transportation capacity that is used primarily for delivering gas at peak periods. In this case, gas storage becomes a substitute for gas transportation. On the other hand, the use of storage can increase the amount of gas to be transported in the nonpeak period as a result of delivering more gas for injection into storage reservoirs. So the demand on the utilization of existing transportation facilities can increase at some locations (primarily those leading into and out of the storage reservoirs) and decrease at other locations as new gas supply loops (patterns) are created by adding storage reservoirs. No general pattern, except those identified above, can be anticipated about the reallocation of the demand for transportation service as a result of the increasing use of gas storage.

The effects of increasing gas storage on the degree of competition in the transportation market can be analyzed through the three factors identified previously: the number of participants, the number of alternatives facing each participant, and the homogeneity of gas services. Given that few general patterns for the reallocation of demand for transportation service can be identified, the impact of storage on the number of buyers in the gas transportation market is less certain. For example, if the reallocation of demand for transportation service leads to an increase in the demand for transportation service provided by a strategically located pipeline (which owns the pipelines leading into and out of a storage facility), the number of buyers of transportation service in that particular location may increase. Conversely, gas storage can lead to a reduction in demand for transportation service provided by another pipeline which is far away from any storage sites, the number of buyers for the transportation service provided by this pipeline may be decreased instead. The effects of gas storage on the number of sellers for transportation service at any particular location is also uncertain. More detailed information on the configuration of transportation pipelines and regional demand and supply patterns is required to provide a definite answer regarding the effects of gas storage on regional demand and supply for transportation service.

Considering the number of options available to participants in the transportation market, the storage of gas, either by the gas buyers themselves or by others who provide storage service, is an added option for the buyer of transportation service. If the price (especially the demand charge) of transportation service becomes too high or if no transportation capacity is available during peak demand periods, the buyers of transportation service can use gas storage to reduce their demand for transportation service during the peak period.

As for the effects on the homogeneity of gas transportation service, this depends on the location of the storage reservoir and the conditions of the storage service being offered. If the storage reservoir is close to the load center or near where the gas will be delivered by the transporter initially, the storage service is a close substitute of the previously required transportation service. Otherwise, transportation service can only be partially replaced by the available storage service, meaning the demand for transportation service may increase in a certain location and decrease in other locations. The homogeneity of the transportation service in a particular region may or may not increase. The homogeneity of gas transportation service is probably affected more by the service terms of storage service offered. For example, if the local distribution company will only provide storage service for gas purchased from the LDC itself, and not gas procured by the end-users from other sources, the acquisition of transportation service may become a superior product to the acquisition of gas storage service. The state regulatory commissions can play a significant role in deciding the service terms of storage service. A more detailed discussion is provided in chapter 6.

In summary, since the current market for transportation is not quite competitive and can be made more competitive, the extensive use of storage service may be an important tool in enhancing competition. But given the locational aspect of the gas storage service available, part of the gas transportation market may become more competitive while other parts may become less competitive if the use of storage significantly induces more demand for transportation services provided by one or two transporters who own the pipelines leading into or out of the gas storage facilities.

Effects of Storage on Noncore Gas Sales Market

As indicated earlier, the characteristics of the noncore market are the buyers' ability to switch to other fuels or sources in the period of gas delivery curtailment, and the freedom on the part of the sellers to curtail gas delivery upon proper notice. Two kinds of gas service are usually provided in the noncore gas sales market: firm service and interruptible service. The terms of the firm sales service typically are no different from the core sales service. But, the alternatives available to the buyers are usually more than one, given their ability to switch to other fuels or gas suppliers. As for the alternatives available to the sellers in this market, they would have several if interruptible sales service is provided in addition to firm service. In general, if there is no significant barrier to the full access to gas transportation facilities, the noncore gas market can be quite competitive due to the presence of several options available to the buyers and sellers of noncore gas service. In other words, if the gas transportation market is quite competitive, the noncore gas sales market is also likely to be quite competitive. The effects of the extensive use of storage on the noncore sales market are contingent upon its effect on the gas transportation market. Given the uncertain nature of the effects of gas storage on the reallocation of demand for transportation service, noncore gas sales markets in certain regions may become more competitive than those in other regions. One thing that should be noted is that the use of gas storage tends to reduce the amount of gas available for interruptible gas sales and the incentives of sellers to engage in such sales. For the gas sellers, the possibility of storing gas during nonpeak period in order to increase the amount of gas available for sale at a higher price during the peak period can decrease the gas sellers' need to provide interruptible gas service at a lower price.

Summary

Even though the increase in storage capacity and the provision of a separate storage service can have important cost and service reliability implications for gas service, it appears that the use of gas storage may have only a limited impact on the competitiveness of the various components of the gas market. Specifically, the use of storage can enhance competition in the gas transportation market if the

storage reservoirs are located in desirable locations and if the storage services offered are similar to those provided by the gas sellers for its sales customers. Under this circumstance, the storage of gas becomes a close substitute for gas transportation. The viable options available to gas customers are increased. On the other hand, if the use of gas storage significantly increases the demand for access to certain transportation facilities owned by one or two gas companies, the market power of these gas companies in the gas transportation market in a particular region may increase, thus reducing the extent of competition.

CHAPTER 5

CURRENT STATE AND FEDERAL REGULATION OF GAS STORAGE

This chapter contains an overview of state and federal regulation of gas storage. Federal regulation derives from section 7 of the Natural Gas Act and the authority is vested in the Federal Energy Regulatory Commission (FERC). Federal oversight is discussed in a later section of this chapter.

In order to compile current information about state regulatory policies and practices with respect to gas storage, a survey of utility commissions in forty-eight states and the District of Columbia was conducted during the spring of 1990.[1] Commissions in forty-six states responded. This chapter contains a summary of the survey results. Interested readers are also directed to appendix A of this report for the detailed responses to the survey.

The discussion in this chapter takes the following form. The next section highlights the major results of the survey. The following section covers state commission regulation of the construction, acquisition, and leasing of gas storage facilities. Subsequent sections cover state commission regulation of gas storage facility operations, state regulation of storage banking and other services, and other state regulatory issues such as encouraging the use of storage by local distribution companies (LDCs), and the use of storage by LDCs to satisfy least-cost purchasing requirements. The overview of federal regulation of gas storage follows the discussion of state regulation.

Overview of State Commission Survey Results

The major results of the NRRI survey on state commission gas storage policies for local distribution companies are summarized in this section. An overall conclusion from the responses is that the state commissions are treating storage in a "business-as-usual" manner, relying on traditional forums and means of oversight

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[1] Hawaii and Nebraska are the two states that were excluded from the survey. The Nebraska Commission does not regulate natural gas local distribution companies. The Hawaii Commission had previously informed the NRRI that there was no natural gas in use in that state.

(mainly rate cases and purchased gas adjustment proceedings). Storage does not appear to be an area meriting very different or new commission procedures.

Gas storage construction projects are treated in the same manner as other LDC construction projects. The NRRI found that no commissions reported differences in financing requirements and cost recovery procedures for gas storage projects. Depreciation rate procedures differed mainly to the extent that each construction project or account had its own rate. The procedures used reportedly did not differ just because the project was a storage project.

About half of the commissions reported having authority to approve gas storage construction projects. Few preapprove distributors' leases or acquisitions of storage from pipelines, other distributors, or other sources. This would seem to indicate that the state commissions are somewhat more likely to examine what the LDC has already done rather than preapproving what the distributor wants to do. In terms of examining what the LDC has already done, commissions prefer to examine ongoing storage operations in rate cases and cost of gas proceedings. Except for safety regulations, few commissions reported having special monitoring of storage facility operations. None of the commissions reported a different purchased gas adjustment treatment for gas injected into storage compared with regular system supply. Underground gas leakage or loss is mainly a concern of other state agencies rather than the commissions.

Although storage may not be treated differently from other LDC operations, this is not to suggest that the state commissions are somewhat remiss. Besides reviewing LDC operations in rate cases and cost of gas adjustments, some commissions reported differences in cost allocation procedures for storage gas. Many commissions have methods for setting storage rates and for allocating the benefits of storage. State commissions have approved bidding procedures for storage services and storage banking. Rate case and purchased gas adjustment reviews can be effective means of oversight. In addition, it should be noted that storage is an old operation that may take on added significance in the new gas market. State commissions may adapt their procedures as the need arises.

Several questions from the survey indicate that distributors are actively using storage facilities and services. LDCs in many states are acquiring storage from pipelines. A smaller number of distributors is acquiring storage from other distributors and other sources. LDCs are using storage to satisfy least-cost purchasing requirements. Many LDCs are offering storage banking and other

services to end-users. None of the responding commissions reported that LDCs had acquired storage from pipelines or other sources on behalf of particular end-users.

One finding from the survey suggests a possible policy option that state commissions could pursue. A small number of commissions reported that LDCs were using storage as a bargaining tool in negotiations with pipelines over system supply gas. State commissions might want to promote such a use of storage as well as the use of storage generally. Twelve commissions reported they already are encouraging LDCs to use storage. Storage as a bargaining tool would seem an effective means for achieving least-cost objectives as well as a way for distributors to take advantage of the opportunities presented by the changing gas market structures.

State Regulation of Construction, Acquisition, and Leasing

In the NRRI survey on state commission gas storage policies, the authors first sought basic information about the extent of state commission authority over the construction, acquisition, and leasing of gas storage facilities and services by local distributors. These questions were intended to provide some insight into how actively state commissions oversee LDC gas storage activities at the initial stages of those activities. Commission authority over the construction, acquisition, and leasing of gas storage facilities and services, if present and depending upon how it is used, could signify that the regulators have earlier input into (and thus have potentially a greater impact on) LDC gas storage decisions.

The NRRI asked whether a jurisdictional LDC had to obtain the commission's approval before constructing gas storage facilities, whether the commission used a formal proceeding to review the application by the LDC to construct the facilities, and whether the commission issued a certificate of public convenience and necessity in approving the gas storage project. The NRRI also asked whether the LDC needed to obtain the commission's approval before acquiring or leasing storage facilities or services from an interstate or intrastate pipeline, from other distributors within the state or distributors in other states, or from sources other than pipelines and distributors (such as oil and gas producers).

Table 5-1 contains the responses on commission approval of the construction of gas storage facilities and the acquisition and leasing of storage facilities from the various sources. The table shows that about half of the responding state

TABLE 5-1

COMMISSION JURISDICTION OVER LDC CONSTRUCTION, ACQUISITION, AND LEASING OF STORAGE FACILITIES

	Commission Approval Required for Construction of Storage Facilities	Commission Approval Required for Acquiring or Leasing Storage from Interstate or Intrastate Pipeline	Commission Approval Required for Acquiring or Leasing Storage from Other Distributors	Commission Approval Required for Acquiring or Leasing Storage from Other Sources
Alabama	Y*a,b	--*	--	--
Alaska	N*	Y	N	N
Arizona	N	N	N	N
Arkansas	Ya,b	N	N	N
California	Ya,b	--	Y	--
Colorado	Ya,b	N	N	N
Connecticut	N	N	N	N
Delaware	N	N	N	N
Florida	N	N	N	N
Georgia	N	N	N	N
Idaho	N	N	N	N
Illinois	Ya,b	N	Y	N
Indiana	Y	N	Y	N
Iowa	Ya	N	N	N
Kentucky	Ya,b	N	N	N
Louisiana	N	N	N	N
Maine	Ya,b	Y	Y	Y
Maryland	N	N	N	N
Massachusetts	N	N	N	N
Michigan	Ya,b	N	N	N
Mississippi	Ya,b	Y	Y	Y
Missouri	N	N	N	N
Montana	N	N	N	N
Nevada	Ya,b	N	N	N
New Hampshire	N	N	N	N
New Jersey	Ya,b	N	N	N
New Mexico	N	N	N	N
New York	Ya,b	N	N	N
N. Carolina	N	N	N	N
N. Dakota	N	N	N	N
Ohio	N	N	Y	N
Oklahoma	N	Y	Y	Y
Oregon	N	N	N	N

TABLE 5-1--Continued

	Commission Approval Required for Construction of Storage Facilities	Commission Approval Required for Acquiring or Leasing Storage from Interstate or Intrastate Pipeline	Commission Approval Required for Acquiring or Leasing Storage from Other Distributors	Commission Approval Required for Acquiring or Leasing Storage from Other Sources
Pennsylvania	Y	Y	Y	Y
Rhode Island	N	N	--	N
S. Carolina	N	N	N	N
S. Dakota	N	N	N	N
Tennessee	Y	Y	Y	Y
Texas	N	N	N	N
Utah	N	Y	N	Y
Vermont	Y[a,b]	Y	--	--
Virginia	Y[a,b]	N	Y	N
Washington	Y	N	N	N
West Virginia	Y[a,b]	Y	Y	N
Wisconsin	Y[a,b]	Y	Y	Y
Wyoming	Y[a,b]	Y	Y	Y
	Y=22 N=24	Y=11 N=33	Y=13 N=30	Y= 8 N=35

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

* Y = Yes; N = No; -- = no answer given, don't know, issue never addressed.

a Commission uses a formal proceeding in reviewing the application for constructing gas storage facilities.

b Commission issues a certificate of public convenience and necessity in approving the gas storage project.

commissions (22 of 46) have the authority to approve or disapprove the construction of gas storage facilities by LDCs. The majority of those commissions (18 of 22) use a formal proceeding to review the LDC's application to construct storage facilities.

Most (17 of 22) also issue a certificate of public convenience and necessity in approving the gas storage project.

One-quarter of the responding commissions (11 of 44) have the authority to approve or disapprove the acquisition or leasing of storage facilities or services from an interstate or intrastate pipeline. Almost one-third of the responding commissions (13 of 43) have such approval/disapproval authority when the LDC seeks to lease or acquire storage facilities from other distributors. Less than one-fifth (8 of 43), however, have oversight authority when the LDC seeks to acquire or lease storage facilities from sources other than pipelines or distributors.

Comments on specific commission policies follow. Construction of gas storage facilities is considered below. The policies of the state commissions, shown in table 5-1, that do approve or disapprove LDC construction of gas storage facilities are discussed first.

State Regulation of Storage Facility Construction

Several respondents among the commissions that review and then approve or disapprove LDC gas storage construction plans describe the routine procedure that begins with the LDC filing its application. This is followed by staff review and then approval or disapproval by the commission. Hearings may or may not be part of the process. Other respondents noted various criteria that would determine commission involvement and approval or disapproval of the project. For some commissions, such as California and Pennsylvania, the cost of the project was a determining factor. For other commissions, including New York and Wisconsin, the length of the pipeline and the type of gas being provided (more particularly, whether the type of gas changed as a result of the project) were important factors.

Respondents describing the routine procedure of review and approval or disapproval included Alabama. There, the LDC applies for a certificate of public convenience and necessity, a hearing is held on the application, and an order granting or denying the request is issued. A similar sequence occurs in Mississippi. Commission staff reviews the LDC's application for the certificate, and the PSC issues an order of approval or disapproval. The Tennessee Commission's Engineering Division reviews all utility proposed construction projects, including gas storage. The Commission's order is prepared after this review.

According to Arkansas Code Annotated, Section 23 3 201 et seq., any person intending to construct, operate, or extend equipment or facilities for supplying a public service must obtain a certificate of public convenience and necessity from the Arkansas Public Service Commission. The applicant for the certificate must give notice of the application, as the Commission may require, and must file any information required by the PSC. After a hearing, the Commission may grant or refuse the request. It may also issue the certificate but attach any conditions that it feels are required by the public convenience and necessity. West Virginia Code, Section 24-2-11, is similar. No public utility may construct a facility for furnishing a public service unless it has obtained a certificate of public convenience and necessity from the West Virginia Commission. The Commission may approve or disapprove the application or grant a partial certificate.

In California, a certificate of public convenience and necessity is required if the estimated cost of construction is greater than $50 million. The LDC must then file an application for the certificate. Various economic, environmental, aesthetic, and community values would be considered. Hearings may or may not be necessary. Similar to California, the Pennsylvania Commission's involvement in gas storage construction also somewhat depends on the cost of the project. According to the Pennsylvania Code (52 Pa. Code Chapter 59.38) if the project involves expenditures of greater than $200,000 or 10 percent of the LDC's plant in service, whichever is less, the LDC must notify the Commission. Notification must be made at least thirty days before work on the project is to begin.

The Colorado Commission must consider and approve or disapprove major utility construction projects. Underground gas storage projects thus would be considered. In Illinois, the LDC files a petition requesting a certificate of public convenience and necessity. The utility must demonstrate first that the construction is necessary; second, that the project is consistent with the most recent energy plan adopted by the Illinois Commission for the LDC and for the state; third, that the LDC would be able to manage and supervise the construction; and fourth, that the LDC would be capable of financing the construction project without incurring any serious adverse financial consequences.

The Kentucky Revised Statute section 278.010 (3)(B) defines a utility as including gas storage "to or for the public for compensation. . . " The issue of gas storage construction has not been presented to the Commission, but the respondents stated that the Commission would probably be required to approve or disapprove

such construction and would probably use a formal proceeding and issue a certificate of public convenience and necessity.

In Michigan, the Commission becomes involved in approving or disapproving LDC gas storage construction only if the utility cannot obtain storage and mineral rights on a voluntary basis and condemnation is required. The certificate of public convenience and necessity that the Commission would issue would be needed in court as part of the condemnation proceeding.

In Nevada, the Commission has granted certificates of public convenience and necessity to existing gas storage facilities. According to the respondent, however, it is not clear whether the Commission and the utility are legally required to proceed through a process of application, review, and approval/certification or disapproval.

The New Jersey Board shares jurisdiction over LDC gas storage construction with the state Department of Energy. Under New Jersey's Department of Energy Act (NJSA 52:27F-1 et seq.) and P.L. 1987, c. 365 amending the Act, the Division of Energy Planning and Conservation (DEPC) has authority over general facility siting. The statute (NJSA 52:27F-15c) gave the DEPC jurisdiction along with any other state agency that might have authority over energy facility siting anywhere in New Jersey. Applications by LDCs for construction must address DEPC criteria as set forth in the Energy Master Plan. Public hearings may be held after public notice is given. A report, based on the public record, is prepared either approving or disapproving the application.

The New York Commission does not have jurisdiction over the actual storage field, but reviews and issues a certificate of environmental compatibility and public need for pipelines and related facilities going into and out of the storage fields. The Commission issues such a certificate only if the pipeline in question is greater than 1,000 feet in length and operates at a pressure of 125 pounds per square inch or greater.

The Virginia Code, Section 56-265.2, requires a formal or informal hearing for all improvements other than normal and ordinary line extensions. A certificate of public convenience and necessity would then be granted. In Wisconsin, the LDC files an application for the certificate of public convenience and necessity, explaining the need, cost, and feasibility of the project. If the project does not involve a change in the type of gas to be supplied to the public, a hearing to rule

on the application may or may not be held. A hearing must be held, however, if the proposal includes a change in the type of gas to be sold to the public.

In Wyoming, an application to the Commission is required under Wyoming PSC Rule Section 202(c) 4, 204, and 205. LDCs are urged to provide information to the PSC staff earlier than the filing of the application to expedite the review process. A public notice is issued and an opportunity given for a public hearing. A final order is then issued if no hearing is required or after holding the hearing. Commission staff conducts field checks and reviews the rate effects of the project for later rate hearings.

Among the commissions responding that they do not review and then rule on LDC gas storage construction plans was Alaska. There, certificates are required only for service areas and pipelines. In Utah, construction projects costing an amount equal to 20 percent of the utility's gross plant require the approval of the Commission, but certificates are not required for any construction projects.

Some commissions review storage facilities in a different forum such as a rate case or system supply review. The Connecticut DPUC, for example, while not approving construction still would be kept informed of any storage involving liquid natural gas or propane through annual reviews of supply that it conducts. There is no underground storage in the state.

The Oklahoma Commission reviews storage facilities during a rate case to determine an appropriate level of return on them for the LDC. In Oregon, the LDCs need Commission approval in a general rate case to add facilities to the rate base upon their completion.

The NRRI asked the commission staff members if an LDC needed to obtain approval from any other state or federal agency, such as an environmental protection agency or a department of natural resources, for the construction of gas storage facilities. Table 5-2 shows that in twenty-three of the responding states, an LDC must obtain approval from such an agency before proceeding with the construction of storage facilities.

The table shows that a variety of agencies have some type of jurisdiction over LDC construction plans. In addition to environmental and natural resources agencies, offices or departments mentioned include a state fire marshal, a department of mines and minerals, and an energy facilities siting council. Some respondents also mentioned the Federal Energy Regulatory Commission. Additional

TABLE 5-2

STATES IN WHICH LDCs NEED APPROVAL FROM OTHER STATE OR FEDERAL AGENCIES FOR STORAGE FACILITY CONSTRUCTION

State	Agency
Alaska	Alaska Department of Environmental Conservation Alaska Department of Natural Resources
California	Division of Oil and Gas of the California Department of Conservation
Delaware	Delaware Department of Natural Resources and Environmental Control
Georgia	Georgia State Fire Marshal's Office
Idaho	Federal Energy Regulatory Commission (FERC)
Indiana	Indiana Department of Natural Resources
Iowa	Iowa Department of Natural Resources
Kentucky	Kentucky Department of Mines and Minerals
Maine	Maine Board of Environmental Protection
Massachusetts	Massachusetts Energy Facilities Siting Council Massachusetts Department of Environmental Protection (MEPA Unit)
Michigan	Michigan Department of Natural Resources
Mississippi	Mississippi Oil & Gas Board
Montana	Montana Oil & Gas Commission
New Jersey	New Jersey Department of Environmental Protection
New York	New York State Department of Environmental Conservation
North Dakota	FERC (if interstate system)
Oregon	Oregon Energy Facilities Site Evaluation Council (EFSEC)

TABLE 5-2--Continued

State	Agency
Pennsylvania	Bureau of Oil and Gas Management of the Pennsylvania Department of Environmental Resources
Rhode Island	Rhode Island Department of Environmental Management
Vermont	Vermont Environmental Agency
Washington	Washington Energy Facilities Siting Council
Wisconsin	Wisconsin Department of Natural Resources
Wyoming	Wyoming Oil & Gas Conservation Commission Wyoming Department of Environmental Quality

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

information about the list in the table, if provided by the respondents, is discussed below.

The Kentucky Department of Mines and Minerals determines compliance with the correlative rights of mineral owners, oversees well construction and completion, and requires documentation to protect gas horizons and fresh water supplies in the subsurface. These criteria are used in examining storage field construction. The Montana Oil and Gas Commission becomes involved when storage facility construction consists of the conversion of producing wells to storage fields. The New York Department of Environmental Conservation has jurisdiction over well drilling, well spacing, and storage field development and operation.

The Oregon Energy Facilities Site Evaluation Council solicits comments from the Oregon Department of Energy, the Oregon Department of Geology and Mineral Industries, and the Oregon PUC in evaluating storage facility construction. Vermont state law (Act 250) mandates Vermont Environmental Agency review of storage facility construction.

In Wyoming, gas storage facilities are underground depleted oil and gas fields. Any party constructing a storage facility must obtain approval from the Wyoming Oil and Gas Conservation Commission as well as approval from the Wyoming Department of Environmental Quality if gas was to be vented or flared from above ground or underground facilities.

In addition to the state agency listed in table 5-2, the respondent from the New Jersey Board noted that the LDC also must obtain a local building permit to construct the storage facility. The respondent from the Rhode Island Commission mentioned that the LDC would need the approval of the local city or town.

Although not listed in table 5-2, LDCs in Nevada are subject to environmental regulations under the Utility Environmental Protection Act. This law, however, is enforced by the Nevada Commission itself rather than another agency.

State Regulation of Acquisition and Leasing of Storage Facilities

State commission policies with respect to LDC acquisition or leasing of storage facilities or services from an interstate or intrastate pipeline are considered next. Table 5-1 shows that eleven commissions require jurisdictional LDCs to obtain approval before acquiring or leasing storage from a pipeline. These commissions are discussed first. Staff review of the LDC application (as in LDC construction of storage facilities), review of the distributor's plans in a rate case, and review of affiliated transactions are some of the types of policies and procedures that commissions are using.

The Alaska Commission's procedure of approval or disapproval consists of reviewing the contracts that the LDC has entered into for services. The Wisconsin Commission has no set procedure for its approval or disapproval. The Maine Commission staff conducts an informal review of the arrangement. If the staff finds that the acquisition or lease is satisfactory, the Commission will grant its approval. If the staff has some substantive questions, a formal proceeding will be conducted, including a public hearing.

The Mississippi and Tennessee Commissions follow the same procedures in reviewing acquisition/leasing of storage services from a pipeline as they do in considering LDC construction of storage facilities. In Mississippi, the LDC applies to the Commission, staff reviews the application, and the Commission then issues an order either approving or disapproving the proposed arrangement. In Tennessee, the

Engineering Division of the Commission reviews and approves the proposal. A Commission order is then prepared.

The Oklahoma Commission evaluates, during a rate case, any storage facilities acquired by the LDC in order to determine a level of investment to be recovered. In Pennsylvania, if one of the entities involved in the arrangement is an affiliated interest of the other, the LDC is required to file the transaction with the Commission. The Commission must then determine if the proposed agreement is in the public interest. The Utah and West Virginia Commissions also need to approve the transaction if the LDC is leasing from an affiliated company.

The Vermont Board must approve the arrangement if the LDC plans to purchase the facility and thus add to its system or rate base. In Wyoming, the Commission must give prior approval, under Section 37-3-111 of Wyoming Statutes 1977 and Wyoming PSC Rule Section 218, for any storage for which the LDC has contracted. The LDC may either file the contract with the Commission (that is, the Commission accepts the contract for filing) or follow the procedure set forth for Commission approval of utility construction projects (utility application to Commission, public notice and opportunity for hearing, final order, staff field check, and staff review of rate effects).

State commissions may not approve or disapprove LDC acquisition or leasing of storage facilities and services from an interstate or intrastate pipeline for a variety of reasons. For example, the California Commission has not had to consider the issue at the present time because California LDCs have significant storage facilities of their own while only one interstate pipelines serving California has minimal storage capacity available. In Georgia, there are no gas wells except for one land-fill gas site. In Kentucky, the LDCs that have storage facilities have operated them for a long period of time and no additional storage fields have been acquired or leased.

Other commissions may not approve or disapprove LDC acquisition or leasing of storage services and facilities from a pipeline, but the respondents stated that the commissions still hold the LDC accountable for its decisions. For example, the New York Commission has the right of final review of all costs passed through the monthly Gas Adjustment Clause (GAC). In Nevada, cost recovery could be contingent on an approved gas resource plan. In Ohio, storage contracts, like other supply contracts, are reviewed through the Gas Cost Recovery audit process and included in the LDC's long-term forecast once they are in effect. In Oregon, the

LDCs need the Commission's approval in a rate case before they can recover lease or acquisition costs in rates.

State commission policies with respect to LDC acquisition or leasing of storage facilities from other distributors within the state or from distributors in other states are considered next. Thirteen commissions, as shown in table 5-1, responded that jurisdictional LDCs must obtain their approval before embarking upon this type of arrangement. Their policies are discussed first.

In California, the LDC must seek Commission approval by making a formal application or request. The Illinois Commission must approve the arrangement if the LDC is seeking storage services from another jurisdictional public utility. In that instance, both the jurisdictional LDC seeking to lease or purchase storage and the other jurisdictional public utility must seek Commission approval. The companies file a petition and the Commission holds a hearing if it decided one was necessary. The Commission would grant the request upon a finding that the request was reasonable and in the public interest. The LDC need not secure the Commission's approval if it is seeking to purchase or lease storage from a distributor located in another state.

Indiana Code, Section 8-1-2-84(c), provides that any public utility "may purchase or lease the used and useful property, plant or business, or any part thereof, of any other such public utility at a price and on terms approved by the commission." Section 8-1-2-84(e) provides that a public utility may sell or lease its "used or useful property, plant or business" to another utility "at a price and on terms approved by the commission." Section 8-1-2-84(g) allows a public utility with the approval of the Indiana Commission to purchase or lease "any real or personal estate or other property" of another utility "not used and useful in the public service of such other public utility." Section 8-1-2-84(h) allows a public utility, with the approval of the Indiana Commission, to sell or lease to another utility any of its property "not used and useful in its public service."

The Maine Commission's procedure for approval or disapproval of the lease or acquisition of storage from another distributor is the same as its procedure of approval/disapproval of the lease or acquisition of storage from a pipeline. Staff conducts an informal review and if it is satisfied, the Commission grants its approval. If the staff raises substantive questions, a formal proceeding would be initiated. The Mississippi, Tennessee, and Wyoming Commissions also use the same

procedures of review, described above, as they do for construction of storage facilities or lease/acquisition of storage from a pipeline.

In Ohio, the state law covering transactions between utilities (Section 4905.48 of the Ohio Revised Code) requires that the contract for this type of arrangement be submitted to the Commission for its approval. In Oklahoma, review is conducted during rate proceedings. The Pennsylvania Commission reviews the arrangement if one of the parties involved is an affiliated interest of the other. The Commission must then determine that the transaction is in the public interest.

The Virginia Utility Transfers Act requires the Commission to approve any transfer, by lease or acquisition, of any interest in jurisdictional public utility facilities. The West Virginia Commission's approval or disapproval occurs during its review of the disposition of utility assets. The Wisconsin Commission, as in the case of obtaining storage from pipelines, has no set procedure for approving or disapproving an LDC's acquisition or lease of storage from other distributors.

One of the commissions that does not require the LDC to obtain its approval before leasing or acquiring storage from another LDC is the New York Commission. While the LDC does not need the Commission's approval, the Commission oversees the LDC through the monthly gas cost adjustment. All such costs are reviewed subject to disallowance by the regulators. The selling or leasing LDC must obtain Commission approval to "transfer or lease . . . any part of such . . . works or system. . . ." The LDC would be required to show that the sale or transfer was not harmful to the public interest.

State commission policies with respect to LDC acquisition or leasing of storage facilities from sources other than pipelines and other distributors (such as oil and gas producers) are considered next. As shown in table 5-1, eight commissions responded that jurisdictional LDCs must obtain their approval before entering into this type of arrangement. These commissions are discussed first.

In approving or disapproving this type of acquisition or leasing arrangement, the Maine, Tennessee, and Wyoming Commissions use the same procedures, described above, that they use for LDC acquisition or leasing of storage from pipelines or distributors. The Oklahoma Commission reviews the fuel procurement practices of each LDC every six months. The distributor must demonstrate a need exists for the facility in order to recover its cost during the purchased gas adjustment hearing.

The Pennsylvania Commission, as in the cases of LDC acquisition or leasing of storage from pipelines or distributors, must approve the arrangement if one of the

entities is an affiliated interest of the other. The Commission must determine that the agreement is in the public interest. The Utah Commission also must approve agreements between affiliated companies.

The Wisconsin Commission also approves or disapproves LDC acquisition or leasing of storage from other sources. It does not have a set procedure for its review of the arrangement. The Mississippi Commission is in a similar position. While it has the authority to approve or disapprove, no procedure has been developed. LDCs have not yet approached the Commission with this type of agreement.

Some commissions that do not require LDCs to obtain their approval before leasing or acquiring storage from sources other than pipelines and other distributors responded that the LDC is still accountable in other types of reviews for its decisions. In Nevada, cost recovery would be contingent on the LDC having in place an approved gas resource plan. The New York Commission has the right of final review of all costs passed through the monthly gas cost adjustment. In Virginia, the pass-through of any costs from such a storage arrangement is subject to purchased gas adjustment review.

LDC Activities in Acquisition or Leasing of Storage

In addition to asking the staff members about their commissions' oversight of jurisdictional LDCs' acquisition or leasing of storage facilities or services from pipelines, other distributors, and other sources, the NRRI asked whether any of the LDCs were currently using storage facilities or services supplied by any of these sources. Table 5-3 shows the commission responses.

As seen in the table, interstate or intrastate pipelines are more frequently used sources of storage services and facilities. Twenty-eight of the responding commissions stated that jurisdictional LDCs were currently using storage facilities or services supplied by interstate or intrastate pipelines. Eight commissions reported that LDCs were leasing or acquiring storage facilities or services from other distributors. Eight commissions also reported that LDCs were leasing or acquiring storage facilities or services from sources other than pipelines and other distributors.

The responses to these questions are probably to be expected. Interstate and intrastate pipelines would undoubtedly have much larger storage facilities and a

TABLE 5-3

COMMISSION RESPONSES ON LDC USE OF STORAGE FROM VARIOUS SOURCES

LDCs Currently Using Storage Supplied by Interstate or Intrastate Pipelines	LDCs Currently Using Storage Supplied by Other Distributors	LDCs Currently Using Storage Supplied by Other Sources
Arkansas	Maine	Maine
Connecticut	Michigan	Massachusetts
Delaware	New Hampshire	New York
Georgia	Ohio	North Carolina
Idaho	Oregon	Oregon
Illinois	Rhode Island	Rhode Island
Indiana	Tennessee	Vermont
Iowa	Washington	Washington
Maryland		
Massachusetts		
Michigan		
Missouri		
Nevada		
New Hampshire		
New Jersey		
New York		
North Carolina		
Ohio		
Oregon		
Pennsylvania		
Rhode Island		
South Carolina		
Tennessee		
Texas		
Virginia		
Washington		
West Virginia		
Wisconsin		
(N = 28)	(N = 8)	(N = 8)

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

much greater variety of storage services to make available to LDCs than the other sources considered here. However, it is important to note that in light of the results of the NRRI survey reported in table 5-1, LDCs are overwhelmingly taking storage from sources and in transactions that most state commissions did not oversee from the beginning. As mentioned by some respondents, commissions apparently prefer to oversee the transactions at a later point or in a different forum, such as a rate case or purchased gas adjustment.

The NRRI also asked the staff members whether, based on their knowledge, any of the jurisdictional LDCs had been hampered in their efforts to procure storage services or facilities from pipelines or other distributors. Table 5-4 shows that in eight states commission staff were aware of instances in which LDCs had been hampered. This relatively small number perhaps would indicate that few LDCs overall are encountering hindrances in obtaining storage. The commission responses are discussed below.

In Illinois, the LDCs are attempting to gain access to pipeline storage as part of FERC dockets. In Iowa, the LDCs have had difficulty injecting third-party gas into pipeline storage. Access to storage capacity for third-party injections has also been a problem for Virginia LDCs. However, the problem may be diminishing as more capacity is becoming available. New Hampshire LDCs have been hampered through shortages of firm storage and firm transportation capacities. In Ohio, LDCs

TABLE 5-4

COMMISSIONS RESPONDING THAT LDCs HAVE BEEN HAMPERED IN THEIR EFFORTS TO PROCURE STORAGE FROM PIPELINES OR OTHER LDCs

Illinois	Oregon
Iowa	Virginia
New Hampshire	Wisconsin
Ohio	Wyoming

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

face a situation in which not all pipelines are offering storage service to new customers. Oregon LDCs have been hampered because the only unused storage available has been on "the wrong side of the pipeline's bottleneck." In Wisconsin, the rates and conditions of storage service charged to LDCs by pipelines are often unknown due to the extensive time needed to obtain FERC approval of those provisions. Cost and contractual obligations of storage have been problems for LDCs in Wyoming.

Other commissions stated that they did not know of any instance where the jurisdictional LDCs had been hampered in trying to procure storage from pipelines or other distributors. The Maryland Commission, for example, was not aware of any instances in which jurisdictional LDCs had been hampered. The respondent, however, did mention the possible hindrance of capacity constraints on interstate pipelines. In the view of the North Carolina staff respondent (similar to the concern raised by the Wisconsin respondent), the only hindrance has been obtaining FERC approval for specific projects.

State Regulation of Storage Facility Operations

The NRRI asked a series of questions about state commission oversight of storage facility operations. Staff members were asked whether their commissions monitored the day-to-day operations of the gas storage facilities owned and operated by the jurisdictional LDCs; what the frequency of their commissions' monitoring of storage facility operations was; whether their commissions specified any delivery and operating conditions (such as peak delivery from storage or injection rate into storage, number of wells tapping into a storage reservoir, and so on); whether their commissions had in place safety regulations dealing with gas storage facilities; whether their commissions specified an injection period (such as summer) during which gas was to be placed into storage; and whether their commissions specified any delivery period (such as winter) during which gas could be taken from storage.

These questions were designed to gauge the extent of state commission monitoring and regulation of storage facility operations. In contrast to the previous questions which dealt with commission authority over the beginning of an LDC's storage operations, the questions discussed here covered a variety of possible

instances in which state regulators could seek to exercise some control over an LDC's existing storage operations. Tables 5-5 and 5-6 show the commission staff responses to the questions.

It is clear from the responses that state commissions vary in their oversight of LDC gas storage facility operations. Nine of the responding commissions monitor the day-to-day operations of the facilities. One specifies delivery and operating conditions and none specifies injection and delivery periods. Twenty-three commissions, however, reported that they have safety regulations in place.

Commissions may feel that such comprehensive oversight, as implied in the questions, is an unwarranted intrusion into LDC management prerogatives that could lead to micromanaging the utility. The commissioners may also feel that their primary and perhaps sole duty with respect to ongoing storage operations is public safety. In addition, as mentioned, many rely on rate case and PGA review for monitoring facility operations.

Specific comments about commission policies follow. The first topic is commission monitoring of the day-to-day operations of storage facilities. The nine commissions that reported undertaking such oversight are considered first.

The Alabama Commission monitors LDC storage facility operations as part of its audits and facilities inspections. As noted in table 5-6, this inspection is done annually. The Georgia Commission's annual monitoring is a safety inspection. The Michigan Commission undertakes periodic field inspections done on a variable schedule, as resources permit. The Nevada Commission monitors storage during periodic audits. All storage by Nevada's LDCs is undertaken with interstate pipelines, and pipeline safety is a concern of the Commission. The New Hampshire Commission's oversight is conducted by a gas safety engineer, employed by the Commission, whose responsibilities cover propane and LNG bulk storage facilities.

In North Carolina, the LDCs submit daily dispatching sheets to the Commission. These sheets detail all purchases and withdrawals from and injections into storage. The Rhode Island Commission monitors LNG storage monthly to insure compliance with federal regulations. The Texas Railroad Commission monitors storage facilities every two weeks from November through March. In Vermont, the Department of Public Service oversees storage facilities. The Department is required to describe any problems as well as furnish periodic reports to the Public Service Board.

TABLE 5-5

COMMISSION OVERSIGHT OF LDC STORAGE FACILITY OPERATIONS

	Commission Monitors the Day-to-Day Operations of Facilities	Commission Specifies Delivery & Operating Conditions	Commission Has Safety Regulations in Place	Commission Specifies an Injection Period	Commission Specifies a Delivery Period
Alabama	Y*	N*	Y	N	N
Alaska	N	N	N	N	N
Arizona	N	N	Y	N	N
Arkansas[a]	N	N	N	N	N
California[a]	N	N	Y	N	N
Colorado[a]	N	N	N	N	N
Connecticut	N	N	N	N	N
Delaware	N	N	N	N	N
Florida	N	N	N	N	N
Georgia	Y	N	Y	N	N
Idaho	N	N	N	N	N
Illinois[a]	N	N	Y	N	N
Indiana[a]	N	N	Y	N	N
Iowa[a]	N	N	Y	N	N
Kentucky[a]	N	N	N	N	N
Louisiana[a]	N	N	N	N	N
Maine	N	N	Y	N	N
Maryland[a]	N	N	N	N	N
Massachusetts	N	N	N	N	N
Michigan[a]	Y	N	Y	N	N
Mississippi[a]	N	N	N	N	N
Missouri[a]	N	N	Y	N	N
Montana[a]	N	N	N	N	N
Nevada	Y	N	Y*	N	N
New Hampshire	Y	Y	--	N	N
New Jersey	N	N	Y	N	N
New Mexico[a]	N	N	N	N	N
New York[a]	N	N	Y	N	N
North Carolina	Y	N	Y	N	N
North Dakota	N	N	Y	N	N
Ohio[a]	N	N	Y	N	N
Oklahoma[a]	N	N	N	N	N
Oregon[a]	N	N	Y	N	N
Pennsylvania[a]	N	N	N	N	N
Rhode Island	Y	N	Y	N	--
South Carolina	N	N	N	N	N
South Dakota	N	N	N	N	N

TABLE 5-5--Continued

	Commission Monitors the Day-to-Day Operations of Facilities	Commission Specifies Delivery & Operating Conditions	Commission Has Safety Regulations in Place	Commission Specifies an Injection Period	Commission Specifies a Delivery Period
Tennessee	N	N	Y	N	N
Texas[a]	Y	N	--	N	N
Utah[a]	N	N	Y	N	N
Vermont	Y	N	Y	N	N
Virginia	N	N	Y	N	N
Washington[a]	N	N	--	N	N
West Virginia[a]	N	N	--	N	N
Wisconsin	N	N	N	N	N
Wyoming[a]	N	N	Y	N	N
	Y=9 N=37	Y=1 N=45	Y=23 N=19	Y=0 N=46	Y=0 N=45

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

* Y = Yes; N = No; -- = no answers given, don't know, issue not addressed.
[a] States that have underground storage reservoirs, based on the underground storage survey by AGA.

Other commissions responded that they do not monitor storage facilities routinely, although oversight may occur in other settings such as a rate case or a purchased gas adjustment proceeding. More oversight appears to take place in these other settings than in monitoring done exclusively for storage. The California Commission, for example, reviews storage operations in annual reasonableness review proceedings, triennial general rate cases, and during curtailments and other such out-of-the ordinary occurrences. The Illinois Commission reviews storage operations during rate cases. The Indiana Commission reviews LDC storage operations during rate proceedings and quarterly and semi-annual gas cost adjustment proceedings. The Commission also conducts routine safety inspections. The Maine Commission

TABLE 5-6

FREQUENCY OF COMMISSION MONITORING OF LDC GAS STORAGE FACILITIES

Commission	Frequency of Monitoring
Alabama	Annually
Georgia	Annually
Michigan	Varies
North Carolina	Daily
Rhode Island	Monthly
Texas	Every two weeks during November to March

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

reviews storage operations during cost of gas adjustment proceedings. There is one such proceeding during the winter and one during the summer.

The Kentucky Commission oversees storage operations when it feels that oversight is needed. For example, when questions arose about storage in a case involving Western Kentucky Gas and a bypass proposal, the Commission staff requested detailed information from the LDC about daily, seasonal, and annual injection and withdrawal volumes, operating pressures, and other system characteristics.

The Massachusetts Department receives weekly copies of information on LDC receipt of supplies, dispatch of sendout, and supply levels from November through April. The New Mexico Commission reviews the quantities of gas injected into and withdrawn from storage every month through the purchased gas adjustment filings. The New Jersey Board and the Oregon and South Carolina Commissions conduct storage reviews through annual purchased gas adjustment proceedings. In Oregon, PGA filings must include storage gas volumes and prices.

In Oklahoma, Commission staff conducts audits every six months as part of the purchased gas adjustment proceedings. The staff examines injections,

withdrawals, and pricing of gas. The Tennessee Commission's review consists of determining an average inventory level, done during a rate case. In Wyoming, facilities are inspected periodically to insure compliance with U.S. Department of Transportation safety regulations. The injection and withdrawal of gas and volumes are reviewed during rate proceedings.

Commission specification of delivery and operating conditions for storage facilities is the next topic to be considered. As seen in table 5-5, only the New Hampshire Commission responded that it took such action. In New Hampshire, each LDC must have supplies available to withstand a seven-day cold spell. This requirement is translated into a requirement for a certain amount of on-site storage capacity for LNG and propane.

Two other commissions noted some of their policies, although they responded negatively to this question. The California Commission, as mentioned above, does not routinely monitor storage facility operations, but review does occur in annual reasonableness review proceedings, triennial rate cases, and during such events as curtailments. The Wyoming Commission has specified in an order how much storage would be allowed in the rate base of an LDC.

The next question was whether the commission had in place any safety regulations dealing with storage facilities. As seen in table 5-5, twenty-three commissions responded that they have such regulations. Many have adopted federal minimum safety regulations (Title 49, parts 191, 192 and 193 et al. of the Code of Federal Regulations) as their own. They include Alabama, Arizona, Georgia, Illinois, Indiana, Iowa, Maine, Missouri, Nevada, New Jersey, New York, North Carolina, North Dakota, Oregon, Rhode Island, Utah, Vermont, Virginia, and Wyoming.[2]

Some commissions have taken other action in addition to adopting the federal regulations. Vermont, for example, has its own state gas safety rules and regulations in addition to the federal standards. Michigan also has its own Gas Safety Code. The Indiana Administrative Code (170 IAC 5-3) includes some additional requirements for utilities such as an inspection and maintenance plan to be filed with the Indiana Commission.

The New York Commission follows industry consensus standards. The National Fire Protection Codes are used for liquid propane gas and the federal regulations

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2 Three other respondents answered that their commissions do not have safety regulations in place. The commissions, however, have adopted the federal minimum safety regulations. These are the Colorado, Mississippi, and Montana Commissions.

are used for liquid natural gas. There are no safety regulations in place for underground storage. In Ohio, safety requirements for storage facilities apply to the pipeline leading to the compressor and the compressor station itself. The Tennessee Commission conducts safety inspections of the LDC's liquid natural gas facilities. The California Commission has adopted two orders, General Orders 94-B (Rules governing gas holders) and 112-D (Rules governing gas systems), which apply to liquid natural gas storage facilities also.

As shown in table 5-5, none of the responding commissions had specified injection periods or delivery periods. Some, however, did comment on the practices at their commissions or in their states. In California, the injection season is generally April through October, and the delivery period is generally November through March. However, there is no specific order, requirement, or guideline mandating these times. The respondents from the Michigan and Ohio Commissions noted the same injection and delivery periods.

Other comments were similar to those just described. Maine, for example, has no set Commission procedure. The LDC injects gas acquired from the pipeline into its storage facilities during the off-peak summer months. The delivery period is dependent on the contract between the LDC and its pipeline supplier. The supplier takes gas from its own storage and transports it to the LDC's system. Deliveries from the LDC's storage usually occur during the peak winter months.

The New Hampshire respondent stated that injection was dictated by availability and price while the delivery period depended on the demands placed on the distributor and the costs of available gas. In Oregon, liquid natural gas injection is a slow process taking most of the summer. Underground storage injection is usually done during the summer when spot gas is cheap. Storage gas is not delivered for interruptible loads until it is no longer reserved for winter usage.

State Regulation of Recovery of Storage Costs

The NRRI included several questions about the recovery of costs related to storage facility construction and operation in the survey of state commission staff. With respect to the costs of storage construction, the staff members were asked whether their commissions prescribe financing requirements and procedures for the construction of storage facilities that are different from requirements for other LDC construction projects; whether their commissions prescribe different cost

recovery methods for storage construction as compared with other LDC construction projects; and whether their commissions specify a depreciation rate for gas storage facilities that is different from other LDC construction projects.

None of the responding commissions prescribes different financing requirements and procedures and different cost recovery methods. As shown in table 5-7, however, ten commissions do specify different depreciation rates for LDC storage construction projects. These commissions' policies are discussed below.

The Alabama Commission's response was typical of several of the respondents, including Michigan, Missouri, North Carolina, Ohio, and Oklahoma. Each subaccount has a different depreciation rate. The method used at the Commission for storage is no different from any other account. At the Michigan and Ohio Commissions, the same method is used to determine the depreciation rates for storage facilities as for other projects. The specific rates, however, may be different. In Missouri, North Carolina, and Oklahoma, each utility plant account has a separate depreciation rate prescribed.

In California, gas storage facilities are placed in a particular plant category for which average service lives, salvage values, and life curves are estimated. This category is different from transmission facilities, distribution facilities, and so on. In New York, the average service life for each gas plant account is determined

TABLE 5-7

COMMISSIONS WITH DIFFERENT DEPRECIATION RATES FOR LDC GAS STORAGE CONSTRUCTION PROJECTS

Alabama	North Carolina
California	Ohio
Michigan	Oklahoma
Missouri	Oregon
New York	Tennessee

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

based on the retirement history of like facilities. Removal and salvage costs are also based on historical costs or, if no history exists, on a best estimate of the future costs of removal and salvage. The Oregon Commission recognizes the difference in lives between storage, transmission, and distribution. In Tennessee, liquid natural gas tanks are analyzed individually in order to derive a depreciation rate.

The NRRI survey questions on the recovery of storage operating costs included a general question about the commissions' procedures for allocating the costs of gas purchased for storage. Commission staff members were also asked whether their commissions prescribe a different purchased gas adjustment for the gas injected into storage from the purchased gas adjustment used for system gas supplies; whether the cost allocation for storage gas among residential, commercial, and industrial customers is different from the regular cost allocation of system gas supplies; and whether the cost allocation for storage gas between core and noncore customers is different from the regular cost allocation of system gas supplies. These questions were meant to explore any differences in the treatment of storage gas that commissions might have incorporated into their policies. Commission staff were also asked about various treatments of cushion gas and leakage of stored gas. These topics are considered later in this section.

None of the responding commissions prescribes a different purchased gas adjustment for gas injected into storage. The general descriptions of commission cost allocation procedures are covered below first, and then the specific questions about differences in those procedures with respect to different customer classes are discussed.

As might be expected, the commissions use a variety of methods to allocate the costs of gas purchased for storage. Some assign the costs to firm customers, some handle the cost allocation in a rate case, while others use the purchased gas adjustment procedure. As part of their cost of gas adjustments Illinois and Ohio subtract the cost of gas injected into storage from the total cost of gas and add the cost of gas withdrawn from storage to the total. Other commissions use cost of service studies to allocate the storage costs. Some commissions include storage costs in the commodity cost of gas and commissions may include the storage costs in the demand charge. Some commissions may have no set procedure to assign the storage costs. A description of specific commissions follows.

In Alabama, Missouri, South Carolina, and Tennessee, the costs of gas purchased for storage are allocated to all firm customers. In North Carolina, the costs are allocated to high-priority markets. In California, one LDC has separate accounts for gas purchased for core and noncore customers. This practice is intended to avoid summer curtailments of electric utility generation customers in southern California. The other LDC places gas purchased for storage in the core market portfolio account. In Connecticut, gas purchased for storage is allocated to both firm and interruptible customers at the time of withdrawal at the average inventory price. Each day, the lowest commodity or inventory rate is assigned to firm customers first and then to the interruptible customers. The Delaware Commission has no cost allocation specifically for storage gas. All costs are included in the system supply average. In Georgia, the cost of gas while in storage is a capital asset and earns a return. When the gas is used, its cost is flowed through the purchased gas adjustment.

The Idaho Commission does not use a single method of cost allocation. Several cost of service methods are usually presented to the Commission, which reviews them and chooses one. In Illinois, the net cost of excess withdrawals from storage over injections is added to purchased gas costs each month to determine the total cost of gas to be divided by the total number of therms. If injections are greater than withdrawals, that difference would be subtracted from the purchased gas cost. The Ohio Commission procedure is similar to that of Illinois. Under the Commission's Gas Cost Recovery regulation (4905.302 Ohio Revised Code and 4901:1-14 Ohio Administrative Code), total annual gas purchases are included in the quarterly calculation of the expected gas cost. This expected cost is compared, in the next quarterly period, to the actual monthly cost of gas. In determining the monthly cost, storage injections are subtracted and withdrawals are added. These costs are the basis of the rates that are charged to the sales customers of the LDC.

The Indiana Commission allocates capacity related costs of storage to peak-day demands. Commodity-related costs are allocated on a commodity basis. In Kentucky, the cost of storage gas is part of the weighted average cost of gas assigned to all end-users taking system supply. The Maine Commission has no cost allocation procedures for storage gas. The Commission's regulations for its cost of gas adjustment procedure (Chapter 43-Cost of Gas Adjustment for Gas Utilities) state that the cost of gas is not to include storage costs. The Mississippi Commission has no procedure for storage cost allocation as there is a very small

amount of storage. The Texas Railroad Commission also has no set procedure. The Maryland and West Virginia Commissions allocate storage costs to the commodity cost of gas.

Massachusetts Department of Public Utilities cost of gas adjustment regulations (DPU 1669-C: Petition by the Wyman-Gordon Company for the adoption of regulations for reforming and amending the Cost of Gas Adjustment Clause Regulations) provide for the allocation of storage costs under base gas demand charges and supplemental gas costs. Any storage injections or liquefactions for base gas supply are to include demand charges at a rate equal to the base formula per unit demand charge from the LDC's most recent peak season gas adjustment filing. Storage injections of supplemental gas, used to augment supplies to meet firm peak load, include per unit demand plus commodity costs.

In Michigan, storage gas is priced using the inventory method chosen by the LDC. The cost is allocated on a commodity basis. The Montana Commission uses incremental cost of service studies to allocate the storage costs. The Nevada Commission handles storage cost allocation in an ad hoc manner during purchased gas adjustment proceedings. In New Hampshire, gas is withdrawn from storage only during the winter and the costs are reflected in the winter cost of gas adjustment. The New Jersey Board and New Mexico Commission also handle storage cost allocation through the purchased gas adjustment. In addition, the Oregon Commission includes storage costs in the annual weighted average cost of gas of the LDC as part of the purchased gas adjustment.

In New York, the cost of gas purchased for storage is forecast in a rate proceeding for the first year of the new rate schedule. This cost is based on the expected price and injection/withdrawal schedules. An average monthly balance is then determined and allowed in the rate base. The cost of the stored gas is charged on an average inventory cost basis at the time the gas is withdrawn from storage. The cost is flowed through the monthly cost of gas adjustment. In a cost of service study, storage costs are considered demand costs and allocated on the basis of the peak demand of the firm customer classes.

The Oklahoma Commission generally uses the last approved cost of service method in allocating storage costs. These methods usually are coincidental peak and average and excess. The Pennsylvania and Wisconsin Commissions also allocate storage costs through cost of service studies.

In Virginia, peak-day demand costs are allocated on peak-day sales. Winter season entitlement is allocated on total winter season sales and withdrawals of storage gas are allocated to energy costs. The Washington Commission policy is to allocate storage costs through rate cases. In Wyoming, stored gas and cushion gas are considered part of the rate base and costs are allocated to all customers on an Mcf or peak-day basis.

Table 5-8 shows the responding commissions with differences in cost allocation for storage gas among different types of customers. Eight commissions have a cost allocation for storage gas among residential, commercial, and industrial

TABLE 5-8

COMMISSIONS WITH DIFFERENT COST ALLOCATIONS FOR STORAGE GAS

Cost Allocation for Storage Gas Among Residential, Industrial, and Commercial Customers Different from Regular Cost Allocation	Cost Allocation for Storage Gas Between Core and Noncore Customers Different from Regular Cost Allocation*
Alabama	California
California	Idaho
Idaho	Maine
Nevada	North Carolina
North Carolina	Oklahoma
Oklahoma	South Carolina
South Carolina	
Wyoming	
(N=8)	(N=6)

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

* See appendix A for more information on the particular methods used in these commissions.

customers that is different from the regular system supply cost allocation. Six have a different cost allocation for storage gas between core and noncore customers.

The differences in cost allocation for storage gas among residential, industrial, and commercial customers are considered first. Allocation on the basis of peak demand or seasonal (winter) demand forms part of the difference of storage cost allocation. The differences in commission procedures appear to be designed to guarantee that the services are paid for by those who use them.

The Alabama Commission's allocation is the same as the allocation for demand cost, not all gas costs. In Idaho, storage gas would be typically allocated on the basis of coincident peak or winter therms. Other gas commodity costs are allocated on the basis of total therms. In North Carolina, storage costs are allocated to the customers who use the services during the winter period or for the peak-day period. Pipeline supplies are allocated on a peak-and-average basis. In Oklahoma, system gas supplies are usually allocated by a commodity rate. Storage facilities are generally used for peak demands on the system so Commission staff considers peak demand as the method to use for allocating the costs of storage. In South Carolina costs are recovered from firm customers. The Wyoming Commission treats system gas supplies as an expense item and gas in storage is part of the rate base. Once removed from storage, the cost of the gas is treated as system supply.

With respect to cost allocation between core and noncore customers, gas purchased by one California LDC for the noncore portfolio for storage is only for utility electric generation customers during the summer. If this gas is not used, it could be transferred to the core portfolio or used for noncore storage banking. For another California LDC, storage gas is obtained only for core customers. The Idaho, North Carolina, and South Carolina Commission's procedures are as set out in the previous paragraph for residential, commercial, and industrial customers. In Oklahoma, the Commission staff considers core customers to be firm and uninterruptible. Accordingly, firm customers would have the first right to storage gas and the cost allocation would reflect the use of the gas. In Maine, dual-fuel interruptible customers are charged a price for gas that is relative to the price of the alternate fuel, but must be at least five cents above the commodity price of gas. During off-peak winter months, interruptible customers can take gas while

storage gas is being used. However, these customers must be charged a price greater than the cost of the storage gas.

Commissions where cost allocation for storage gas between core and noncore customers does not differ from regular cost allocation for system supply gas include Oregon. Storage gas in that state is not allocated to noncore customers although those customers may contract for storage service. In Ohio, no distinction is made between core and noncore for sales customers who purchase gas from the LDC. Transportation customers do not pay for gas stored for system supply. However, the transportation charge is based on the cost of service base rates so that some of the costs of the storage facilities owned by the LDC may be included in the charge. In New York, all variable costs associated with the gas supply are allocated on a commodity basis. Demand costs related to firm supply and capacity charges, however, are assigned solely to firm, core customers.

Another cost-related question in the survey dealt with the treatment of the cost of cushion gas, the amount of gas preserved in the underground storage cavern to maintain working pressure for the normal delivery of storage gas. The NRRI asked staff members whether their commissions treated cushion gas as a capital investment, an expense, or as some other cost item. The vast majority of commissions responding to this question treat cushion gas as a capital investment. A few treat it as an expense and none treat it as "some other cost item." Table 5-9 shows the commissions using the capital investment and expense treatments.

The commissions treating cushion gas as a capital investment are discussed first. Rate base treatment is the norm. The California Commission policy is to include cushion gas in the rate base at original cost. The New York Commission allows the weighted average cost of cushion gas into rate base to earn a return. The Illinois, Michigan, Montana, Virginia, Washington, Wisconsin, and Wyoming Commissions also include cushion gas in the rate base. The Virginia Commission's view is that the cost of storage gas is recovered only when it is withdrawn. Therefore, all gas injected but not withdrawn is given rate base treatment. The Indiana Commission treats cushion gas as a capital investment to be included in the materials and supplies component of rate base. The Idaho and Maryland Commissions consider cushion gas to be a part of inventory. In Kentucky, underground stored gas is a component in calculating of the total original cost rate base. Noncurrent gas is classified as utility plant and current gas is an addition to the calculation.

TABLE 5-9

COMMISSION TREATMENT OF THE COST OF CUSHION GAS

Cushion Gas Treated as Capital Investment	Cushion Gas Treated as an Expense
Arkansas	Iowa
California	Maine
Colorado	Mississippi
Connecticut	
Idaho	
Illinois	
Indiana	
Kentucky	
Maryland	
Michigan	
Missouri	
Montana	
New Mexico	
New York	
Ohio	
Oklahoma	
Oregon	
Pennsylvania	
Tennessee	
Virginia	
Washington	
Wisconsin	
Wyoming	
(N=23)	(N=3)

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

In Ohio, cushion gas is included in Account 352.3, Non-recoverable Natural Gas, of the Uniform System of Accounts. The Pennsylvania Commission policy is to capitalize cushion gas because it represents a long-term investment. In Tennessee, cushion gas is considered a nondepreciable asset.

Commissions treating cushion gas as an expense include Iowa. The policy there is that cushion gas is a gas cost to be recovered through the purchased gas adjustment.

Commissions that chose none of the three options listed in the survey question included Georgia and New Jersey. The cost of cushion gas in Georgia is part of the charges that the LDC pays for storage. In New Jersey, LDC storage contracts do not specifically identify cushion gas.

The final issue related to the cost of LDC storage facility operations covered in the NRRI survey, was the treatment of underground stored gas leakage or movement. The NRRI asked the commission staff members three questions about this: whether their commissions specify any regulations, such as "correlative rights" or "rule of capture," for the treatment of underground stored gas leakage or movement; whether other state agencies prescribe any regulations concerning the treatment of underground stored gas leakage or movement if the commissions did not; and whether the commissions specify any particular way of determining and recovering the cost of gas lost due to leakage and underground movement. As seen from the low number of responses in tables 5-10 and 5-11, this issue does not appear to be a major concern. Other state agencies are more involved in this area than are the public utility commissions.

The New York Commission was the only one responding that it had a regulation for the treatment of underground stored gas leakage or movement. The Commission's procedure involves an operations and maintenance account for recording inventory adjustments resulting from the cost of lost gas.

The Indiana Commission issued an order in August 1987 applying the rule of capture to a particular case. The order allowed a party to take possession of and produce gas that had been injected into storage by another party but had then moved to an area beneath the first party's land. The Commission reaffirmed this decision in March 1988 Cause No. 38239: Order on Petition for Reconsideration and Rehearing; The Petition of Indiana Farm Gas Production Company, Inc. for an Order (1) Requiring Southern Indiana Gas and Electric Company to Transport Indiana Produced Natural Gas Owned by Petitioner, and (2) Setting Rates for Said Transportation. At this writing, the order has been appealed to the courts and the Commission is awaiting a decision.

Table 5-10 shows that in ten states, according to the commission staff respondents, other agencies prescribe regulations for the treatment of underground

TABLE 5-10

STATES IN WHICH OTHER AGENCIES PRESCRIBE REGULATIONS FOR THE TREATMENT OF UNDERGROUND GAS LEAKAGE OR MOVEMENT

State	Agency
California	Division of Oil and Gas of the California Department of Conservation
Iowa	Iowa Department of Natural Resources
Mississippi	Mississippi Oil & Gas Board
Montana	Montana Board of Oil & Gas
New Mexico	New Mexico Oil Conservation Commission
New York	New York State Department of Environmental Conservation
Pennsylvania	Bureau of Oil and Gas Management of the Pennsylvania Department of Environmental Resources
Virginia	Virginia State Fire Marshal
Washington	Washington Department of Ecology
Wyoming	Wyoming Oil and Gas Conservation Commission

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

TABLE 5-11

COMMISSIONS WITH SPECIFIC METHODS OF DETERMINING AND RECOVERING THE COST OF GAS LOST TO LEAKAGE AND UNDERGROUND MOVEMENT

Commission	Method
Indiana	Level of recoverable cost determined in most recent rate filing approved by Commission and allowed in base rates.
New York	O&M expense account available to record amounts of inventory adjustments representing cost of gas lost or unaccounted for in underground storage due to cumulative inaccuracies of gas measurements or other causes; substantial adjustments may be amortized over future periods with Commission approval
Oklahoma	Staff reviews engineering studies for determining the loss and the steps taken by the utility to correct and minimize the cost; once cost is determined, staff recommends an amortization of the cost to be reviewed

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

gas leakage or movement. The Division of Oil and Gas of the California Department of Conservation regulates and monitors wells at underground gas storage facilities. The Division must approve new wells at these facilities and determine if the projects meet technical requirements. The Division also monitors wells to determine if they are operating within technical specifications.

The Mississippi Oil and Gas Board certifies gas wells. In Virginia, the state fire marshal's jurisdiction applies to propane storage only. The New York State

Department of Environmental Conservation has issued regulations (Chapter V-Resource Management Services; Section 554.1(e)) specifying that the drilling, casing, and completion of wells should be adequate to prevent gas migration. The Department also has jurisdiction over spacing gas wells, and its regulations provide that wells should be spaced to protect correlative rights. An exception to the rules could be granted if necessary to protect correlative rights. (Chapter V; sections 553.3(c)(6) and 553.4). Protecting these rights means that the Department's regulations should afford a party reasonable opportunity to recover the gas beneath his or her land without having to drill unnecessary wells or incur other unnecessary expenses. Besides these agencies, the Kentucky Department of Mines and Minerals determines compliance with the correlative rights of mineral owners and oversees well construction and completion. As shown in table 5-11, three commissions responding that they have specific methods of determining and recovering the cost of gas lost due to leakage are listed.

In addition to these commissions, the Ohio Commission has also issued an order dealing with the recovery of lost gas. One LDC has had significant problems with storage gas migration and the Commission permitted it to write off the calculated loss. The Commission allows an LDC to pass through all sources of unaccounted-for gas in the gas cost recovery. The level, however, must be reasonable and cannot exceed five percent of the unaccounted-for gas.

State Regulation of Storage Banking and Other Services

The NRRI included several questions in the commission survey about the provision of storage banking and other services. The staff members were asked whether any of the LDCs under their commissions' jurisdiction offer end-user services such as storage or storage banking; whether their commissions had issued any guidelines or statements about the provision of such services; what their commissions' methods are for determining the rates for storage; and whether storage, storage banking, or other storage-related services are being offered as separate services by the LDCs or as part of bundled services that a customer could purchase, or both. These questions were intended to learn the extent and nature of services that the LDCs were providing and the extent to which the state commissions were overseeing those services.

Table 5-12 shows the commission staff responses to the questions on the end-user storage services being offered by jurisdictional LDCs and whether the commissions had issued any guidelines or statements about the services. The table shows that jurisdictional LDCs in thirteen (or about one-third) of the responding states are providing end-user storage services. Few commissions, however, have issued guidelines about these services.

The services being provided by LDCs are discussed first. In California, a storage banking program offering unbundled storage for noncore customers of the LDCs is scheduled to go into effect during the 1990 injection season. Under the program as approved by the California Commission (Order Instituting Investigation into Procurement and System Reliability Issues Deferred from D.86-12-010; Order Instituting Rulemaking into Natural Gas Procurement and System Reliability Issues; Interim Opinion Authorizing Gas Storage Banking Service; Decision 88-11-034, November 9, 1988), the LDC begins the process by planning to store the gas necessary to supply its core customers' peak season needs. The projection of the amount of gas needed to meet this demand provides the distributor's initial storage target. The initial target also takes into account gas volumes set aside for noncore retail customers who decide to buy gas from the core gas portfolio. The LDC, while deriving this initial target, will also announce the capacity available for storage banking on its system.

The LDC should publish the initial target, volume available for banking, and a solicitation for banking service bids by early February. Noncore customers then have twenty days to submit bids. Winning bidders would be announced by the LDC ten days later. Each bid would include a variety of prices covering the range of banking capacity that the customer would be willing to accept.

The LDC, based upon the bids received, would then establish a banking reservation fee at a level maximizing the reservation of available banking capacity. This fee is not to exceed the price that each bidder was willing to pay for the capacity it is ultimately awarded. The distributor could also revise its storage target if it felt such action was needed to maintain system reliability. The initial and final storage targets would be subject to reasonableness review by the Commission. The LDC may also decide to leave space for "as available" banking service with such customers being interruptible before other banking customers.

The reservation fee would be collected as a fixed charge in equal monthly payments. Banking customers would pay a volumetric charge to recover the variable

TABLE 5-12

COMMISSION RESPONSES ON LDC PROVISION OF END-USER STORAGE

	LDC Offers End-User Services such as Storage or Storage Banking	Commission Has Issued Guidelines on the Provision of Services
Alabama	N*	N
Alaska	N	N
Arizona	N	N
Arkansas	N	N
California	Y*	Y
Colorado	N	N
Connecticut	N	N
Delaware	N	N
Florida	N	N
Georgia	N	Y
Idaho	N	N
Illinois	Y	N
Indiana	Y	N
Iowa	N	N
Kentucky	Y	Y
Louisiana	N	N
Maine	N	N
Maryland	N	N
Massachusetts	N	N
Michigan	Y	Y
Mississippi	N	N
Missouri	Y	N
Montana	N	N
Nevada	N	N
New Hampshire	N	N
New Jersey	Y	N
New Mexico	Y	Y
New York	Y	Y
North Carolina	N	N
North Dakota	N	N
Ohio	Y	N
Oklahoma	N	N
Oregon	Y	N
Pennsylvania	Y	N
Rhode Island	N	N
South Carolina	N	N
South Dakota	N	N
Tennessee	N	N
Texas	--*	N

TABLE 5-12--Continued

	LDC Offers End-User Services such as Storage or Storage Banking	Commission Has Issued Guidelines on the Provision of Services
Utah	N	N
Vermont	N	N
Virginia	N	N
Washington	Y	N
West Virginia	N	N
Wisconsin	N	N
Wyoming	N	N
	Y=13 N=32	Y=6 N=40

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

* Y = Yes; N = No; -- = No answer given, don't know, issue not addressed.

costs of providing the banking service and any transportation charges levied for carrying their gas over the LDC's system. Storage banking is an accounting mechanism through which the distributor agrees to deliver gas to the banking customer or to an end-user designated by the banking customer. Revenues earned by the LDC from banking will be used to offset the fixed costs of storage allocated to noncore customers. A more limited pilot version of this program was begun in April 1989 and is under evaluation.

The California Commission has also approved one distributor's special storage program for its electric utility generator customers (Order Instituting Investigation into Procurement and System Reliability Issues Deferred from D.86-12-010 and Related Matters; Decision 90-03-037, March 14, 1990). The Commission had previously approved a plan for electric utilities to inject gas into storage to avoid any curtailments of gas during southern California's smog season. The LDC,

Southern California Gas, sought Commission clarification that the electric utility gas had priority over the gas stored under the pilot storage banking program. The Commission agreed with the LDC and allowed the distributor to begin the smog season gas injections in March, before the regular injection season. The electric utilities would be charged the same reservation fee assessed other customers under the storage banking program.

In Indiana, one LDC offers storage service on a temporary basis. The distributor, Northern Indiana Public Service Company, has requested that it be allowed to continue to offer storage on an interim basis until the service is made permanent. Under the arrangement, a customer enters into a contract with the LDC by which it can deliver gas to the LDC for storage or withdraw gas from storage. Gas brought to the LDC for injection is subject to the distributor's applicable transportation charge when it is later delivered to the customer. The quantity of gas delivered from storage to a customer is to be equal to the volume that the customer brought to the LDC for injection less 0.85 percent of that amount to cover line losses. The maximum amount that a customer could inject into storage would be 20,000 Mcf per day. The maximum daily withdrawal for a customer would be 100,000 Mcf per day. Customers may inject gas during June 1 to October 31 and withdraw gas from November 1 through March 31.

In Kentucky, Western Kentucky Gas offers storage service to customers who have purchased gas from the company for seasonal storage and who require Western to transport the gas to the storage facility or the place of use. In Michigan, the transportation rates of the LDCs include a load balancing tolerance of 8.5 percent to 10 percent of the annual contract quantity. Transportation customers can thus purchase the amount of service contracted for, moving plus or minus 8.5 percent to 10 percent of the gas that they wish the LDC to transport for them. Storage in excess of this deviation from the annual contract quantity can be purchased from the LDC under a separate agreement. For example, a transportation customer, for whom the LDC is moving 1,000 Mcf of gas, could keep 85 to 100 Mcf in storage. Additional storage capacity would have to be arranged under a separate agreement. The rates for the storage service, both the original 8.5 to 10 percent amount plus any additional amount that the transportation customer may desire, are included in the original transportation service tariff. The separate, additional agreement for storage would cover the amount of additional storage capacity. In Missouri, storage or storage banking has consisted of using the LDC distribution system itself as the

storage field. In New Jersey, storage service is available, but there have been no customers for it. In New Mexico, storage for transportation customers is offered on an interruptible basis. In New York, one distributor has offered a balancing service to its largest interruptible customers by selling contracted storage capacity that is in excess of the distributor's own needs.

In Ohio, East Ohio Gas has offered a load balancing service which includes the use of storage facilities on a limited basis by transportation customers. In Washington, no LDC is offering unbundled storage services. One LDC is offering storage to one large end-user.

In Oregon, an LDC, Northwest Natural Gas Company, is offering firm and "best-efforts" storage service. The customers for the service must deliver gas to the LDC for injection into storage from May through October. The gas then can be withdrawn and delivered to the customer from November through April. The storage service does not include transportation of the gas on the LDC system to the customer. Customers can purchase and store gas that has been obtained by the LDC or deliver gas that they already own to the LDC for storage. Storage service is available in units with each equal to one therm per day of withdrawal of gas from storage and 87.5 therms of seasonal storage facility capacity available for injection. Customers must purchase a minimum of 1,000 storage units (1,000 therms per day of withdrawal or 87,500 therms of injection).

A bidding procedure is used in the Oregon distributor's program. The bids enable the LDC to determine the amount of storage capacity available for allocation to customers for the two types of storage service. Bids must include at least 1,000 storage units. Customers must submit separate bids for the firm and "best-efforts" storage services.

For firm storage, customers must submit bids for a term of at least one and no more than three years of service. The LDC, in allocating the 120,000 units of firm storage capacity (120,000 therms per day of gas for withdrawal and 10.5 million therms per year of capacity available for injection into storage), will give first priority to customers bidding for three years, second priority to customers requesting two years, and third priority to customers bidding for one year. Firm storage customers are assessed a reservation charge, set by the company in the storage service tariff, that is billed in twelve equal monthly installments and is to be paid whether storage is used or not.

Customers bidding for "best-efforts" storage state how many units of storage service they want and the reservation charge they are willing to pay. The LDC sets a minimum reservation charge for the "best-efforts" bids. "Best-efforts" storage service is for one year. The capacity available for this service consists of any capacity not subscribed to by firm service customers. The distributor allocates this capacity to "best-efforts" customers on the basis of the reservation charges in their bids. Higher priority is given to the customers with the highest bids for the reservation charge. Lower priority is given to customers with lower bids for the charge. "Best-efforts" storage service is interruptible.

The Pennsylvania Commission's regulations (52 Pennsylvania Code, section 60.6) state that the LDC must provide optional storage service to a transportation customer when that customer has not taken all of the gas delivered to the LDC for its account. The tariff rate for the storage service must reflect any contribution that the customer may have made to the utility's storage costs through payment of its standby sales service rate. If the transportation customer decides not to take the storage service, the LDC may purchase the unused gas at a price equal to the lower of the distributor's lowest cost gas or the customer's cost.

Some other respondents mentioned other types of services available in their states. One notable example is in Virginia where an intrastate pipeline offers liquid natural gas storage service.

As seen in table 5-12, six commissions have issued guidelines or statements about the types of storage services that the LDCs are offering. The California Commission issued orders, described above, establishing the storage banking program and giving priority for electric utility generation. The Kentucky Commission Administrative Case No. 297 (Gas Transportation in Kentucky), approved Western Kentucky Gas' program, described above. The service is to be unbundled and nondiscriminatory. The Michigan Commission has issued orders setting transportation rates establishing the load balancing tolerance, mentioned before, and setting the price of any additional storage that the transportation customer may wish to purchase.

The New Mexico Commission requires a distributor to provide storage if capacity is available. The New York Commission has required the LDC offering the balancing service to provide it indiscriminately to any customer who qualifies. The distributor may impose a size limitation qualification on customers. This limitation must be based on available capacity. In Georgia, a tariff has been published setting

forth the time of year that a distributor can sell liquid natural gas, the price charged for liquefying the gas, and the price of the gas that was liquefied.

In addition to these six commissions that have already acted, the Idaho Commission has expressed interest in storage services. The Commission has not yet issued any specific guidelines. The Ohio Commission also does not have specific guidelines for storage. It does, however, require LDCs providing transportation to furnish such services to all similarly situated customers. The Commission also expects the LDCs to operate transportation services so as to protect system sales customers from absorbing the costs of transportation imbalances.

Table 5-13 shows the responses of staff who described their commissions' methods for determining the rates for storage and storage-related services provided by the LDCs for end-users. Thirteen commissions are listed and many use a cost of service approach. In addition, the California Commission uses the already described bidding process for storage banking. All customers pay the carrying costs of storage on a per therm basis. The Missouri Commission allocates costs on a seasonal sales basis and recovers costs in a cents-per-thousand cubic foot commodity charge. In Idaho, one LDC uses a moving average method. Beginning with the average cost of the gas already in storage, the average cost of the gas withdrawn from storage is subtracted from that first average and the cost of gas injected into storage is added. A new overall coverage is derived. The average is adjusted at the end of each month and not with each sale of stored gas.

The Oregon Commission has employed a fully allocated cost approach for the firm and best efforts storage services that were described previously. The cost of the storage project for the LDC, in terms of its annual revenue requirement, was $12 million. This figure does not include operations and maintenance charges which, as shown below, are covered separately. It does include about 20 percent of the capital costs of the venture, such as the costs of buying the storage facility from the landowners, compressor stations, gathering and transmission lines, and cushion gas. Firm storage customers and best efforts service customers pay a reservation charge to reserve storage capacity. The charge for firm service customers was calculated by first dividing the annual revenue requirement total by 12 to derive a monthly revenue requirement figure. Next, the daily deliverability from storage was estimated to be about 800,000 therms. The monthly revenue requirement was then divided by the daily deliverability to calculate the reservation charge.

TABLE 5-13

COMMISSION METHODS FOR DETERMINING THE RATES FOR STORAGE SERVICES PROVIDED BY LDCs TO END-USERS

Commission	Method for Determining Rates
California	Storage banking fee determined through bidding; operations and maintenance and injection charge also applied to banking; storage fees assessed from utility electric generation customers include operation and maintenance and injection charges only; carrying costs of stored gas are paid by all customers on a per-therm basis
Idaho	Moving average
Illinois	Based on cost of service studies
Indiana	Average-embedded-cost basis
Michigan	Cost-based rates
Missouri	Storage facilities allocated on a seasonal-sales basis (seasonal sales = total Mcf sales less specified base level usage); costs recovered in the commodity charge on a cents-per-Mcf basis
New Jersey	Incremental cost
New Mexico	Cost based
New York	Average fixed charges and all variable costs are assigned to rates for storage service
Ohio	Rates determined from cost of storage included in LDC's cost-of-service base rates and adjusted based on the level and extent of use of storage system by the customer
Oregon	Fully allocated cost
Pennsylvania	Cost of service
Virginia	Assigned cost of service

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

The calculation of the minimum reservation charge for best efforts service (recall the best efforts service involves a bidding procedure whereby customers submit the charge that they would be willing to pay, at least or above the minimum set by the LDC) begins with the amount of capacity available for both firm and best efforts storage services, about 10.5 million therms or 15 percent of the distributor's total storage capacity (70 million therms). This figure was then multiplied by the savings per therm (about 6 cents) realized by the LDC from purchasing gas in the summer for use in the winter peak season. That total was then divided by a number calculated by multiplying the daily deliverability for these services (120,000 therms per day) by 12 (the number of months in a year) to derive the reservation charge.

Operations and maintenance expenses (including payroll and compressor station fuel, and so on) represented about $1 million. The amount of working gas available for storage was approximately 70 million therms. To derive the operating and maintenance charge for firm service and best efforts service customers, the operating and maintenance costs were divided by the amount of working gas available for storage.

Both firm and best efforts storage service also include an in-kind energy charge. This consists of a 2 percent reduction in the amount of gas in the customer's account to cover shrinkage of gas and other aspects of the storage operations.

In Ohio, as shown in table 5-13, storage rates are determined from the cost of providing the service as found in the LDC cost--of-service base rates. These rates are adjusted based on the level and extent of use of the storage system by the particular customer. One LDC, East Ohio Gas, is providing storage service for end-users. In a rate case, the total costs of utilizing and maintaining the storage facility are examined. This rate case treatment does not determine the cost per unit of providing storage service. In setting storage rates, the capacity costs of storage and the commodity costs of storage are considered. These are compared to (that is, ratios are computed) the total cost of storage to derive unit amounts. The average capacity cost is based on the capacity allocated for storage and associated expenses and a monthly charge is calculated. The total commodity charge is based on the amount of turnover (injections and withdrawals) of gas. Adjustments are made for the load factor of the customer, reflecting the actual use of the storage system by that customer.

The Indiana Commission, as shown in table 5-13, bases storage rates on average embedded costs. A test year would be selected and examined. The costs of the storage service would be allocated to the customer classes on the basis of their use of the service during that test year.

In New Jersey, Elizabethtown Gas Company provides firm and limited storage services. The tariff sheet for these services states that firm storage customers are assessed a customer accounting charge of $65 per month, an injection charge of $.08 per dekatherm and no withdrawal charge. Firm customers must also pay a demand charge monthly for twelve months. The service is available at a 100-day withdrawal rate or a 150-day withdrawal rate. For the 100-day withdrawal rate, the demand charge is $.142 per dekatherm of contracted storage capacity. For the 150-day withdrawal rate, the demand charge is $.108 per dekatherm of contracted storage capacity. Limited storage service customers pay the same accounting and injection charges as firm customers and are also not assessed any withdrawal charge. The demand charge for these customers is $.039 per dekatherm of contracted storage capacity.

Table 5-14 contains the commission staff responses to the question of whether storage, storage banking, or other storage-related services are being offered as separate services or as part of a bundled service by the LDCs. According to the staff members, services are being offered separately and as a package in an equal number of states. LDCs in twelve states offer separate services and distributors in twelve states offer bundled services. Distributors in six states, California, Illinois, Michigan, Ohio, Oregon, and Pennsylvania, offer both separate and bundled storage services. In Ohio, service is bundled for sales customers, but may be unbundled for transportation customers. In Idaho, services are offered separately, but for special contract customers only.

The NRRI included questions about two other types of storage services or arrangements that an LDC could provide for end-users. The staff members were asked if their commissions allow jurisdictional LDCs to lease their storage facilities to end-users and if so, whether any special requirements (such as an obligation to provide reliable services for core customers or certain eligibility requirements on the end-users) are placed on the LDC or the end-user in the case of such an arrangement. Staff were also asked if their commissions allow an end-user to operate storage facilities leased from an LDC, and, if so, whether any special requirements are imposed on the end-user in operating the facilities.

TABLE 5-14

COMMISSION RESPONSES ON
HOW STORAGE SERVICES ARE OFFERED BY LDCs

	Storage, Storage Banking, Other Services Offered As:	
	Separate Services	Bundled Service
Alabama	N*	N
Alaska	N	N
Arizona	N	N
Arkansas	N	Y*
California	Y	Y
Colorado	N	N
Connecticut	N	N
Delaware	N	N
Florida	N	N
Georgia	N	N
Idaho	Y	N
Illinois	Y	Y
Indiana	Y	N
Iowa	N	N
Kentucky	Y	N
Louisiana	N	N
Maine	N	N
Maryland	N	Y
Massachusetts	N	N
Michigan	Y	Y
Mississippi	N	N
Missouri	N	Y
Montana	N	Y
Nevada	N	N
New Hampshire	N	N
New Jersey	Y	N
New Mexico	Y	N
New York	Y	N
North Carolina	N	Y
North Dakota	N	N
Ohio	Y	Y
Oklahoma	N	N
Oregon	Y	Y
Pennsylvania	Y	Y
Rhode Island	N	N
South Carolina	N	N
South Dakota	N	N
Tennessee	N	N
Texas	--*	--
Utah	N	N
Vermont	N	N

TABLE 5-14--Continued

	Storage, Storage Banking, Other Services Offered As: Separate Services	Bundled Service
Virginia	N	N
Washington	N	Y
West Virginia	N	N
Wisconsin	N	N
Wyoming	N	N
	Y=12 N=33	Y=12 N=33

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

* Y = Yes; N = No; -- = No answer given; don't know; issue not addressed

The purpose of these questions was to explore more fully the possible range of storage services and arrangements that could be in use by covering practices that might be less common. In addition, the questions about special requirements should give some idea of the extent to which state commissions were overseeing these less common services.

Table 5-15 contains a list of the commissions that allow LDCs to lease storage facilities to end-users and a list of those that have placed special requirements on such arrangements. While the number of commissions (eight) allowing this practice is small, the number placing any additional safeguards on the arrangement (two) is even smaller. Some commissions, however, have never had a request of this nature and have not had to face the issue. Delaware, Georgia, Indiana, Kentucky, Massachusetts, New York, and Wyoming are examples. Comments on other states follow.

In Michigan, the obligation to provide reliable service to core customers is a continuing duty for LDCs. In Oklahoma, the contract language for this type of arrangement usually provides for the LDC to have the first call on the gas. In Oregon, customers subscribing to the firm storage service described above have the

TABLE 5-15

COMMISSION RESPONSES ON LDC LEASING OF STORAGE FACILITIES TO END-USERS

Commissions that Allow Jurisdictional LDCs to Lease Storage Facilities to End-Users	Commissions that Have Placed Special Requirements on the LDC or End-User in such Arrangements
Arkansas	Oklahoma
Idaho	Oregon
Michigan	
Mississippi	
Oklahoma	
Oregon	
Texas	
Washington	
(N=8)	(N=2)

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

same priority for purposes of making injections into and withdrawals from storage as the LDC may make on behalf of its firm service core residential, commercial, and industrial customers. The core customers, however, have priority over the best-efforts-interruptible-storage-service customers. In addition to these commissions, the Ohio Commission has no regulations specifically prohibiting this type of arrangement, but there is no such leasing currently occurring.

Table 5-16 shows the commissions that allow an end-user to operate the storage facilities that it has leased from an LDC. Only two commissions allow such an arrangement and no commissions impose special requirements. Undoubtedly, this is a rare type of transaction that few commissions have had to consider. Respondents from Georgia, Indiana, and Massachusetts stated that this issue had not arisen at their commissions. No arrangements of this type exist in New York at

TABLE 5-16

COMMISSION RESPONSES ON END-USER OPERATION OF STORAGE FACILITIES LEASED FROM THE LDC

Commissions that Allow End-Users to Operate Storage Facilities Leased from the LDC
Mississippi Texas
(N=2)

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

present, although nothing prohibits them. The New York Commission would review the LDC's participation in any such transaction.

The NRRI included questions about end-user-owned storage facilities in the survey. Staff members were asked if their commissions oversee or regulate gas storage facilities owned by end-users, and, if so, whether such facilities are subject to the same types of regulations as LDC-owned storage facilities. Staff were also asked whether any other state agency oversees or regulates gas storage facilities owned by end-users. These questions were meant to probe into other areas of gas storage and state regulation in addition to the activities of the jurisdictional LDCs, by examining privately-owned facilities.

As with the previous questions dealing with LDC leasing of facilities to end-users and end-user operation of storage facilities leased from the LDC, these questions undoubtedly delve into areas that commissions may rarely consider. That fact in itself is worth noting, however. For example, the Kentucky Commission has not had to address the issue. In Georgia, there is only one such facility and it is not regulated by the Commission. In New Jersey, there are no end-user-owned storage facilities. As seen in table 5-17, only four commissions oversee or regulate end-user owned storage and the same four are the only

TABLE 5-17

COMMISSION OVERSIGHT OF END-USER-OWNED GAS STORAGE FACILITIES

Commissions that Oversee or Regulate End-User-Owned Gas Storage Facilities	Commissions that Subject End-User-Owned Storage to the Same Types of Regulations as LDC-Owned Storage
California	California
Michigan	Michigan
Texas	Texas
Vermont	Vermont
(N = 4)	(N = 4)

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

commissions that subject end-user-owned storage to the same types of regulation as LDC-owned storage.

The California Commission oversees or regulates an end-user-owned storage facility because the end-user, the Electric Department of Pacific Gas and Electric (PG&E), is the same as the LDC. PG&E owns and operates a storage field and its Electric Department must bid on storage space in the same manner as any other noncore end-user. The Vermont Board subjects end-user-owned storage to its standard gas safety regulations. In Michigan, there are currently no end-user-owned storage facilities, but they would be subject to the same types of regulations if any were to open.

Table 5-18 shows that in fourteen states, according to the commission staff respondents, end-user-owned storage is subject to regulation or oversight by other agencies besides the state public utility commission. Many of these are the same agencies listed in table 5-2 as having jurisdiction over LDC storage facility construction. The list in table 5-18 is smaller than that of the table 5-2, but it still shows that in almost one-third of the states there is oversight of private

TABLE 5-18

OTHER AGENCIES THAT OVERSEE OR REGULATE
END-USER-OWNED GAS STORAGE FACILITIES

State	Agency
California	Division of Oil and Gas of the California Department of Conservation
Georgia	Georgia State Fire Marshal's Office
Indiana	Indiana Department of Natural Resources
Iowa	Iowa Department of Natural Resources
Kentucky	Kentucky Department of Mines and Minerals
Michigan	Michigan Department of Natural Resources
Mississippi	Mississippi Oil & Gas Board
Montana	Montana Board of Oil & Gas
New York	New York State Department of Environmental Conservation
Pennsylvania	Bureau of Oil and Gas Management of the Pennsylvania Department of Environmental Resources
Vermont	Vermont Environmental Agency
Virginia	Virginia State Fire Marshal
Wisconsin	Wisconsin Department of Natural Resources
Wyoming	Wyoming Oil & Gas Conservation Commission

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

storage facilities conducted by a variety of agencies besides the public utility commission. As with underground gas leakage, oversight of end-user-owned storage is primarily a function of other state agencies. Comments on some of these agencies, as provided by respondents, follow.

In California, the Division of Oil and Gas of the California Department of Conservation regulates and monitors wells at underground storage facilities. The Division must approve new wells to insure that technical specifications are met. The Division also monitors the wells to check that operations are within required technical specifications. The Georgia State Fire Marshal checks all liquid propane gas tanks owned by LDCs and other parties. The Virginia State Fire Marshal also oversees propane. The Michigan Department of Natural Resources and the Wyoming Oil and Gas Conservation Commission would regulate such facilities if any existed.

In New York, the Department of Environmental Conservation oversees the development of underground storage fields while the New York Commission regulates the safety of pipelines and related facilities going into and out of the fields. A similar situation occurs in Vermont where the Vermont Environmental Agency is concerned with environmental issues related to storage while the Vermont Board oversees gas safety.

The Indiana Department of Natural Resources' areas of responsibility include oil and gas well drilling, plugging of wells, and well spacing (310 Indiana Administrative Code 7-1, 7-2). Gas storage wells are exempt from the well spacing regulations. Any party wishing to drill a well for gas must file a permit application with the Department. Owners of gas storage wells may also have to file various types of reports with the Department. These include a log of the various geological strata encountered in the well, and completion and recompletion reports. An owner of underground gas storage facilities must annually file a map of the facilities with the Department. If a party wishes to drill a well within the boundaries of a storage facility, the Department will notify that party and send a waiver notice. The person wishing to drill must send the waiver to the owner of the storage facility. The waiver states that the owner of the storage facility has no objection to the location of the well. It then must be returned to the Department before the permit for the well will be issued. The owner of the storage facility may also object to the proposed well and request a hearing before the Department.

Other State Regulatory Issues

This section includes a discussion of several other questions included in the NRRI survey of state commission staff. Questions dealing with the allocation of benefits from storage, the extent of LDC storage activities, state commission encouragement of storage, storage and least-cost purchasing, and storage as a bargaining tool are covered.

Allocation of the Benefits from Storage

The NRRI asked the staff members whether their commissions have specific criteria or guidelines for allocating any benefits, such as savings in gas costs, that the LDC might accrue from its use of storage. This question was intended to explore any differences (among commissions and in the contrast of storage with other LDC operations that might result in savings such as spot market purchasing) in commission treatment of the benefits from storage. The criteria or guidelines used by the commissions responding to this question are shown in table 5-19.

Most of the commissions listed pass any benefits through to ratepayers in purchased gas adjustment or rate case proceedings. There are some variations in what the commissions do. For example, in California the costs of storing gas are allocated to all customers even though core customers are the primary beneficiaries. In North Carolina, the increased value of stored gas is retained for the ratepayers to offset any rate increases from purchased gas adjustments. The Vermont Board allocates savings to the customer class served by the storage facility while the New Hampshire Commission assigns savings to winter gas costs. Overall, however, it appears that the use of storage in and of itself does not make a major difference in commission treatment of any benefits received by the distributor.

Extent of LDC Storage Activity

The NRRI asked the staff members what, based on their knowledge, is the extent of storage activity being undertaken by jurisdictional LDCs in their states (for example, putting additional gas into storage, building new storage facilities, better utilization of existing facilities, and so on). This question, along with the previously discussed questions about the sources from which LDCs are contracting

TABLE 5-19

COMMISSIONS WITH SPECIFIC CRITERIA OR GUIDELINES FOR ALLOCATING BENEFITS ACCRUED BY LDC FROM STORAGE

Commission	Criteria
California	Carrying costs of storage gas allocated on per-therm basis to all customers under assumption that all customers benefit
Indiana	Benefits realized through gas cost adjustments based on design in last rate proceeding before Commission
Iowa	Gas cost savings passed on through lower gas rates
New Hampshire	Gas cost savings resulting from the use of underground storage gas assigned totally to winter consumption
New Jersey	Benefits from storage used in purchased gas adjustment
North Carolina	Inventory appreciation adjustment whereby if a PGA increased rates to the utility customer, the appreciation on stored gas is recovered for the benefit of the customers
Ohio	Gas is to be purchased on least-cost basis, consistent with reliable supply; to that extent, benefit of reduced gas costs gained through the use of storage is passed on to the sales customers through the Gas Cost Recovery
Oregon	Benefits accrue to ratepayers through PGAs
Tennessee	Handled through PGA as a refund or surcharge
Vermont	Cost/savings analysis would be a consideration in any rate review; savings would be allocated to the customer class served by the facility
Wisconsin	Done as part of a rate case or savings passed through the PGA to utility customers
Wyoming	"Benefits" from gas storage are considered in setting rates in the same manner as revenues from the sale of utility services

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

for storage services and end-user storage services being provided by distributors and a following question on LDC use of storage for least-cost purposes, should give some indication of what LDCs are doing, and perhaps suggest what state commissions should be doing. If, for example, the findings indicate that LDCs are using storage services and facilities to a great extent but that state regulators are not actively overseeing what the distributors are doing, state commissioners might want to reconsider their hands-off policies. On the other hand, brisk activity by both LDCs and regulators could probably be considered a healthy sign that both sides are making use of the new opportunities presented by the changing gas market structures.

Responses to the question on the extent of storage activity are discussed here. In Alabama, which has no underground storage, one distributor operates two liquid natural gas plants and maintains a portable liquid natural gas plant for emergencies. In Arizona, one LDC has considered undertaking a major underground storage project but has not yet decided that it would be economical to do so. Some storage is undertaken through line packing. Arkansas LDCs have used storage to maintain their peak delivery.

In California, Pacific Gas & Electric is injecting gas for storage banking. Southern California Gas is initiating a new storage program in which it injects large volumes of its own and customer-owned gas in the spring. During this time, it curtails its electric utility generation customers. During the summer, those customers receive service to avoid curtailment. In Delaware, the Delaware Division of the distributor Chesapeake Utilities Corporation has requested that its pipeline supplier, Eastern Shore Natural Gas Company, provide it with additional storage to meet its increased peak demands. The geology of the Delaware service territory is not suitable for the LDC to construct underground storage facilities so the pipeline has been asked to provide the capacity. The Delaware Division also has access to propane stored for its parent corporation, Chesapeake Utilities. A total of 300,000 gallons of propane is stored in an underground cavern owned and operated by other parties. The Delaware Division is planning additional on-site propane storage and will install propane tanks with a capacity of 30,000 gallons each.

In Georgia, one LDC has recently built its third liquid natural gas plant. The facility was completed two years ago and no further activity appears likely in the near future. One distributor from Idaho has an application pending before the FERC to expand an underground storage facility. The LDC is also trying to utilize

its storage better. Illinois has seen no new storage facilities constructed in at least ten years. However, People's Gas is considering an increase in its storage field and there is an application pending before the Illinois Commission from Central Illinois Public Service to enlarge one of its facilities. In Indiana, the distributor Citizens Gas & Coke is constructing a liquid natural gas facility. Distributors are also using out-of-state storage service where available. LDCs in Iowa are considering increasing their use of storage.

Two distributors in Kentucky, Western Kentucky Gas and Louisville Gas and Electric, use storage to reduce system-wide gas costs. Each purchases gas in summer and injects it into storage. The gas is then withdrawn during the heating season. In Michigan, distributors are undertaking a range of storage activities, including injecting additional gas into storage, building new facilities, and using existing facilities better. In Mississippi, there is some limited storage activity undertaken by LDCs. In Maine, Missouri, Pennsylvania, and Wyoming, distributors are not planning any new storage although LDCs in those states already have some storage facilities. A distributor in Montana is enlarging one of its storage fields. In New Hampshire, existing storage capacity is fully utilized when demand permits. One distributor is expanding its winter interruptible sales in order to insure that there is complete withdrawal of storage gas. In Nevada and New Mexico, distributors are acquiring storage from interstate pipeline sources.

In New York, distributors are evaluating their storage needs constantly. Some have checked into the availability of storage from pipelines and shippers particularly in light of the open season proceedings at the FERC. North Carolina distributors are attempting to acquire winter storage services from the pipelines that supply the state. The applications are pending at the FERC. In Ohio, the distributors Columbia Gas of Ohio, Cincinnati Gas & Electric, Dayton Power & Light, and West Ohio Gas recently acquired storage service from Columbia Gas Transmission through a settlement between the pipeline and its customers. Columbia of Ohio is exploring options on other pipelines also. East Ohio Gas has offered some of its storage facilities to Columbia Gas of Ohio and River Gas Company under short-term agreements. East Ohio Gas has also offered storage to some of its transportation customers for purposes of load balancing. In Oklahoma, distributors use storage gas according to the demands and constraints of their systems.

Oregon has enough storage to meet about half of the peak firm load. Building additional pipeline capacity is now the main focus. Increasing the amount of

storage available from interstate pipelines is the focus also in South Carolina. In Tennessee, two distributors have liquid natural gas facilities. Each has a capacity of 1,000,000 Mcf. One distributor has underground storage facilities. In Vermont, a propane storage facility is under construction and not operational at present. In Virginia, distributors are purchasing unbundled storage capacity and service from interstate pipelines that allow third-party injection of gas. In Washington, one LDC recently completed a substantial enlargement of its storage facilities. The interstate pipeline serving the state is considering expanding a storage facility that it owns along with two distributors. Wisconsin LDCs and the Wisconsin Commission are currently studying the use of storage.

Clearly, a wide variety of initiatives are being pursued by distributors. LDCs are expanding facilities, studying the expansion and/or better utilization of their facilities, and pursuing more storage capacity and services from pipelines. In most states, distributors are using storage.

State Commission Encouragement of LDC Storage

The NRRI asked staff members if their commissions have encouraged storage activities undertaken by the jurisdictional LDCs and if so how. Table 5-20 shows that respondents at twelve commissions feel that their agencies have encouraged LDC use of storage. These responses show a variety of actions that commissions

TABLE 5-20

COMMISSIONS THAT REPORTEDLY HAVE ENCOURAGED THE USE OF STORAGE BY LDCs

Alabama	New Mexico
California	New York
Georgia	North Carolina
Idaho	Ohio
Illinois	Oklahoma
Iowa	Oregon

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

have taken that staff members feel are helping to promote storage. In some instances, encouragement has consisted of suggestions to the LDC in an order or a study of LDC operations. Other encouragement comes in the form of reviews of gas procurement, although this may be a more negative type of suggestion as cost disallowance or other sanctions may loom in the background. Other commission policies include allowing storage costs in rates and promoting storage along with spot purchasing. Specific commission policies and actions are discussed below.

In Alabama, the Commission's encouragement of distributors' storage efforts has consisted of publicizing the use of the portable liquid natural gas plant, mentioned earlier, that one distributor has for emergencies. The California Commission has issued an order, also described earlier, requiring Southern California Gas to set aside storage for electric utility generation customers and to allow earlier injection of the electric utilities' gas in order to avoid summer curtailment of those customers. The Georgia Commission directed one LDC in the early 1980s to project its storage needs for the mid-1980s. The LDC has just completed a new liquid natural gas plant. The Idaho Commission has promoted least-cost planning efforts.

The Illinois Commission conducted a management audit of People's Gas recommending that the LDC consider increasing its storage capacity, which it is now doing. The Iowa and New Mexico Commissions encourage LDC storage efforts through gas procurement reviews. The New York Commission has supported LDC efforts, including the use of storage, to meet peak-day obligations. The Ohio Commission has encouraged the use of storage by distributors to maximize the benefits of spot gas purchases in the summer. Such purchasing reduces the utilities' weighted average cost of gas (and possibly contract demand purchases from pipelines) and provides more supply security on peak days. The Commission encourages the LDCs through orders issued in gas cost recovery proceedings. The Oklahoma Commission staff would address any imprudent use of storage in rate case or purchased gas adjustment proceedings. The Oregon Commission has allowed storage costs into rates.

Storage and Least-Cost Purchasing

The last part of the survey included questions about different uses or purposes that an LDC could pursue through storage. Satisfying least-cost requirements, acting as agent for specific end-users, and procuring system supply were three possibilities. The NRRI asked the commission staff members whether, based on their knowledge, any jurisdictional LDCs had purchased or leased storage service or facilities from pipelines or other sources on behalf of particular end-users; whether, based on their knowledge, any of the jurisdictional LDCs had used storage as part of a strategy to achieve least-cost gas purchases; and whether, based on their knowledge, any of the jurisdictional LDCs had used gas storage to bargain with pipelines in procuring system gas supply. Bargaining is considered in the next section. Before turning to least cost, LDC purchasing or leasing of storage for end-users can be briefly discussed.

None of the commission respondents reported any purchasing or leasing of storage by LDCs on behalf of end-users. The Washington Commission, however, noted that one LDC offers storage as a purchasable product to one large end-user. In Virginia, utility electric generation customers, cogenerators, and independent power producers have secured their own upstream storage.

Table 5-21 shows the commissions reporting that jurisdictional LDCs had used storage as part of a least-cost purchasing strategy. Twenty-seven commissions are listed, giving an indication that distributors are making widespread use of storage for this purpose. Not surprisingly, the responses show that storage is being used mainly for buying cheaper, perhaps spot, gas during the summer off-peak period for injection and later use during the winter peak heating season. This practice helps to attain the goal of least-cost purchasing by allowing the LDC to avoid buying gas during the peak period when it is more expensive. Storage is also used for load management as the LDC would have a supply available for meeting its peak demand. Storage is used to help distributors manage contract demand levels with pipelines and reduce some of the charges they pay to pipelines. In one New England state, storage is used to help the distributor avoid the purchase of more expensive propane and liquid natural gas. Comments on specific states follow.

In Alabama, gas is injected into storage during months of peak spot purchases. In California, storage allows core customers' requirements to be met while freeing

TABLE 5-21

COMMISSIONS RESPONDING THAT LDCs HAVE USED STORAGE AS PART OF A LEAST-COST GAS PURCHASING STRATEGY

Alabama	Montana
California	New Hampshire
Connecticut	New Jersey
Delaware	New Mexico
Idaho	New York
Illinois	North Carolina
Indiana	Ohio
Iowa	Oregon
Kentucky	Pennsylvania
Maine	Virginia
Maryland	West Virginia
Massachusetts	Wisconsin
Michigan	Wyoming
Missouri	

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

space on interstate pipelines. LDCs may be able to use storage to make greater spot purchases when prices are favorable. Storage may also allow distributors to reduce some of their more costly purchases. In Connecticut, LDCs purchase spot gas and place it into storage during the summer, reducing inventory costs. Lower gas costs also result when the gas is withdrawn and used in place of additional purchases. In Delaware, Chesapeake Utilities Corporation has used storage to satisfy its peak demand. Storage is generally less expensive than purchasing additional supply from the pipeline supplier. Such purchases would also require the LDC to pay high additional fixed monthly charges. In Idaho, storage supply is used to meet winter peak demand. Storage enables the distributor to purchase less expensive gas in summer to use in winter.

In Illinois, storage is one option that LDCs consider when making purchasing decisions. Indiana LDCs use storage to reduce peak-day demand requirements. In Iowa, distributors purchase lower-cost gas during the off season and use it during

peak periods. Kentucky distributors follow a similar pattern, purchasing gas in summer for storage and using it in the winter heating season. Maine LDCs purchase spot gas to meet winter peak demand. In Maryland, LDCs use storage to reduce their commodity purchases during winter. Distributors in Massachusetts purchase low-cost spot gas, storing it for peak season delivery. Michigan distributors use storage to reduce the level of pipeline demand charges that they have to pay. Storage enables the LDCs to purchase cheaper gas in the summer for use in the winter. Missouri LDCs inject gas during the summer to get lower prices and maximize their contract demand quantities. Gas is then withdrawn during the winter to supplement supplies and deliveries. One distributor in Montana is buying gas from third parties. The price it is paying reflects in part its ability to use pipeline storage facilities to meet its peak demands.

Underground storage services enable New Hampshire distributors to displace expensive liquid natural gas and propane and also to minimize wintertime gas purchases. In New Jersey, storage is used for load balancing. This, along with spot purchases, enables LDCs to offset contract demands. In New York, all gas utilities are under the statutory obligation to adopt least-cost reliable gas purchasing strategies. Storage has been used to take advantage of low-cost spot gas. North Carolina distributors have been putting spot gas into storage and this has reduced the cost of storage service. The Ohio Commission has encouraged distributors to use storage to maximize the benefits of summer spot-gas purchasing. This reduces the utility's weighted average cost of gas, helps reduce contract demand purchase levels with pipeline suppliers, and provides more peak supply security. Oregon LDCs use storage for peak supply so that pipeline capacity and base load supplies will have a higher load factor of about 50 percent. This helps lower gas costs.

In Pennsylvania, purchased gas is stored during periods of low demand and withdrawn during periods of high demand. In Virginia, storage is used as a means of capturing rents from differences in seasonal gas prices. In West Virginia, the distributor Mountaineer Gas has acquired storage rights from Columbia Gas Transmission, its pipeline supplier, and will purchase currently stored gas at embedded costs. In Wisconsin, distributors store cheaper off-peak gas for later use during the winter peak period.

In addition to these states, respondents from two other commissions noted the overriding concern of satisfying peak demand while answering that distributors are not or may not be using storage for least-cost purchasing. Georgia LDCs have used

storage mainly to have secure peak supplies and not necessarily to guarantee least-cost. Similarly, in Oklahoma, the use of storage is an operational use of the transmission system. The Oklahoma Commission is concerned about distributors' ability to serve ratepayers' peak demand.

Storage as a Bargaining Tool

Table 5-22 shows the commissions responding that jurisdictional LDCs had used storage to bargain with pipelines in procuring system gas supply. An LDC could, for example, purchase a large quantity of spot gas during the off-peak period and store it. With that cushion, the distributor then could go to its traditional pipeline supplier (or some other pipelines) and try to negotiate a transaction for system supply. The distributor would not feel as pressured to agree to possibly unfavorable terms because it would have the stored gas to fall back on if needed. As the low number suggests, bargaining is not a widespread use of the storage function. Comments on these states follow.

In Michigan, the large amount of storage available enables the major LDCs to purchase at 100 percent load factor, reducing their reliance on the pipeline for peak-day service. Similarly, Oregon distributors have been able to obtain lower gas prices because storage enables system gas load factors to be higher. The New York Commission is aware that storage has been used for bargaining purposes, but has no specific details. In Ohio, the distributors Columbia Gas of Ohio, Cincinnati

TABLE 5-22

COMMISSIONS RESPONDING THAT LDCs HAVE USED STORAGE TO BARGAIN WITH PIPELINES IN THE PROCUREMENT OF SYSTEM GAS SUPPLY

Michigan
New York
Ohio
Oregon

Source: NRRI survey on state commission gas storage policies for local distribution companies, 1990.

Gas & Electric Company, Dayton Power and Light Company, and West Ohio Gas Company were able to obtain gas storage service in exchange for other rate and service concessions in settlement negotiations with their pipeline supplier, Columbia Gas Transmission Corporation.

In addition to these states, storage is being discussed as a bargaining tool in Mississippi. In Illinois, the storage option would be considered in negotiations between the distributor and the pipeline.

Federal Regulation of Gas Storage

This section provides a brief overview of the Federal Energy Regulatory Commission's (FERC) regulation of gas storage. The discussion that follows will concentrate on the granting of certificates of public convenience and necessity for storage projects by the FERC to an interstate pipeline. There are three means by which a pipeline under the jurisdiction of the FERC may obtain the certificate: the traditional NGA section 7 approach, optional certification, and blanket certification. Each is covered below.

As noted at the beginning of this chapter, federal regulation of gas storage originates with section 7 of the Natural Gas Act of 1938. Section 7(c) of the Act provides that no natural gas company is to engage in the transportation or sale of natural gas in interstate commerce or construct, extend, acquire, or operate facilities needed for such transportation or sale unless the FERC has issued a certificate of public convenience and necessity authorizing such actions.

Under this statutory authority, the FERC has issued regulations establishing the three procedures listed above.[3] The traditional NGA section 7 certificate of public convenience and necessity is considered first. Applicants for this certificate are to provide the Commission with all of the information needed to advise it concerning the operation, sales, service, construction, extension, or acquisition for which the certificate is requested. Applicants are to furnish the information needed

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3 Part 157 of Subchapter E ("Regulations under Natural Gas Act") of the Commission's regulations can be found in II FERC Statutes & Regulations, beginning with paragraph 19,550.

for "a full and complete understanding of the proposed project, including its effect upon applicant's present and future operations. . . ."[4]

After the application is filed with the FERC, a notice is published in the *Federal Register* and the opportunity given to interested parties to intervene and protest the project. The Commission then schedules a public hearing on the application during which the applicant could present its case. If the Commission grants the certificate, the applicant must accept it in writing within thirty days from the date of issue. The construction, extension, or acquisition authorized in the certificate must be completed and in operation (and any authorized sale must be undertaken) within the time period specified by the Commission in the certificate.[5]

The optional certificate procedure allows an applicant to undertake a new service for which it does not currently have a certificate. The application procedure itself is similar to that for the traditional certificate of public convenience and necessity. The applicant must furnish all the necessary information to advise the Commission about the sales, services, and facilities that are being requested and any construction, acquisition, or extension of facilities must be completed (and any authorized sale undertaken) within the time period specified by the Commission in the certificate. But the optional procedure, which was established in FERC Order 436, is designed to incorporate more market elements into regulation. This certificate would not be for an exclusive service territory meaning there could be competing applications to serve the same market. If the applicant complies with the requirements of the program, including certain rate conditions, the contents of the application, and the nonexclusiveness of the service territory, there is a presumption, subject to rebuttal, that the applicant is qualified, willing, and able to perform the service and that the service is in the public convenience and necessity.[6]

The blanket certificate procedure for interstate pipelines allows the applicant, upon receipt of the certificate, to engage in certain specified activities without further Commission action. Any interstate pipeline that has already received a

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4 II FERC Statutes & Regulations, section 157.5, para. 19,555.

5 II FERC Statutes & Regulations, sections 157.9 to 157.12; 157.20, para. 19,559 to 19,562; 19,570.

6 The optional certificate procedures are in II FERC Statutes & Regulations, sections 157.100 to 157.106, para. 19,614 to 19,620.

certificate of public convenience and necessity from the FERC and has had rates approved by the Commission is eligible to apply for a blanket certificate.[7] With respect to storage, the certificate holder is automatically authorized to provide service and any necessary transportation provided that the volume of service is within the capacity of the pipeline's storage facilities, the contract is for a period of two years or less, and the rates to be charged are covered by a current rate schedule. The service to be provided must also not harm the service being currently furnished to the pipeline's existing customers. The transaction could be for a period of longer than two years if the pipeline follows the procedure of giving notice and allowing interested parties to intervene and protest.

The pipeline, after following the notice and protest procedure, may also increase the maximum volume of gas authorized to be stored in a facility. The request to the Commission must include the current and intended maximum storage capacity, the current and planned maximum storage pressure, the average depth of the storage facility's geological formation, engineering and/or geological studies on the feasibility of the planned increase, and a statement of the purpose of the increased capacity. The pipeline, after increasing the capacity, files reports with the FERC twice each year until the volume of gas stored reaches the requested maximum.

The pipeline certificate holder can be automatically authorized to construct and operate pipeline and compression facilities needed to test or develop new underground storage reservoirs. For automatic authorization, without the notice and protest procedure, the testing and development would have to be completed within three years, and the quantity of gas injected into the fields could not exceed 10,000,000 Mcf at any time in all of the fields developed and no more than 2,000,000 Mcf in any single field. The field could not be used for service unless authorized by the FERC and gas could be injected for testing only during off-peak periods.[8]

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7 II FERC Statutes & Regulations, sections 157.201 to 157.205, para. 19,631 to 19,635.

8 For storage, see II FERC Statutes & Regulations, sections 157.213 to 157.215, para. 19,643 to 19,645.

CHAPTER 6

CERTAIN STATE REGULATORY OPTIONS FOR GAS STORAGE

As indicated in previous chapters, the use of storage can have significant implications on gas service cost and reliability as well as the extent of competition in the gas market. This chapter will suggest several regulatory options that may be considered by state public service commissions to help assure realization of the full advantages of gas storage. The development of state gas storage policies should be based on the recognition of important trends in a restructuring gas market, namely the almost-universal access to interstate transportation facilities, the strong tendency of expanding access to gas transportation facilities within a state, the emergence of new unbundled services such as transportation, storage, load-balancing, and standby service, and the prevalence of direct purchase by LDCs and end-users.

There are several criteria that a state public service commission may want to take into account in developing its gas storage policy. They include the preservation of competitive price signals, the avoidance of drastic cost reallocation, the prevention of undue market power, and compatibility with other state gas policies. Obviously, a specific gas storage policy may not satisfy all these goals at the same time. Then it is up to the individual state commission to consider the gas demand and supply conditions within a particular state and to decide the rank order of the criteria. The policy suggestions provided here are not necessarily applicable to all states.

Considerations in Setting State Gas Storage Policy

Based on the results from the recent NRRI survey, it seems that state public service commissions generally adopt a traditional approach toward gas storage by local distribution companies and end-users. The policies and procedures adopted in dealing with the construction, certification, operation, and cost allocation of gas storage are similar to other aspects of gas distribution service. State commissions mostly rely on traditional forms of oversight, primarily rate case hearings and purchased gas adjustment proceedings, for setting policies and guidelines concerning

gas storage. The absence of active regulatory initiatives in gas storage is not surprising given that gas deliverability has been high relative to demand in the 1980s. Consequently one basic rationale of gas storage--avoiding the curtailment of gas service--is not present. It may also be that the need for active oversight is less since the function of a gas storage facility in delivering gas is closer to that of a gas production facility than that of a gas transportation or distribution facility. Currently, there exists almost no public utility-type regulations regarding the development and production of gas, and many state commissions may not feel the need for active regulation regarding the construction and utilization of gas storage facilities. Furthermore, given that the separate provision and pricing of gas storage service is a relatively new phenomenon, state public service commissions simply may not have sufficient and concrete information upon which to develop gas storage policies.

However, this does not mean the state public service commissions need always take a passive role toward gas storage. If the trend toward direct gas purchase by the LDCs continues, the use of various storage options may become an important element in the supply management strategies for more distribution companies. The ownership and usage of storage capacity by distributors may increase considerably, and state public service commissions soon may be confronted with new regulatory issues of gas storage.

The NRRI survey on current storage-related regulations also indicates that the state commissions tend to be more active on the generic issues of construction approval, monitoring of operation, and cost recovery of gas storage operations than on those issues specifically related to storage. These specific issues include the service terms of storage and storage-related services, the pricing of storage service, and the use of storage as a strategic tool for negotiating gas procurement contracts. The implication is that it may be more desirable for the state public service commissions to direct new state regulatory initiatives to these areas that are still in the initial stage of development.

Like most discussions on the development of public utility regulatory policies, economic efficiency improvements and assurances of fairness to gas companies and ratepayers alike are viewed as the overall goals in setting storage-related policies. Several specific considerations can be derived from these two objectives.

One consideration in setting state gas storage policy is to preserve the competitive forces in the gas market and allow them to work to their fullest

extent possible. The preservation of competitive price signals means that no subsidies or preferential treatments in financing, environmental regulations, or other aspects of construction and operation should be provided for the construction, operation, and use of storage facilities. A storage facility should be subject to the same requirements that are applicable to the construction and operation of gas transportation facilities, compression stations, and other gas distribution operations. After all, all options in meeting the gas requirements of end-users should be evaluated fairly and equitably on their technical and economic merits. The increase in gas storage is of no significance in energy resource utilization unless it can truly lower the cost of gas service or improve service reliability.

Similarly, the principle of accurately reflecting the true costs of different storage-related services should be applied in setting the prices and service terms for storage and storage-related services provided by local distribution companies for other LDCs and end-users. If subsidies were provided for those customers using storage service by charging a price lower than the true cost of storage, users of storage wind up being subsidized by other groups of customers. By doing so, the storage capacity and the amount of gas stored may reach uneconomical levels for society as a whole even though such a course may not be unprofitable for individual gas users in comparison with other options such as building additional gas transportation pipelines or pursuing other standby arrangements.

Another consideration in setting storage policy is avoiding drastic cost increases on core customers. As discussed in chapter 4, one of the possible effects of the increased use of storage is the conversion of sales service to transportation-only service by certain customers. If a large number of customers who previously were sales customers choose to use transportation-only service exclusively, substantial revenue loss for the local distribution company may result. Even so, the revenue loss may be partly or wholly offset by the increase in gas transportation and gas storage fees collected if unbundled storage service is provided by the local distribution company. In the case where the availability of storage capacity leads to a substantial number of end-users bypassing the local distribution company, a larger revenue loss may result. The fixed costs of the local distribution company needs to be allocated to the remaining customers (a smaller load) thus making a substantial rate increase likely.

The third consideration relates to the prevention of creating undue market power derived from an LDC's ownership of storage facilities or the preferential

treatments received by certain end-users. As indicated previously, control of the access to storage capacity is not as critical as control of the access to transportation and distribution facilities. Since significant economies of scale and scope are not apparent in the building and operating of storage facilities, the market power that certain local distribution companies can command as a result of owning storage capacity may be restricted. Nevertheless, some instances indicate the local distribution companies can potentially provide preferential treatment in storage-related services for affiliates and certain customers, and thus improve the market position of these entities in relation to others. For example, a local distribution company can limit the access to storage facilities to its marketing affiliate or allow the run-up of a large load-supply imbalance when no physical storage of gas is involved. By doing so, the affiliate can sell more gas than it has at peak period when the price of gas is higher, and make up the imbalance at a later nonpeak period when the price of gas is lower. The gas marketing affiliate is afforded a substantial cost advantage in competing with other nonaffiliated gas marketing companies. A similar arrangement has been alleged against an interstate pipeline company.[1] It should be noted that allowing load-supply imbalance does not necessarily require or involve gas storage but could be aided or covered through LDC storage capability.

The fourth consideration in setting state gas storage policy is coordination with existing state gas regulatory policies. Those that are most closely related to gas storage are the gas transportation policy, the regulation of LDC direct gas purchase, and the curtailment of gas supplies (the priority of allocating available gas in the case of supply shortage). As indicated previously, the use of storage can lead to a reallocation of demand for transportation service, and storage service can be a complementary service or a substitute service for gas transportation. It is important to set a gas storage policy that is consistent with current gas transportation policies, and make both alternatives (storage and transportation) compete on an equal footing. For example, the regulation on allowing the abandonment of storage service may be hinged upon the full open-access to LDC-owned transportation facilities by all end-users.

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1 See "FERC Should Stop Pipelines from Tying Storage to Sales Gas," *Inside F.E.R.C.*, 7 March 1988, 13.

The policy on direct gas purchase also interacts closely with the availability and pricing of storage service. In buying gas directly, the LDCs must consider backup gas supplies available. The increased availability of gas storage, whether built by the LDC itself or leased from others, is a useful backup arrangement. So the wide availability of gas storage may enhance the feasibility of direct gas purchase for most end-users. On the other hand, if the state commissions actively encourage direct gas purchase by LDCs as a way to reduce gas supply cost, the demand for backup service (including gas storage) is likely to increase.

The state gas curtailment policy determines the order of gas being used for various purposes (including gas being injected into and withdrawn from storage in periods of chronic supply shortage). Such a policy can affect the reliability of using storage as a backup supply. For example, if gas intended to be injected into storage reservoirs during the summer non-peak period is given a lower priority than gas for industrial use, there may be no gas for storage injection in summer and storage withdrawal in winter peak period. If such a conflicting curtailment policy is adopted, the economic advantages of using gas storage are decreased and the effects of policies aimed at promoting gas storage may be hindered.

Provision of Unbundled Storage Service

Based on these four considerations and the current status of state oversight on gas storage, certain policy suggestions are made. As indicated before, the emphasis is on those areas specifically related to gas storage or that are in their initial stage of formulation rather than on the generic areas of state gas regulation. Specifically, three broad policy areas are addressed: the provision of unbundled storage service, the pricing of storage-related service, and the use of storage as a supply management tool by LDCs. Obviously, this is not a complete list of possible state regulatory initiatives.

It can be argued that the gas companies, whether they are pipelines or local distribution companies, always have provided and will continue to provide "storage" and "load balancing" services for customers all the time. This indeed may be the case from the technical aspect of delivering gas as well as from the accounting aspect of determining who pays how much for the gas delivered. As gas is transported from the underground reservoirs to the end-users' burnertip, a balance in the amount of gas injected into and taken out of the pipelines, and the operating

pressure in the gas delivery system must be maintained constantly. Obviously, with the fluctuating and uncertain nature of the demand for gas, some forms of gas storage and load-balancing are performed by gas companies in the operation of the gas delivery system. But a distinction can be made about the provision of storage as a part of the traditional bundled gas sales service and the provision of a separate unbundled storage service.

Currently, a number of states and the Federal Energy Regulatory Commission (FERC) have approved the provision of unbundled gas storage or storage-related services by interstate pipelines and local distribution companies. The state activities in this area were discussed in chapter 5 and will not be repeated here. As for the interstate gas market, Natural Gas Pipeline Company of America, Williams Natural Gas Company, ANR Pipeline Company, United Gas Pipe Line Company, and Texas Eastern Transmission Corporation are some examples of those that either have been approved to start providing storage service or have proposed to do so.

In approving ANR Pipeline's storage program, the FERC noted that the ANR storage program was consistent with the goal of making unbundled service available to shippers as a means of promoting competition, and that offering storage service could further the effort to achieve a fully open access market by permitting transportation service that would not be feasible unless provided in conjunction with storage service.[2] The FERC order also indicated that, as many sales customers make significant contract-demand conversions, the unbundled service would also help ensure the full utilization of storage capacity that will no longer be needed by ANR for system-supply flexibility. This order may reflect the rationales of the FERC in approving unbundled storage service.

It should be emphasized, however, that the above-mentioned rationales may not be applicable to all states. There should be no presumption that all LDCs should provide unbundled storage services to the end-users. For some states, no underground storage capacity is available or no suitable storage sites can be found. In others, the LDCs may be inexperienced in operating storage facilities or lack the necessary accounting and flow monitoring capability to perform and record storage and storage-related gas movements and transactions. It has been pointed out that as more parties became involved in gas transaction (including storage), the potential

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2 See "ANR Unbundled Storage Service Authorized, With Access Conditions," *Inside F.E.R.C.*, 3 April 1989, 3-4.

for differences regarding what has actually been bought, sold, and transported has increased and could be a serious problem in the future.[3] Furthermore, the LDC may not have any storage capacity available after providing core gas sales and transportation service.

Nevertheless, once a separate storage service is to be provided, a number of elements need to be considered for the design of a state storage program. These elements include the service types, service categories, service priority, scheduling and curtailment, tariffs for different kinds of service, and the abandonment of service.

Two types of storage service are usually provided. One is "firm" service where the gas company agrees to make a certain amount of storage capacity available for a fixed period of time, typically the summer months or a twelve-month period. Another is "interruptible" service under which a local distribution company provides storage service from time to time when capacity is available after covering firm resales, firm storage, and transportation obligations. This means customers may have no choice on when or how much gas can be put into and withdrawn from storage. For example, the Northwest Natural Gas Company, in its rate schedule filed with the Oregon Public Utilities Commission, specifies that injections into and withdrawals from storage on any day on behalf of the Company's core customers plus its customers served under another schedule will have priority over any storage operation provided under the "best efforts" storage service. Because of the uncertain availability of storage capacity, customers have less flexibility in planning gas purchase and disposition, so interruptible storage service is generally less valuable. As gas prices become more volatile, the existence of interruptible storage service, compared to the case of no storage at all, still provides additional flexibility for both the providers and users of storage service. What's more, tariffs charged for interruptible storage service are usually lower than those for firm storage service. For the LDCs that provide interruptible storage service, the marginal costs of providing such service are low and storage capacity simply may be wasted if it is not used for interruptible storage. In summary, the local distribution companies should be afforded the opportunity to offer separate firm and interruptible gas storage services with the understanding

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[3] See Dean C. Maschoff and Terry G. Palmberg, "Gas Imbalance: A Growing Problem," *Public Utilities Fortnightly*, 26 October 1989, 24-27.

that the storage capacity available for interruptible storage service can be determined only after the capacity required for assuring reliable service to core customers has been allocated.

Several categories of storage service are available. Storage service can be provided for gas transported into and out of the storage facilities by third parties (such as pipelines or other LDCs) or only by the LDCs that provide the storage service. Also, storage may be provided only for gas supplied by the LDC or for gas procured by end-users directly. Even though distribution companies can be allowed to provide storage service in combination with other services such as gas acquisition and gas transportation, there is no reason to require storage service customers to purchase other services such as gas acquisition and gas transportation which they may not need. It may be that in order to achieve the full unbundling of gas service and to prevent creating undue power for the LDCs, a simple (basic) storage service untethered to any other services should always be provided.

The priority, scheduling, and order of curtailment of storage service among different types and categories of services, as well as with other unbundled services, is another element of a gas storage program. These issues concern primarily the comparability of storage with other services. Since firm storage customers enter into the transaction with the understanding that the storage capacity is always available to them when they need it and they are paying a higher price than that paid by customers of interruptible storage service, they should have a higher priority in terms of receiving and scheduling storage service.

As for storage services connected or unconnected with other services provided by the LDCs, there should be no difference among them in terms of service, scheduling, and curtailment priorities. If the customers who are buying gas acquisition or transportation service in addition to storage service are given a higher priority in receiving and scheduling storage service, the storage really is not provided as an unbundled gas service and the choice of the customers is restricted unnecessarily.

If certain economies of scale and scope arise in providing storage service with other gas services (though the authors see no concrete evidence to suggest this), a lower tariff for storage service in combination with other services may be justified. However, the service, scheduling, and curtailment priority should not be affected. In the case where certain customers are not willing to deal with the simultaneous procurement of several distinct services, they may be better off buying a bundled

firm or interruptible gas sales service from an LDC. In summary, a separately provided gas storage service should not be given preferential treatment (or conversely a lower priority) compared with other gas services in terms of access and service terms to the gas delivery system. It is better to reflect the cost differences in providing storage service in the tariffs charged rather than through the differences in service terms. By doing so, the individual customers are afforded the freedom to make their own choice and undertake the associated consequences (supply risk and cost).

Regarding the abandonment of storage service upon the expiration of underlying contracts, the local distribution companies should be afforded the freedom to do so. After all, denying access to the storage facilities does not necessarily preclude the customer's access to the gas delivery system, and the customer presumably has the option of building its own storage capacity or obtaining it from other sources, provided two conditions are met. First, there must be open access to the transportation facilities within the LDCs service territory. Second, a broad range of comparable storage services (firm and interruptible storage service, storage service in combination with gas acquisition, and transportation or simple storage service) as discussed previously must be available provided that service to captive customers is not affected by the provision of storage services. If these two conditions are met, the buyers of the storage service are assured several alternative options, and the sellers (the LDCs) should be allowed the option of not providing storage service after the expiration of current contract and proper notice.

Pricing of Storage Service

Setting the tariffs for unbundled storage and storage-related services is a complex exercise as there are many different cost components and markets associated with the many types and categories of storage services. There is a distinction between allocation of cost for storage function provided by the distribution companies for their customers and setting prices for unbundled storage service that is selected by individual end-users. The various approaches used by local distribution companies in allocating storage-related cost have been discussed in chapter 5, and will not be repeated here. In general, the cost allocation for storage-related costs is similar to the cost recovery of other gas operations.

The emphasis here is on how to set the tariff for unbundled storage service provided for individual customers. It should be emphasized that sometimes a single tariff (covering both capacity charge and operating cost) is published, while at other times more than one tariff is published, for the access and use of storage service. For example, in California the storage capacity reservation fee is determined by a second-price bidding procedure while the operating cost of stored gas is allocated on a per therm basis.

Two general approaches can be used in setting the tariffs for storage service. The tariffs can be set either by a commission-approved market-based mechanism such as competitive bidding, or by the commission based on the cost of providing the service. Both approaches have been used by the local distribution companies before various state commissions.[4] The choice of either approach may depend on the specific cost components involved. Basically, two cost components are involved in setting the tariffs for storage service: the capital costs incurred in adding storage capacity, and the operating cost of using the storage facilities.

A market-based approach is generally preferred in setting tariffs for storage capacity. A market-based mechanism such as competitive bidding tends to allocate storage capacity to customers who value it the most, and the storage capacity is built and used in the most economically efficient manner. Another advantage of a market-based approach is the avoidance of a long and sometimes unfruitful cost-discovery process. At the present time, many gas companies do not break down their storage-related investments from other capital investments. Moreover, information on the capital cost of a specific storage reservoir is usually difficult to ascertain and the attribution of such a cost among various users (including the LDC that owns the reservoir) may be a matter of considerable debate. It is also true that the capital costs of various storage options are site-specific, and no average comparable and valid cost data can be used as a general guide in setting tariffs for storage capacity. The experience of the Federal Power Commission in attempting to set the wellhead price of gas on an individual- well basis is a good illustration of the possible difficulties that can be encountered in assessing the capacity cost of individual storage facilities.

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[4] See table 5-13 for the various approaches in setting storage tariffs in various states. It should be noted that some states may not have a general policy concerning the gas storage tariff and may adopt different methods in setting the tariffs for different local distribution companies.

It is no surprise that some may argue that the determination of storage-related cost is no more difficult than the determination of transportation and distribution-related costs. But given the competitive features of the market for storage service (in contrast to the monopoly features of transportation and distribution services), there appears to be no compelling reason (such as preventing monopoly pricing) to use a cost-based tariff for allocating storage capacity. Of course, a market-based approach is valid only when a competitive market for storage service exists or where a "fair" market transaction mechanism has been established. Otherwise, a market-based approach may create undue market power, and windfalls for certain market participants. As discussed in chapter 4, there are few barriers that an active and competitive market for storage service cannot be established.

As for setting the tariff to cover the operating cost of gas storage, both market-based and cost-based approaches can be used. A cost-based approach is feasible here since the costs incurred for the operation of a storage facility (such as fuel costs, labor costs, or gas costs due to leakage and migration) are more readily identifiable and comparable than the capacity cost of storage. Another reason for using a cost-based approach to recover operating costs of storage is to reduce the possibility of drastic cost shifting among different customer groups that could occur under a market-based tariff.

The choice between a market-based or cost-based tariff for storage should be based on the state commission's perception of the degree of competitiveness of the market for storage service, whether the market-based rates can lead to drastic cost reallocation, and whether the dichotomy of storage tariffs suggested here (market versus cost-based tariffs) may be a necessary compromise.

Storage and Gas Supply Management

This policy area deals with the use of gas storage as a supply management tool by the local distribution companies, especially in terms of the use of storage as part of a least-cost-gas-purchasing strategy (or alternatively as a way to reduce the cost of gas supplies), and the bargaining with the pipelines for arranging system gas supply provided by the pipelines. The NRRI survey results indicate that the use of storage to meet a least-cost purchasing requirement is quite prevalent, being used by LDCs in more than half of the states. There are two storage-related strategies that the LDCs can use to reduce the cost of gas supplies. First, the LDCs have

been quite active in using storage to shift the timing of gas purchases (from winter to summer) and to substitute stored natural gas for more expensive propane or liquid natural gas. Alternatively, in purchasing from interstate pipelines, the LDCs can reduce contract demand charges paid by decreasing their peak demand.

However, the extent of the use of storage as a bargaining tool by the LDCs for system gas supply is less clear. Gas storage can be used as a bargaining tool by allowing the LDCs to purchase a more stable amount of gas from the pipeline, thus enabling the pipeline to have a higher system load factor. But few states indicate that the LDCs have actually done so. This, however, does not necessarily mean that LDCs are not using storage as a bargaining tool. It simply may be that less information is available to state commissions about the detailed and sometimes confidential process of procuring gas. In any event, it seems that the local distribution companies are generally aware of the benefits of using storage in managing gas supplies. There appears no strong justifications for state commissions to issue additional guidelines concerning the use of storage by LDCs as part of their gas procurement strategies. The possible options available in this regard are to publicize the state commission's encouragement of the incorporation of storage as an integrated part of any gas supply the LDCs may have, and to remove any informational barriers (such as the lack of data on storage capacity within the state) that might exist.

CHAPTER 7

CONCLUSIONS

This study has analyzed some competitive implications of storage in a restructuring gas market, identified the types of benefits and costs of storage to individual gas companies, and suggested certain state regulatory options to enhance the role of storage in providing economical and reliable gas service. This study concludes that, under current and projected gas demand and supply conditions, the main benefits of the extensive use of storage are the costs that can be avoided in deferring or cancelling construction of new transportation pipelines, the reduction in demand-related costs in contracting gas supplies, and the added opportunities available to the gas companies to achieve cost savings by adjusting gas procurement in response to volatile gas prices and supplies. Avoiding actual gas curtailments during peak periods is probably of relatively less concern.

As for using gas storage to enhance competition in the gas market, the results are somewhat ambiguous. The effects of gas storage in enhancing or hindering competition are limited. This is because a substantial part of the gas market is either already quite competitive or cannot be made competitive by the nature of the service provided, and that access to gas storage facilities is not as crucial as access to transportation facilities in delivering gas. Furthermore, gas storage service can be supplied competitively and the participants (with the exception of captive customers) in the gas market have the option of acquiring storage capacity for their own use. This is true because the entry investment for storage is relatively small, no limitation exists on the number of potential operators of storage facilities within the gas delivery system, and no clear indication that significant economies of scale and scope are experienced in building or operating storage facilities.

The market for transportation service is one area where the extensive use of storage has some potential to enhance competition. The use of storage may result in a shifting of the demand for transportation service, but few general patterns of such demand reallocation can be anticipated. Such a reallocation can lead to more competition in part of the gas transportation market and probably less competition in other part of the gas transportation market.

Various gas storage options were examined, and it appears that underground storage is likely to remain the most important one in terms of the impact on the

availability and cost of gas service. The shut-in of gas-producing wells and the buying and selling of gas futures contracts may play significant roles in the future even though they do not fit the strict definition of gas storage. Storing liquefied natural gas in tanks is an expensive option, but, given its rapid rate of delivery at peak demand periods and the absence of geographical limitations, can be a useful peak-shaving tool for certain service areas where other forms of storage options are technically infeasible.

The study also contains the findings of an NRRI survey on state oversight of gas storage. The survey results indicate that gas storage is not an active area of new regulatory initiatives. A majority of state commissions are treating gas storage similar to other aspects of the local distribution companies' operations. State commissions rely mostly on traditional forums and means of oversight (primarily rate case and purchased gas adjustment hearings) in setting storage-related policies and procedures. This is not surprising given the relatively abundant supply of gas since the early 1980s. Consequently one of the basic rationales for using storage--to avoid curtailments of gas delivery at peak periods--may not apply in this circumstance.

On the other hand, providing unbundled storage service is a relatively new phenomenon, and the linkage between gas storage and a competitive gas market has not yet been firmly established. So state regulation of gas storage is still in an initially fluid state. Another reason for the lack of state oversight may be that there is less need for it since the role of storage facilities in delivering gas is closer to that of gas production facilities (which are generally unregulated) than that of gas transportation and distribution facilities.

Nevertheless, the survey results still provide some interesting insights about state activities in gas storage, particularly in the pricing and provision of storage service, the use of storage as a way of achieving least-cost gas purchases, and in the way that LDCs are using storage as a bargaining tool in negotiating with pipelines for system supply gas.

This study suggests several regulatory options which the state public service commissions can consider using to enhance the role of gas storage in providing economical and reliable gas service. No presumption about the desirability and necessity of providing an unbundled storage service by all local distribution companies should be made. But, if such a service is provided, both firm and interruptible storage services need to be provided. All customers should be allowed

to make their own choice. As for storage service provided in combination with other services such as transportation and gas acquisition, no preference in service priority, scheduling, and curtailment needs to be accorded over storage service unconnected with other services. A market-based tariff for allocating storage capacity to end-users is preferred over a cost-based tariff primarily because of the difficulties of ascertaining storage-related capacity costs and the advantages in providing competitive price signals that can lead to economic efficiency improvement. As for abandoning storage service after the contract expires, it is better to allow such an option for local distribution companies upon proper advance notice to end-users, and more importantly upon giving assurances to the state public service commission that full transmission access and comparable storage and storage-related services will continue to be available.

Finally, there are several areas for future study on the subject of gas storage. Two are mentioned here. A detailed and extensive analysis of the full potential and effects of the establishment of a gas futures market is one area. Is it possible to "store" gas without its actual physical storage? What are the implications in acquisition and transportation markets if gas futures contracts are extensively used by producers, pipelines, and local distribution companies? How should the state commissions treat the "losses" and "profits" associated with the trading of gas futures by the local distribution companies?

Establishing a data base on the disposition of gas storage (that is, the demand for storage capacity and the allocation of stored gas to individual distribution companies and large end-users) is another area of great importance. Currently, detailed information exists about the supply of gas storage; that is, the *capacity* and *operation* of individual storage facilities. But no comparable information is available on the *demand* for gas storage. Without such information, it is difficult to assess the real impact gas storage can have on the gas delivery system in this country.

APPENDIX A

SUMMARY OF STATE COMMISSION SURVEY RESULTS

This appendix contains the questionnaire and responses from the NRRI survey on state commission gas storage policies for local distribution companies. The survey was conducted during the spring of 1990. Forty-six commissions responded. In most instances the responses reported in this appendix are direct quotations from the survey forms. Some minor editing was occasionally done to improve the readability of the responses. In order to facilitate the readers in identifying information on specific topics, the full text of the survey questions is presented first and the corresponding page numbers referring to the responses are indicated.

The commission staff members who responded to the survey are: Robert E. Reed, Alabama PSC; Steve Pratt, Alaska PUC; Richard V. Kauffman, Arizona CC; David C. Lewis, Arkansas PSC; Brian Schumacher, California PUC; Craig Merrell, Colorado PUC; Jeff Honcharik, Connecticut DPUC; Susan B. Neidig, Delaware PSC; Wayne Makin, Florida PSC; R. Lynnard Tessner, Georgia PSC; Dave E. Schunke, Idaho PUC; Thomas E. Kennedy, Illinois CC; Adam King, Indiana URC; Vernon Jordan, Iowa SUB; Ralph Dennis, Leah Faulkner, and Isaac Scott, Kentucky PSC; Roy F. Edwards, Louisiana PSC; Dave DiProfio, Maine PUC; David Valcarenghi, Maryland PSC; John C. Boll, Massachusetts DPU; Gary Kitts, David Berquist, Michael Collins, Sue Devon, John King, and Rob Ozar, Michigan PSC; C. Keith Howle, Mississippi PSC; Bo Matisziw, Missouri PSC; Dan Elliott, Montana PSC; Michael L. Greedy, Nevada PSC; George McCluskey, New Hampshire PUC; Robert Nottingham, New Jersey BPU; Gary Roybal, New Mexico PSC; Lyle Van Vranken, New York PSC; Ray J. Nery, North Carolina UC; Jerry Lein, North Dakota PSC; Marcy G. Kotting, PUC of Ohio; Jimmy Crosslin, Oklahoma CC; Gerald Lundeen, Oregon PUC; James B. Strausbaugh and Vernon E. Chandler, Jr., Pennsylvania PUC; Paul Grieco, Rhode Island PUC; James S. Stites, South Carolina PSC; Dave Jacobson, South Dakota PUC; William H. Novak, Tennessee PSC; Tym Seay, RR Commission of Texas; Dan W. Bagnes, Utah DPU; Kathleen Fleury, Vermont PSB; Scott Gahn, Virginia SCC; Bethany Weidner, Washington UTC; Byron Harris, West Virginia PSC; Patti Schulthess and Harold A. Meyer, PSC of Wisconsin; and Alex Eliopulos, Steve Ellenbecker, Dave Walker, and Jon Jacquot, Wyoming PSC.

THE NATIONAL REGULATORY RESEARCH INSTITUTE

Survey on
State Commission Gas Storage Policies
for Local Distribution Companies

March 1990

As one of its Board-approved projects for 1989-90, the National Regulatory Research Institute is undertaking a study of the functions of storage in the gas industry and related policy issues. This survey is an important part of the study, designed to develop current information on state commission regulations and policies concerning gas storage, storage cost allocation, storage banking for end-users by local distribution companies, and other issues.

Please provide copies of any opinions, orders, statements, or other documents that might be useful in understanding your commission's policies and viewpoints. Please return this survey by April 2, 1990 to:

Peter A. Nagler
The National Regulatory Research Institute
1080 Carmack Road
Columbus, OH 43210-1002
Phone No. (614) 292-9404

Name of person completing form:

Title:

Phone No.:

1. Does a local distribution company (LDC) under your commission's jurisdiction need to obtain the commission's approval before constructing gas storage facilities? Yes No

   If yes, is a formal proceeding used in reviewing the application for constructing gas storage facilities? Yes No

   Does the commission issue a certificate of public convenience and necessity in approving the gas storage project? Yes No

   Please briefly describe your commission's procedures.

   Responses to this question start from page 176.

2. Does an LDC need to obtain approval from any other state or federal agency, such as an environmental protection agency or a department of natural resources, for the construction of gas storage facilities? Yes No

   If yes, please state the names of the agencies.

   Responses to this question start from page 180.

3. Does a jurisdictional LDC need to obtain your commission's approval before acquiring or leasing storage facilities or services from an interstate or an intrastate pipeline? Yes No

   If yes, please describe your commission's procedure of approval.

   Responses to this question start from page 182.

4. Are any of the jurisdictional LDCs currently using storage facilities or services supplied by interstate or intrastate pipelines? Yes No

   If yes, please provide data on the LDCs' use of storage services and their load characteristics (such as average non-coincidental peak demand and coincidental peak demand).

   Responses to this question start from page 184.

5. Does a jurisdictional LDC need to obtain the commission's approval before leasing or acquiring storage facilities from other distributors within the state or distributors in other states? Yes No

   If yes, please describe your commission's procedure of approval.

   Responses to this question start from page 187.

6. Are any of the jurisdictional LDCs currently leasing or acquiring storage facilities or services from other distributors within the state or from distributors in other states? Yes No

   If yes, please provide relevant data.

   Responses to this question start from page 189.

7. Does a jurisdictional LDC need to obtain the commission's approval before leasing or acquiring storage facilities from sources other than pipelines and other distributors (such as oil and gas producers)? Yes No

   If yes, please describe your commission's procedure of approval.

   Responses to this question start from page 192.

8. Are any of the jurisdictional LDCs currently leasing or acquiring storage facilities or services from sources other than pipelines and other distributors? Yes No

   If yes, please provide relevant data.

   Responses to this question start from page 194.

9. Does your commission monitor the day-to-day operations of the gas storage facilities owned and operated by the jurisdictional LDCs? Yes No

   What is the frequency of the commission's monitoring of storage facility operations?

   Please describe the commission procedure for monitoring the operation of storage facilities.

   Responses to this question start from page 196.

10. Does your commission specify any delivery and operating conditions (such as peak delivery from storage or injection rate into storage, number of wells tapping into a storage reservoir, etc.)? Yes No

    If yes, please describe the specified conditions.

    Responses to this question start from page 198.

11. Does your commission have in place any safety regulations dealing with gas storage facilities? Yes No

If yes, please describe the safety regulations.

Responses to this question start from page 200.

12. Does your commission specify an injection period (such as summer) during which gas is to be placed into storage? Yes No

Please specify the injection period or the procedure used in determining such a period.

Responses to this question start from page 202.

13. Does your commission specify a delivery period (such as winter) during which gas can be taken from storage? Yes No

Please specify the delivery period or the procedure used in deciding such a period.

Responses to this question start from page 204.

14. Please describe your commission's procedures for allocating the costs of gas purchased for storage.

Responses to this question start from page 206.

15. Is the cost allocation for storage gas among residential, commercial, and industrial customers different from the regular cost allocation of system gas supplies? Yes No

If yes, please describe the difference.

Responses to this question start from page 210.

16. Is the cost allocation for storage gas between core and noncore customers different from the regular cost allocation of system gas supplies? Yes No

If yes, please describe the difference.

Responses to this question start from page 212.

17. Does your commission prescribe a different purchased gas adjustment for the gas injected into storage from the one for system gas supplies? Yes No

If yes, please describe the difference.

Responses to this question start from page 214.

18. Does your commission prescribe financing requirements and procedures for the construction of gas storage facilities that are different from such requirements for other LDC construction projects? Yes No

If yes, please describe any difference.

Responses to this question start from page 215.

19. Does your commission prescribe different cost recovery methods for the construction of gas storage facilities as compared with other LDC construction projects? Yes No

If yes, please describe any difference.

Responses to this question start from page 217.

20. Does your commission specify a depreciation rate for gas storage facilities that is different from other LDC construction projects? Yes No

If yes, please describe any difference.

Responses to this question start from page 219.

21. Does your commission treat cushion gas (the amount of gas preserved in the underground storage cavern in order to maintain working pressure for normal delivery of storage gas) as a capital investment, as an expense, or as some other cost item? Capital Investment Expense Other Cost Item

Please describe the method chosen.

Responses to this question start from page 221.

22. Does your commission specify any regulation (such as the "correlative rights" or "rule of capture") for the treatment of underground stored gas leakage or movement? Yes No

If yes, please describe the regulation.

If no, do other state agencies prescribe any regulations concerning the treatment of underground gas leakage or movement? Yes No

Please list the names of the agencies and describe their regulations.

Responses to this question start from page 223.

23. Does your commission specify any specific way of determining and recovering the cost of gas lost due to leakage and underground movement? Yes No

If yes, please describe the method chosen.

Responses to this question start from page 227.

24. Do any of the LDCs under your commission's jurisdiction offer end-user services such as storage or storage banking? Yes No

If yes, please describe these services.

Has the Commission issued any guidelines or statements about the provision of such services? Yes No

If yes, please describe.

Responses to this question start from page 229.

25. Please describe the methods used in determining the rates for storage and storage-related services provided by the LDC for end-users.

Responses to this question start from page 233.

26. Are storage, storage banking, or other storage-related services being offered as separate services by the LDC or as part of a bundled service that a customer could purchase or both? Separate Bundled Service Both

Responses to this question start from page 235.

27. Does your commission allow jurisdictional LDCs to lease their storage facilities to end-users? Yes No

If yes, are any special requirements (such as an obligation to provide reliable services for core customers or certain eligibility requirements on the end-users) placed on the LDC or the end-user in the case of such an arrangement? Yes No

If yes, please describe these requirements and typical leasing contract provisions.

Responses to this question start from page 237.

28. Does your commission allow an end-user to operate the storage facilities that it has leased from an LDC? Yes No

If yes, are there any special requirements imposed on the end-user in operating the storage facilities? Yes No

If yes, please describe the special requirements.

Responses to this question start from page 239.

29. Does your commission oversee or regulate gas storage facilities owned by end-users? Yes No

If yes, are such facilities subject to the same types of regulations as LDC-owned storage facilities? Yes No

Please describe your commission's procedures and regulations dealing with gas storage facilities owned by end-users.

Responses to this question start from page 241.

30. Does any other state agency oversee or regulate gas storage facilities owned by end-users? Yes No

Please list the agencies and describe the regulations.

Responses to this question start from page 244.

31. Does your commission have specific criteria or guidelines for allocating any benefits, such as savings in gas costs, that the LDC might accrue from its use of storage? Yes No

If yes, please describe.

Responses to this question start from page 246.

32. Based on your knowledge, what is the extent of storage activity (for example, putting additional gas into storage, building new storage facilities, better utilization of existing facilities, etc.) being undertaken by jurisdictional LDCs in your state?

Has your commission encouraged this activity and in what way?

Responses to this question start from page 248.

33. Based on your knowledge, have jurisdictional LDCs used storage as a part of a strategy to achieve least-cost gas purchases? Yes No

If yes, please describe.

Responses to this question start from page 252.

34. Based on your knowledge, have any of the jurisdictional LDCs been hampered in their efforts to procure storage services or facilities from pipelines or other distributors? Yes No

If yes, please describe the possible hindrances.

Responses to this question start from page 254.

35. Based on your knowledge, have any of the jurisdictional LDCs purchased or leased storage service or facilities from pipelines or other sources on behalf of particular end-users? Yes No

If yes, please describe.

Responses to this question start from page 256.

36. Based on your knowledge, have any of the jurisdictional LDCs used gas storage to bargain with pipelines in the procurement of system gas supply? Yes No

If yes, please describe.

Responses to this question start from page 258.

1. Does a local distribution company (LDC) under your commission's jurisdiction need to obtain the commission's approval before constructing gas storage facilities? Yes _ No _

If yes, is a formal proceeding used in reviewing the application for constructing gas storage facilities? Yes _ No _

Does the commission issue a certificate of public convenience and necessity in approving the gas storage project? Yes _ No _

Please briefly describe your commission's procedures.

Alabama: The LDC does need the Commission's approval before constructing storage facilities. There is a formal proceeding and the Commission does issue a certificate of public convenience and necessity. After the LDC applies for the certificate, there would be a hearing, followed by an order granting or denying the certificate.

Alaska: The LDC does not need the Commission's approval before constructing storage facilities. The Commission does not issue a certificate of public convenience and necessity for storage projects. Certificates are required only for service areas and pipelines.

Arizona: The LDC does not need the Commission's approval before constructing storage facilities. The Commission does not issue a certificate of public convenience and necessity for storage projects.

Arkansas: The LDC does need the Commission's approval before constructing gas storage facilities. According to Arkansas Code Annotated Section 23-3-201 et seq., persons desiring to construct or operate equipment or facilities for supplying a public service or extension must first obtain from the Arkansas Public Service Commission (APSC) a certificate of public convenience and necessity (CPCN). An applicant for a CPCN must give notice of its application and file at the APSC the necessary information as required by the APSC. After hearing, the APSC has the power to issue or refuse the requested certificate.

California: The LDC does need the Commission's approval before constructing gas storage facilities. A certificate of public convenience and necessity is required if it is estimated that the costs will be in excess of $50 million. The utility must file an application with the Commission including specified information. Economic, environmental, aesthetic, community, etc. values are considered. Hearings may or may not be necessary.

Colorado: Generally the answer is yes. Major capital construction requires the above. Underground storage would be major capital construction.

Connecticut: No underground storage in Connecticut; the Commission through an annual review of supply would be aware of any storage involving LP-Air or LNG.

Delaware: The LDC does not need the Commission's approval before constructing storage facilities.

Florida: We do not have gas storage facilities in Florida.

Georgia: The LDC does not need the Commission's approval before constructing storage facilities. The Commission does not issue a certificate of public convenience and necessity for storage projects.

Idaho: The LDC does not need the Commission's approval before constructing storage facilities.

Illinois: The LDC does need the Commission's approval before constructing storage facilities. The LDC files a petition requesting a certificate of public convenience and necessity. The matter is set for hearing. The company must demonstrate (1) that the construction is necessary, (2) that it is consistent with the most recent energy plan adopted by the Commission for the company and for the State, (3) that the company is able to manage and supervise the construction, and (4) that the company is capable of financing the construction without serious adverse financial consequences.

Indiana: The LDC does need the Commission's approval before constructing storage facilities, however, no formal proceeding is used in reviewing the application. The Commission does not issue a certificate of public convenience and necessity.

Iowa: The LDC does need the Commission's approval before constructing storage facilities. A formal proceeding is used for reviewing the application, however, no certificate of public convenience and necessity is issued by the Commission. Iowa Code Chapter 479; Iowa Administrative Code Chapter 199-10.

Kentucky: Kentucky revised statutes define a utility to include ". . .storage of natural or manufactured gas. . . to or for the public for compensation. . ." KRS 278.010 (3)(B). With issues unrelated to storage the term "public" has been defined to mean consumption in Kentucky. While the issue of constructing a storage field has not been presented to the Commission, the answers to the above questions would probably be yes if the situation occurs.

Louisiana: The natural gas companies subject to the jurisdiction of this Commission do not have any gas storage facilities in Louisiana.

Maine: The LDC does need the Commission's approval before constructing storage facilities. There is a formal proceeding for reviewing the application for constructing gas storage facilities. The Commission does issue a certificate of public convenience and necessity for storage projects.

Maryland: The LDC does not need the Commission's approval before constructing storage facilities.

Massachusetts: The LDC does not need the Commission's approval before constructing storage facilities. The Commission does not issue a certificate of public convenience and necessity for storage projects.

Michigan: All of the above are "Yes" only if the LDC cannot obtain storage and mineral rights on a voluntary basis and condemnation is required. The certificate from the Commission is needed for the condemnation proceeding in court.

Mississippi: Yes, the LDC does need the Commission's approval before constructing storage facilities. The LDC applies for a certificate. The Commission staff reviews the application and the Commission issues an Order of approval or disapproval.

Missouri: No, the LDC does not need the Commission's approval before constructing storage facilities. The Commission does not issue a certificate of public convenience and necessity for storage projects.

Montana: No, the LDC does not need the Commission's approval before constructing storage facilities.

Nevada: Yes, the LDC does need the Commission's approval before constructing storage facilities. A formal proceeding is used for reviewing the application--whether it is legally required is debatable. Existing facilities did receive certificates.

New Hampshire: No, the LDC does not need the Commission's approval before constructing storage facilities.

New Jersey: Yes, under Department of Energy Act, N.J.S.A. 52:27F-1 et seq., and P.L. 1987, c.365 which amended the DOE Act, the Division of Energy Planning and Conservation (DEPC) has authority for general facility siting. In addition, N.J.S.A. 52:27F-15c gives DEPC coextensive jurisdiction with any other state instrumentality regarding energy facility siting anywhere in New Jersey. Application for construction must address the DEPC criteria specified in the Energy Master Plan. Public hearings may be held after public notice is given. A report is prepared either approving or disapproving the application based upon the public record.

New Mexico: No, the LDC does not need the Commission's approval before constructing storage facilities.

New York: Yes. The New York Public Service Commission does not have jurisdiction over actual storage fields but does review and issues certificates of environmental compatibility and public need (Article VII proceeding) for pipelines and related facilities going into and out of the storage fields providing that the lines are greater than 1,000 feet in length and operated at 125 Psi or greater.

North Carolina: No, the LDC does not need the Commission's approval before constructing storage facilities.

North Dakota: No, the LDC does not need the Commission's approval before constructing storage facilities. The Commission does not issue a certificate of public convenience and necessity for storage projects.

Ohio: No, the LDC does not need the Commission's approval before constructing storage facilities. The Commission does not issue a certificate of public convenience and necessity for storage projects.

Oklahoma: No, the LDC does not need the Commission's approval before constructing storage facilities. The Commission does not issue a certificate of public convenience and necessity for storage projects. The storage facilities are reviewed during a rate case proceeding to determine an appropriate level to earn a return on the facilities.

Oregon: No, the LDC does not need the Commission's approval before constructing storage facilities. The Commission does not issue a certificate of public convenience and necessity for storage projects. LDCs need commission approval in a general rate case to add facilities to rate base upon completion.

Pennsylvania: Yes, the LDC does need the Commission's approval before constructing storage facilities, however no formal proceeding is used. The Commission does not issue a certificate of public convenience and necessity for storage projects. If the facility involves expenditures in excess of $200,000 or 10 percent of the LDC's plant in service, whichever is less, the LDC must provide notification to this Commission at least 30 days prior to the commencement of work in accordance with 52 Pennsylvania Code Chapter 59.38.

Rhode Island: No, the LDC does not need the Commission's approval before constructing storage facilities.

South Carolina: No, the LDC does not need the Commission's approval before constructing storage facilities.

South Dakota: No, the LDC does not need the Commission's approval before constructing storage facilities.

Tennessee: Yes, the LDC does need the Commission's approval before constructing storage facilities. No formal proceeding is used. The Commission does not issue a certificate of public convenience and necessity. Reviewed and approved by engineering division as with all material construction projects; a Commission Order is then prepared.

Texas: No, the LDC does not need the Commission's approval before constructing storage facilities. The Commission does not issue a certificate of public convenience and necessity.

Utah: No, the LDC does not need the Commission's approval before constructing storage facilities. The Commission does not issue a certificate of public convenience and necessity. See attached copy of certain sections of Utah Code which touch on these questions.

Vermont: Yes, the LDC does need the Commission's approval before constructing storage facilities. A formal proceeding is used. The Commission does issue a certificate of public convenience and necessity. Peak shaving facility approved after 248 proceeding. Title 30, Section 248.

Virginia: Yes, the LDC does need the Commission's approval before constructing storage facilities. Virginia Code Section 56-265.2 requires formal or informal hearing for all improvements other than normal and ordinary line extensions. A certificate of public convenience and necessity is granted.

Washington: Yes, the LDC does need the Commission's approval before constructing storage facilities. A formal proceeding is not used. The Commission does issue a certificate of public convenience and necessity.

West Virginia: Yes, the LDC does need the Commission's approval before constructing storage facilities. A formal proceeding is used sometimes. The Commission does issue a certificate of public convenience and necessity. See copy of West Virginia Code Section 24-2-11.

Wisconsin: We have assumed for purposes of this questionnaire that gas storage is underground and limited to natural gas storage. The LDC files an application for a certificate of public convenience and necessity, setting forth the need, cost, and feasibility of the project. If the application proposes no change in type of gas supplied to the public, the Commission may or may not go to hearing to decide on the application. If the application proposes a change in the type of gas to be supplied, a hearing must be held.

Wyoming: 1) An application is required pursuant to Wyoming PSC Rule Section 202(c)4, 204, and 205 (earlier provision of information to Commission technical staff is urged to expedite review); 2) Public notice and opportunity for public hearing; 3) If no hearing required (or after hearing) final order; and 4) Staff field check, and staff review of rate effects for possible later rate hearing.

2. Does an LDC need to obtain approval from any other state or federal agency, such as an environmental protection agency or a department of natural resources, for the construction of gas storage facilities? Yes _ No _

If yes, please state the names of the agencies.

Alabama: No, not to my knowledge.

Alaska: Yes, the Department of Environmental Conservation and the Department of Natural Resources.

Arizona: Do not know.

Arkansas: No.

California: Yes, the Division of Oil and Gas within the Department of Conservation.

Colorado: Not certain what state or federal agencies would be involved.

Connecticut: Not applicable.

Delaware: Yes, Department of Natural Resources and Environmental Control.

Georgia: Yes, the State Fire Marshal's Office.

Idaho: Yes, FERC.

Illinois: Any permits or leases required by any other state or federal agency would be between that agency and the utility. The Illinois Commerce Commission would not be involved in that process.

Indiana: Yes, Indiana Department of Natural Resources.

Iowa: Yes, Department of Natural Resources.

Kentucky: Yes. Kentucky Department of Mines and Minerals determines compliance to correlative rights of mineral owners, well construction and completion, and documentation to protect gas horizons and fresh water supplies in the subsurface. These are the criteria used in looking at the construction of a storage field.

Maine: Yes, Maine Board of Environmental Protection.

Maryland: No.

Massachusetts: Yes, Massachusetts Energy Facilities Siting Council; Massachusetts Department of Environmental Protection (MEPA Unit).

Michigan: Yes, Michigan Department of Natural Resources.

Mississippi: Yes, Mississippi Oil & Gas Board.

Missouri: No.

Montana: Yes, Oil & Gas Commission--upon conversion of producing wells to storage fields.

Nevada: Yes, UEPA.

New Hampshire: No.

New Jersey: Yes, New Jersey Department of Environmental Protection; local building permits; CAFRA permits.

New Mexico: Unknown.

New York: Yes. New York State Department of Environmental Conservation has jurisdiction over the drilling of wells, well spacing, and storage field development and operation.

North Dakota: Yes, FERC if interstate system.

Oklahoma: No.

Oregon: Yes, Energy Facilities Site Evaluation Council (EFSEC) which solicits comments from State Department of Energy, Department of Geology and Mineral Industries, PUC, etc.

Pennsylvania: Yes, Pennsylvania Department of Environmental Resources, Bureau of Oil and Gas Management.

Rhode Island: The Department of Environmental Management; the local city or town.

South Carolina: Yes. Not sure of all agencies.

South Dakota: Not applicable.

Tennessee: Unknown.

Texas: Don't know.

Utah: Unknown.

Vermont: Yes, Environmental Agency - under Act 250 review.

Virginia: No.

Washington: Yes, Energy Facilities Siting Council.

West Virginia: Don't know.

Wisconsin: Yes, only when streams or wetlands are impacted.

Wyoming: Yes. The only gas storage facilities built in Wyoming are underground using depleted oil and gas fields. As such, any person constructing such a facility must obtain authority from the Wyoming Oil & Gas Conservation Commission. Permitting by the Wyoming Department of Environmental Quality would also be necessary for any venting or flaring from above ground or underground facilities.

3. Does a jurisdictional LDC need to obtain your commission's approval before acquiring or leasing storage facilities or services from an interstate or an intrastate pipeline? Yes _ No _

If yes, please describe your commission's procedure of approval.

Alabama: Never addressed. This is not specifically covered and would have to be decided on a case-by-case basis.

Alaska: Yes, review of contracts.

Arizona: No.

Arkansas: No.

California: Has never been an issue since only one interstate pipeline serving California has (minimal) storage. California LDCs have significant storage facilities.

Colorado: Probably not; it depends on the size of the undertaking. Any utility for its own sake should have a firm position from the PUC before undertaking major construction.

Connecticut: No.

Delaware: No.

Georgia: No. There are no gas wells in Georgia except for one land fill gas site.

Idaho: No.

Illinois: No.

Indiana: No.

Iowa: No.

Kentucky: LDCs which have storage facilities have had them for a long period of time. No additional storage fields have been acquired or leased. Some storage fields have been shut-in, which had some implications regarding depreciation/ amortization in previous rate cases.

Maine: Yes. If staff's informal review finds acquisition or lease satisfactory, Commission will grant approval. If staff has substantive questions, a formal proceeding will be conducted, including a public hearing.

Maryland: No.

Massachusetts: No.

Michigan: No.

Mississippi: The LDC applies for a certificate. The Commission staff reviews the application and the Commission issues an Order of approval or disapproval.

Missouri: No.

Montana: No.

Nevada: No, but cost recovery could be contingent on an approved gas resource plan.

New Hampshire: No.

New Jersey: No.

New Mexico: No.

New York: No, but the Commission has the right of final review of all costs passed through the monthly Gas Adjustment Clause (GAC).

North Carolina: No.

North Dakota: No.

Ohio: No. Storage contracts, like those for other supply options, are reviewed through the Gas Cost Recovery audit process and included in the LDC's long-term forecast once they are in place.

Oklahoma: Yes. The storage facility will need to be evaluated during a rate proceeding to determine a level of investment to be recovered.

Oregon: No. LDCs need Commission approval in a rate case to recover lease or acquisition costs in rates.

Pennsylvania: Yes. If one of the entities is an affiliated interest of the other, the LDC is required to make a filing with this Commission for a determination that the agreement between them is in the public interest.

Rhode Island: No.

South Carolina: No.

South Dakota: No.

Tennessee: Yes. See question #1.

Texas: No.

Utah: Yes, only if leasing from affiliated companies.

Vermont: Yes, if company plans to purchase facility and add to system or rate base.

Virginia: No.

Washington: No.

West Virginia: Yes, if the service is leased from an affiliate.

Wisconsin: Yes, no set procedure.

Wyoming: Yes. The Commission must give prior approval for any contracted-for storage under Section 37-3-111 Wyoming Statutes 1977 and Wyoming PSC Rule Section 218. The Commission may accept the contract for filing, or may follow the procedure set forth in answer to question #1 above.

4. Are any of the jurisdictional LDCs currently using storage facilities or services supplied by interstate or intrastate pipelines? Yes _ No _

If yes, please provide data on the LDCs' use of storage services and their load characteristics (such as average non-coincidental peak demand and coincidental peak demand).

Alabama: No.

Alaska: No.

Arizona: No, not to our knowledge.

Arkansas: Yes. Arkansas Louisiana Gas Company, bundled in transportation program.

California: No.

Colorado: No.

Connecticut: Yes. Virtually all storage services are "best effort" and as such are available to about 35-40 effective heating degree days. Peaking is met by LP-Air and LNG above this degree day level.

Delaware: Yes. See attachment 1.

Georgia: Yes. See attached data for peak day in December 1989 (peak for year also). This LDC has a number of storage sites to pull from. Only LNG and propane are in state.

Idaho: Yes.

WWP: C.P. 1,544,000 therms
Avg. 88,000 therms

IGC: C.P. 1,913,550 therms
Avg. 529,160 therms

Note: Quantities are firm load only and do not include transportation. Storage is used to meet peak.

Illinois: We don't have information about the storage load characteristics of LDC's use. The LDC may be able to provide such information. The following are the peak daily-withdrawal rates from storage with intrastate and interstate pipelines:

NiGas	498,000
Peoples	713,810
IP	66,861
CIPS	20,000
CILCO	-0-
North Shore	97,100

Indiana: Yes.

Northern Indiana Public Service Company
Indiana Gas Company, Inc.
Northern Indiana Fuel & Light Co.
Kokomo Gas & Fuel Company
Richmond Gas Corporation
Citizens Gas & Coke Utility

* No specific data available on load characteristics.

Iowa: Yes. LDCs currently purchase storage services as part of their firm supply to help meet peak demand.

Kentucky: No. We cannot be absolutely sure of this answer regarding interstate services. To the extent such use does occur it has not become an issue in any formal proceedings before the Kentucky Commission.

Maine: No.

Maryland: Yes. LDC use of storage for Design Day - PY90

	Storage Gas (Dth)	Total Supplies (Dth)
Washington Gas Light	356,100	1,244,700
Baltimore Gas & Electric	177,439	764,997
Columbia Gas of MD	13,873	45,793

Massachusetts: Yes. See attachment.

Michigan: Yes. Data not available.

Mississippi: No.

Missouri: Yes. Information not readily available.

Montana: No. Not on a disaggregated basis.

Nevada: Yes.

New Hampshire: Yes. New Hampshire has two jurisdictional natural gas companies. Both have contracts with storage companies. Energy North Natural Gas receives firm underground storage service from three companies but can only obtain interruptible transportation service. Northern Utilities receives second-best underground storage from one company and has the gas delivered under interruptible transportation arrangements. Both utilities endeavor to receive the gas at a uniform daily rate covering a sixty-day period around December and January of each year.

New Jersey: Yes. Not applicable.

New Mexico: No.

New York: Yes. See attached sheets from New York Gas Group Report.

North Carolina: Yes, LGA - a liquified LNG Service, PS-2 - a peaking service, and GSS - General Storage Service. All of these are for peak service to high priority customers.

North Dakota: No.

Ohio: Yes. Cincinnati Gas & Electric - 3.9 BCF firm storage service from Col. Gas Trans.
Columbia Gas of Ohio - 22.6 BCF firm storage service from Col. Gas Trans.
Dayton Power and Light - 4.5 BCF firm storage service from Col. Gas Trans.
Ohio Gas - 100 MMcf maximum annual storage from ANR pipeline
West Ohio Gas - 1.2 BCF firm storage service from Col. Gas Trans.

Oklahoma: No.

Oregon: Yes. LDCs use underground storage for about thirty days of full dispatch to meet noncoincidental peak loads. Also, LDCs can use LNG for about seven days of full dispatch to meet coincidental peak demand.

Pennsylvania: Yes. To the extent available this information is provided in attachment 1.

Rhode Island: Yes. LDCs use storage facilities out-of-state. There is little review of costs associated therewith at this commission. We do not have the information you are looking for.

South Carolina: Yes. Used for winter peaking service to meet firm requirements.

South Dakota: No.

Tennessee: Yes. One LDC leases LNG space from an interstate pipeline. Coincidental peak.

Texas: Yes. See attached tables.

Utah: No.

Vermont: No.

Virginia: Yes.

Washington: Yes.

West Virginia: Yes, Mountaineer Gas uses an allocated portion of Columbia Transmission's storage. Allocations based on settlement.

Wisconsin: Yes. Data on use of storage not readily available.

Wyoming: No.

5. Does a jurisdictional LDC need to obtain the commission's approval before leasing or acquiring storage facilities from other distributors within the state or distributors in other states? Yes _ No _

If yes, please describe your commission's procedure of approval.

Alabama: Never addressed. This is not specifically covered and would have to be decided on a case-by-case basis.

Alaska: No.

Arizona: No.

Arkansas: No.

California: Yes, through some formal application or request.

Colorado: No.

Connecticut: No.

Delaware: No.

Georgia: No.

Idaho: No.

Illinois: Yes. (No, out of state.) If one jurisdictional LDC wishes to lease or purchase the storage facilities of another jurisdictional public utility, both entities must seek Commission approval. The companies file a petition. The Commission holds a hearing if deemed necessary, and the Commission grants its approval if it determines that the petition should reasonably be granted and that the public will be convenienced thereby.

Indiana: Yes. Indiana Code 8-1-2-84 (see attachment A).

Iowa: No.

Kentucky: No. LDCs which have storage facilities have had them for a long period of time. No additional storage fields have been acquired or leased. Some storage fields have been shut-in, which had some implications regarding depreciation/ amortization in previous rate cases.

Maine: Yes. If staff's informal review finds acquisition or lease satisfactory, Commission will grant approval. If staff has substantive questions, a formal proceeding will be conducted, including a public hearing.

Maryland: No.

Massachusetts: No.

Michigan: No.

Mississippi: Yes. The LDC applies for a certificate. The Commission staff reviews the application and the Commission issues an Order of approval or disapproval.

Missouri: No.

Montana: No.

Nevada: No, but cost recovery could be contingent on an approved gas resource plan.

New Hampshire: No.

New Jersey: No.

New Mexico: No.

New York: No. The acquiring LDC is not required to obtain prior approval, however, all costs that are passed through the monthly Gas Cost Adjustment are reviewed subject to disallowance by the Commission. The selling or leasing LDC must obtain permission to "transfer or lease...any part of such...works or system... ." Evidence would be required that the sale or transfer is not adverse to the public interest.

North Carolina: No.

North Dakota: No.

Ohio: Yes. The contract must be submitted and receive Commission approval pursuant to Section 4905.48, Revised Code which governs transactions between public utilities. An example is included.

Oklahoma: Yes. Staff reviews the storage gas facilities during rate proceedings.

Oregon: No. See question #3.

Pennsylvania: Yes. If one of the entities is an affiliated interest of the other, the LDC is required to make a filing with this Commission for a determination that the agreement between them is in the public interest.

South Carolina: No.

South Dakota: No.

Tennessee: Yes. See question #1.

Texas: No.

Utah: No.

Virginia: The Utility Transfers Act requires Commission approval prior to the transfer, by lease or acquisition, of any interest in public utility facilities under the jurisdiction of the SCC.

Washington: No.

West Virginia: Yes, review of disposition of utility assets.

Wisconsin: Yes. No set procedure.

Wyoming: Yes. See question #3 above.

6. Are any of the jurisdictional LDCs currently leasing or acquiring storage facilities or services from other distributors within the state or from distributors in other states? Yes _ No _

If yes, please provide relevant data.

Alabama: No.

Alaska: No.

Arizona: No. Note: there may be a small LDC which distributes propane that uses underground storage facilities.

Arkansas: No.

California: No. San Diego Gas and Electric Company, an LDC and wholesale customer of Southern California Gas Company, was allocated a share of SoCal's storage facilities, which the Commission authorized through a decision. However, this is neither an acquisition or a lease.

Colorado: No.

Connecticut: No.

Delaware: No.

Georgia: No.

Idaho: No.

Illinois: Transactions between two or more jurisdictional utilities are subject to Commission approval, transactions between a jurisdictional utility and any other entity are not.

Indiana: No.

Iowa: No.

Kentucky: No.

Maine: Yes. Northern Utilities - Penn-York Storage - pipeline gas storage
Northern Utilities - Bay State Gas - LNG storage

Maryland: No.

Massachusetts: No.

Michigan: Yes. Southeastern Michigan Gas Co. is leasing 1.5 Bcf from Eaton Rapids Storage Co.; Michigan Gas Utilities Co. is leasing 1.6 Bcf from Michigan Consolidated Gas Co. and 2 Bcf from Consumers Power Co.; Michigan Gas Co. is leasing 2 Bcf from Eaton Rapids Storage Co. and 2 Bcf from Consumers Power Co.

Mississippi: No.

Missouri: No.

Montana: No.

Nevada: No.

New Hampshire: Yes. Energy North Natural Gas has a propane storage agreement with Colonial Gas of Massachusetts. Colonial provides ENGI with 500,000 gallons of capacity.

New Jersey: Not applicable.

New Mexico: No.

New York: No.

North Carolina: No.

North Dakota: No.

Ohio: Yes. Columbia Gas of Ohio - 2.5 BCF from East Ohio Gas Company
Ohio Gas - 300 MMCF annual storage from Michigan Consolidated
River Gas - 500 MMCF annual storage from East Ohio Gas Company

Oklahoma: No.

Oregon: Yes. Cascade Natural leases underground storage from Washington Water Power.

Pennsylvania: No.

Rhode Island: Yes. Bristol and Warren and South County Gas companies utilize some of Providence Gas Company's portion of an LNG tank in the state that is owned by Algonquin Gas Transmission Co.

South Carolina: No.

South Dakota: No.

Tennessee: Yes. One LDC acquired an underground storage facility from another interstate pipeline in another state.

Texas: Don't know.

Utah: No.

Vermont: No.

Virginia: No.

Washington: Yes.

West Virginia: No.

Wisconsin: No.

Wyoming: No.

7. Does a jurisdictional LDC need to obtain the commission's approval before leasing or acquiring storage facilities from sources other than pipelines and other distributors (such as oil and gas producers)? Yes _ No _

If yes, please describe your commission's procedure of approval.

Alabama: Never addressed. This is not specifically covered and would have to be decided on a case-by-case basis.

Alaska: No.

Arizona: No.

Arkansas: No.

California: Don't know, very unlikely event in California.

Colorado: No.

Connecticut: No.

Delaware: No.

Georgia: No.

Idaho: No.

Illinois: No.

Indiana: No.

Iowa: No.

Kentucky: No. LDCs which have storage facilities have had them for a long period of time. No additional storage fields have been acquired or leased. Some storage fields have been shut-in, which had some implications regarding depreciation/ amortization in previous rate cases.

Maine: Yes. If staff's informal review finds acquisition or lease satisfactory, Commission will grant approval. If staff has substantive questions, a formal proceeding will be conducted, including a public hearing.

Maryland: No.

Massachusetts: No.

Michigan: No.

Mississippi: Yes. No procedure developed--never had a request by an LDC.

Missouri: No.

Montana: No.

Nevada: No, but cost recovery could be contingent on an approved gas resource plan.

New Hampshire: No.

New Jersey: No.

New Mexico: No.

New York: No, but the Commission has the right of final review of all costs passed through the monthly GAC.

North Carolina: No.

North Dakota: No.

Ohio: No.

Oklahoma: Yes. The Corporation Commission reviews the fuel procurement practices of each LDC on a six-month basis. The utility will need to demonstrate the need of the facility for recovery of cost during the six-month Purchase Gas Adjustment hearing.

Oregon: No. See question #3.

Pennsylvania: Yes. If one of the entities is an affiliated interest of the other, the LDC is required to make a filing with this Commission for a determination that the agreement between them is in the public interest.

Rhode Island: No.

South Carolina: No.

South Dakota: No.

Tennessee: Yes. See question #1.

Texas: No.

Utah: Yes, only if dealing with affiliated companies.

Virginia: No, however, pass-through subject to PGA review.

Washington: No.

West Virginia: No.

Wisconsin: Yes. No set procedure.

Wyoming: Yes. See question #3 above.

8. Are any of the jurisdictional LDCs currently leasing or acquiring storage facilities or services from sources other than pipelines and other distributors? Yes _ No _

If yes, please provide relevant data.

Alabama: No.

Alaska: No.

Arizona: No, but, as mentioned in question #6, there may be a small LDC which distributes propane that uses underground storage facilities.

Arkansas: No.

California: No. See answer question #6.

Colorado: No.

Connecticut: No.

Delaware: No.

Georgia: No.

Idaho: No.

Illinois: Transactions between two or more jurisdictional utilities are subject to Commission approval. Transactions between a jurisdictional utility and any other entity are not.

Indiana: No.

Iowa: No.

Kentucky: No.

Maine: Yes. Northern Utilities - Penn-York Storage

Maryland: No.

Massachusetts: Yes. See attachment.

Michigan: No.

Mississippi: No.

Missouri: No.

Montana: No.

Nevada: No.

New Hampshire: No.

New Jersey: No.

New Mexico: No.

New York: Yes. Several utilities subscribe to storage service from Honeoye Storage Corp. which is owned jointly by three downstate LDCs. NYSEG and O&R lease off-site storage for LPG for their peaking plants.

North Carolina: Yes, LDC's have made arrangements to buy winter storage service if their need requires such service. These have not been long-term arrangements.

North Dakota: No.

Ohio: No.

Oklahoma: No.

Oregon: Yes. Northwest Natural Gas Company has developed its own LNG and underground storage facilities.

Pennsylvania: No.

Rhode Island: Yes. Valley Gas Company has some out-of-state storage--we have no detailed information.

South Carolina: No.

South Dakota: No.

Tennessee: No.

Texas: Don't know.

Utah: No.

Vermont: Yes, Vermont Gas Systems built a peak shaving facility containing LP storage after a 248 proceeding.

Virginia: No.

Washington: Yes, Northwest Natural Gas owns its own storage facility at Mist, Oregon.

West Virginia: No.

Wisconsin: No.

Wyoming: No.

9. Does your commission monitor the day-to-day operations of the gas storage facilities owned and operated by the jurisdictional LDCs? Yes _ No _

What is the frequency of the commission's monitoring of storage facility operations?

_____

Please describe the commission procedure for monitoring the operation of storage facilities.

Alabama: The Commission monitors storage facility operations annually. They are monitored as part of the audits and facilities inspections.

Alaska: No, the Commission does not monitor storage facility operations.

Arizona: No, the Commission does not monitor storage facility operations.

Arkansas: No, the Commission does not monitor storage facility operations.

California: No, the Commission doesn't routinely monitor day-to-day operations of storage facilities. Review of storage operations does take place in annual reasonableness review proceedings, triannual general rate cases, and during special events such as curtailments.

Colorado: No, the Commission does not monitor storage facility operations.

Connecticut: No, the Commission does not monitor storage facility operations.

Delaware: No, the Commission does not monitor storage facility operations.

Georgia: Yes, the Commission monitors storage facility operations yearly. They are monitored from a safety standpoint only.

Idaho: No, the Commission does not monitor storage facility operations.

Illinois: The storage facility operations are subject to Commission oversight but a regularly scheduled operation review is not performed at this time. Storage facilities operations are usually reviewed during rate case proceedings.

Indiana: No, the Commission does not monitor storage facility operations on a day-to-day basis. Commission staff reviews a utility's storage operations in connection with rate proceedings filed with the Commission, routine safety inspections and the quarterly and semi-annual Gas Cost Adjustment proceedings.

Iowa: No, the Commission does not monitor storage facility operations.

Kentucky: No, the Commission does not monitor storage facility operations on a day-to-day basis. Monitoring is done on an as-needed basis. When storage facility operations have become an issue (most recently regarding Western Kentucky Gas and a proposed bypass), staff requested detailed information from Western regarding daily, seasonal, and annual injection and drawdown volumes, operating pressures, and other system characteristics.

Maine: No, the Commission does not monitor storage facility operations on a day-to-day basis. Biannual monitoring is done during CGA proceedings--one winter, one summer.

Maryland: No, the Commission does not monitor storage facility operations.

Massachusetts: No, the Commission does not monitor storage facility operations. The Department receives weekly copies of daily information on LDC receipt of supplies, dispatch of sendout, and supply levels during the winter months of November through April.

Michigan: Yes, the Commission does monitor storage facility operations. The frequency of monitoring varies. Periodic field inspections are conducted as resources permit.

Mississippi: No, the Commission does not monitor storage facility operations.

Missouri: No, the Commission does not monitor storage facility operations.

Montana: No, the Commission does not monitor storage facility operations.

Nevada: Yes, during audit and under pipeline safety.

New Hampshire: Yes. The Commission employs a gas safety engineer--responsibilities cover propane and LNG bulk storage facilities.

New Jersey: No, the Commission does not monitor the day-to-day operations of the gas storage facilities. Monitoring is done yearly in purchased gas adjustment negotiations.

New Mexico: No, the Commission does not monitor the day-to-day operations of the gas storage facilities. Review of gas injected and withdrawn is done on a monthly basis through the PGAC.

New York: No, the Commission does not monitor the day-to-day operations of the gas storage facilities.

North Carolina: Yes, the Commission does monitor storage facility operations daily. The companies submit daily dispatching sheets that contain all purchases and withdrawals and injections into or from storage.

North Dakota: No.

Ohio: No.

Oklahoma: No, the Commission does not monitor the day-to-day operations of the gas storage facilities. Monitoring is done monthly. Staff performs audits every six months for Purchase Gas Adjustment hearings. In this process staff examines injections, withdrawals, and pricing of gas.

Oregon: No, the Commission does not monitor the day-to-day operations of the gas storage facilities. Monitoring is done once a year. Purchase Gas Adjustment filings made each autumn include storage gas volumes and prices.

Pennsylvania: No.

Rhode Island: Yes, the Commission does monitor the day-to-day operations of the gas storage facilities. Monitoring is done monthly. The Commission only monitors LNG storage in compliance with CFR part 193.

South Carolina: No, the Commission does not monitor the day-to-day operations of the gas storage facilities. Monitoring is done annually. Review is done in public hearings concerning purchasing policies and Purchased Gas Adjustment.

South Dakota: No facilities exist.

Tennessee: No, the Commission does not monitor the day-to-day operations of the gas storage facilities. Monitoring done in rate case. Determine an average inventory level.

Texas: Yes, the Commission does monitor the day-to-day operations of the gas storage facilities. Monitoring done every two weeks from November through March.

Utah: No, the Commission does not monitor the day-to-day operations of the gas storage facilities.

Vermont: Yes, Department of Public Service monitors the day-to-day operations. Storage facilities are required to report incidents to PSB and DPS; also required to furnish reports.

Virginia: No, the Commission does not monitor the day-to-day operations of the gas storage facilities.

Washington: No, the Commission does not monitor the day-to-day operations of the gas storage facilities.

West Virginia: No, the Commission does not monitor the day-to-day operations of the gas storage facilities.

Wisconsin: No, the Commission does not monitor the day-to-day operations of the gas storage facilities.

Wyoming: No, the Commission does not monitor the day-to-day operations of the gas storage facilities. Periodic inspections done along with other gas facilities. Physical facilities are inspected for compliance with the Safety Regulations of the U.S. Department of Transportation. Input and output of gas and volumes are monitored during rate proceedings.

10. Does your commission specify any delivery and operating conditions (such as peak delivery from storage or injection rate into storage, number of wells tapping into a storage reservoir, etc.)? Yes _ No _

If yes, please describe the specified conditions.

Alabama: No.

Alaska: No.

Arizona: No.

Arkansas: No.

California: No. See answer question #9.

Colorado: No.

Connecticut: No.

Delaware: No.

Georgia: No.

Idaho: No.

Illinois: No.

Indiana: No.

Iowa: No.

Kentucky: No.

Maine: No.

Maryland: No.

Massachusetts: No.

Michigan: No.

Mississippi: No.

Missouri: No.

Montana: No.

Nevada: No.

New Hampshire: Yes. Each LDC must have supplies available to meet a specified seven-day cold spell. After subtracting available pipeline supplies this translates into a requirement of on-site storage capacity (i.e., LNG and propane).

New Jersey: No.

New Mexico: No.

New York: No.

North Carolina: No.

North Dakota: No.

Ohio: No.

Oklahoma: No.

Oregon: No.

Pennsylvania: No.

Rhode Island: No.

South Carolina: No.

South Dakota: No.

Tennessee: No.

Texas: No.

Utah: Not applicable.

Vermont: No.

Virginia: No.

Washington: No.

West Virginia: No.

Wisconsin: No.

Wyoming: No. The Commission does specify how much storage goes into the rate base of an LDC. See attached Order regarding Northern Gas Company et al.

11. Does your commission have in place any safety regulations dealing with gas storage facilities? Yes _ No _

If yes, please describe the safety regulations.

Alabama: Yes, adopted Part 193, CFR 49.

Alaska: No.

Arizona: Yes, 49 CFR, parts 191, 192, and 195 as may be applicable.

Arkansas: No.

California: Yes. General Orders 94-B (Rules governing gas holders) and 112-D (Rules governing gas systems) [to include LNG storage].

Colorado: No.

Connecticut: Not applicable.

Delaware: No.

Georgia: Yes. We use the Federal Minimum Safety Standards - Parts 191, 192, and 193 for LNG and Propane.

Idaho: No.

Illinois: To the extent applicable, 49 CFR Part 192.

Indiana: Yes. 49 CFR Part 192 & 193; Indiana Administrative Code (see attachment B) (170 IAC 5-3).

Iowa: Yes. State has adopted 49 CFR Part 192.

Kentucky: No.

Maine: Yes. Just CFR 49 Parts 191, 192, and 193 regarding the safety of natural gas including storage facilities and LNG and propane storage facilities.

Maryland: No.

Massachusetts: No.

Michigan: Yes. All piping in gas storage field must comply with Michigan Gas Safety Code.

Mississippi: No. Federal Safety Standards apply.

Missouri: Yes. Enforcement of 49 CFR 192.163, 192.165, 192.167, 192.171, 192.173, 192.479, 192.619, 192.722, and 192.735.

Montana: No--except Federal Pipeline Safety considerations.

Nevada: Yes. Commission is agent for federal safety regulations.

New Jersey: Yes. Title 49 CFR Part 193.

New Mexico: No.

New York: Yes. The Commission follows industry consensus standards. For LPG, we use the National Fire Protection Codes. For LNG, we adopt the Federal Safety Code. For underground storage, there are no safety regulations either in place or adopted by the Commission.

North Carolina: Yes, D.O.T. Pipeline Safety Code.

North Dakota: Yes. Code of Federal Regulations - Section 49, adopted June 1, 1984, as section 69-09-03-02, North Dakota Administrative Code.

Ohio: Yes. Storage facility safety requirements extend to the safety of the pipeline leading to the compressor and the compressor station itself, in the same manner as other pipelines and compressors.

Oklahoma: No.

Oregon: Yes. 49 CFR, Parts 191, 192, 193, 199.

Pennsylvania: No.

Rhode Island: Yes. LNG storage only CFR part 193.

South Carolina: No. None in state.

South Dakota: No.

Tennessee: Yes. We inspect LNG facilities of LDCs.

Texas: Don't know.

Utah: Yes, have regulations that adopt the Federal Pipeline Safety Rules.

Vermont: Yes, Federal Code plus State Gas Safety Rules and Regulations.

Virginia: Yes, the Virginia Commission has adopted in total the Pipeline Safety Regulations of the D.O.T.: parts 190 through 195, subchapter D of Title 49 of the Code of Federal Regulations.

West Virginia: Don't know.

Wisconsin: No.

Wyoming: Yes. Safety Regulations of the U.S. Department of Transportation.

12. Does your commission specify an injection period (such as summer) during which gas is to be placed into storage? Yes _ No _

Please specify the injection period or the procedure used in determining such a period.

Alabama: No.

Alaska: No.

Arizona: No.

Arkansas: No.

California: No. (The "injection season" is generally recognized as April through October, but this is not specifically an order, requirement, or guideline.)

Colorado: No.

Connecticut: No.

Delaware: No.

Georgia: No.

Idaho: No.

Illinois: No.

Indiana: No.

Iowa: No.

Kentucky: No.

Maine: No. Our gas utility does inject its pipeline gas into its Penn-York storage facilities during the off-peak summer months. No procedures used in determining such a period.

Maryland: No.

Massachusetts: No.

Michigan: No. Generally injection is from April through October.

Mississippi: No.

Missouri: No.

Montana: No.

Nevada: No.

New Hampshire: No. Injection is dictated by availability and price.

New Jersey: No.

New Mexico: No.

New York: No.

North Carolina: No.

North Dakota: No.

Ohio: No. However, the injections are made typically between April and October, corresponding with the nonheating season.

Oklahoma: No.

Oregon: No. LNG injection is a slow thermodynamic process that takes most of the summer, regardless. Underground storage injection generally occurs during the summer when spot gas is cheapest.

Pennsylvania: No.

Rhode Island: No.

South Carolina: No.

South Dakota: No.

Tennessee: No.

Texas: No.

Utah: No, not applicable.

Vermont: No.

Virginia: No.

Washington: No.

West Virginia: No.

Wisconsin: No.

Wyoming: No.

13. Does your commission specify a delivery period (such as winter) during which gas can be taken from storage? Yes _ No _

Please specify the delivery period or the procedure used in deciding such a period.

Alabama: No.

Alaska: No.

Arizona: No.

Arkansas: No.

California: No. (The delivery period is generally recognized as November through March, but this is not specifically an order, requirement, or guideline.)

Colorado: No.

Connecticut: No.

Delaware: No.

Georgia: No.

Idaho: No.

Illinois: No.

Indiana: No.

Iowa: No.

Kentucky: No.

Maine: No. Delivery period is dependent on the contract between Northern and Tennessee Gas Pipeline which delivers the gas from storage and transports it to Northern's system. Delivery is during the peak winter months. No procedure used in deciding such a period.

Maryland: No.

Massachusetts: No.

Michigan: No. Generally withdrawal is from November through March.

Mississippi: No.

Missouri: No.

Montana: No.

Nevada: No.

New Hampshire: No. The delivery period is dictated by the demands on the distribution system and the costs of the available gas supplies.

New Jersey: No.

New Mexico: No.

New York: No.

North Carolina: No.

North Dakota: No.

Ohio: No. However, the withdrawals are taken typically between November and March, corresponding with the heating season.

Oklahoma: No.

Oregon: No. Storage gas is not dispatched for interruptible loads until it is no longer needed for winter reserve.

Pennsylvania: No.

South Carolina: No.

South Dakota: No.

Tennessee: No.

Texas: No.

Utah: No, not applicable.

Vermont: Not specifically required, but this facility was constructed to be used in emergencies and peak load situations; peak occurs in January and February.

Virginia: No.

Washington: No.

West Virginia: No.

Wisconsin: No.

Wyoming: No.

14. Please describe your commission's procedures for allocating the costs of gas purchased for storage.

Alabama: Allocated to all firm customers.

Alaska: None allocated at this time.

Arizona: Not applicable.

Arkansas: Not applicable.

California: One LDC separately accounts for gas purchased for core and noncore customers. See Attachment A. This is intended to avoid summer curtailments of utility electric generation (UEG) customers in southern California. The other LDC books gas purchased for storage to the core market portfolio account.

Attachment A: I.86-06-005 et al. ALJ/KIM/pc

Southern California Gas Company
Illustrative Operating Plan
1989-1990
MMcf/d

	Core Supply Purchases			Storage (Inj.)/With.			
	Long-term	Spot	Total	Core Reqmnt.	Core Storage	Non-core Storage	Net Storage
1989							
Mar	1205*	0	1205	1085	(120)	(285)	(405)
Apr	1140	230	1370	1150	(220)	(44)	(264)
May	1115	225	1340	900	(440)	(90)	(530)
Jun	945	75	1020	760	(260)	(170)	(430)
Jul	935	0	935	710	(225)	225	0
Aug	825	0	825	700	(125)	125	0
Sept	960	0	960	720	(240)	240	0
Oct	830	0	830	830	0	0	0
Nov	1015	0	1015	1215	200	0	200
Dec	950	0	950	1700	750	0	750
1990							
Jan	1395	0	1395	1715	320	0	320
Feb	1380	0	1380	1570	190	0	190
Mar	1110	190	1300	1470	170	0	170
13 Mo. Avg.	1062	55	1117	1117	0	0	0

*Recorded March 1989 "Inj." = injection into storage; "with." = withdrawal from storage
The data in this table are based on average temperature conditions.

Colorado: None.

Connecticut: Gas purchased for storage is allocated to customers, both firm and interruptible, at the time of withdrawal at the average inventory price. In allocating gas costs between firm and interruptible, the lowest commodity or inventory rate is assigned to firm first and then to interruptible on a daily basis.

Delaware: There is no allocation - all costs go to system supply average.

Georgia: Cost of gas while in storage is a capital asset and earns a return; when used, cost of gas flows through PGA.

Idaho: Several cost-of-service methods are typically presented to the Commission. These are reviewed along with other considerations and the Commission makes a

decision based on many factors including cost-of-service. Thus, it is difficult to cite a specific method of allocation as the accepted method. The majority of gas costs are allocated on the basis of total therms with lesser amounts being allocated on the basis of therms used in winter months.

Illinois: The net cost of excess withdrawals from storage over injections is added to purchased gas each month to determine total cost of gas to be divided by total therms. An excess of injections over withdrawals is subtracted from purchased gas cost.

Indiana: Capacity Related Costs - Peak Day Demands
Commodity Related Costs - Commodity Basis

Iowa: IAC Chapter 199-19.10.

Kentucky: Cost of storage gas is part of the weighted average cost of gas to all end-users taking system supply gas.

Maine: There are none. (See attached copy of Chapter 43 - Cost of Gas Adjustment - our regulations governing CGA filings and proceedings).

Maryland: Allocated as a commodity cost of gas.

Massachusetts: See attached copy of the Department's Standard Cost of Gas Adjustment Clause.

Michigan: The cost of gas from storage is priced using the inventory method chosen by the utility (may be LIFO, FIFO or average). This cost is allocated on a commodity basis.

Mississippi: Very small amount of storage. No procedure for cost allocation.

Missouri: Costs are generally allocated to firm customers.

Montana: Via incremental cost of service studies.

Nevada: Ad hoc during a PGA proceeding.

New Hampshire: Natural gas stored in underground storage facilities is withdrawn only during the winter months and the costs reflected in the sixth monthly winter-cost-of-gas adjustment.

New Jersey: Various, but usually through the gas fuel clause.

New Mexico: Done through the PGAC on a monthly basis.

New York: The costs of gas purchased for storage are forecast in a rate proceeding for the first year of new rates based on expected price and injection/withdrawal schedules. An average monthly balance is then determined and allowed in rate base. The cost of the stored gas is then expensed on an average inventory cost basis at the time of withdrawal and flowed through the monthly gas cost

adjustment. In a fully allocated cost of service study, storage costs are considered demand related and generally allocated based on peak demand of the firm service classes.

North Carolina: Allocated to high priority markets.

North Dakota: Hasn't been addressed.

Ohio: Under Ohio's gas cost recovery mechanism (4905.302 Revised Code and 4901:1-14 Administrative Code) total annual gas purchases are included in the quarterly calculation of the "expected gas cost." The expected gas cost is compared, in a subsequent quarterly period, to the actual monthly cost of gas. In determining the actual monthly book cost of gas, injections are backed out and withdrawals are included, priced at the appropriate vintage price (most LDCs use LIFO pricing). These costs form the rates that are charged uniformly to all sales customers of the LDC.

Oklahoma: The Corporation Commission typically utilizes the last approved cost of service method. These methods usually are coincidental peak and average, and excess.

Oregon: It is first capitalized to inventory and then expensed in the annualized WACOG as part of Purchased Gas Adjustment filings.

Pennsylvania: Cost of service.

South Carolina: Cost of gas is recovered through Purchased Gas Adjustment from firm customers.

South Dakota: Our regulated LDCs have not purchased gas for storage in the past and we do not expect them to in the near future.

Tennessee: Gas purchased for storage is allocated to "firm" customers.

Texas: No set procedure.

Utah: Not applicable.

Vermont: New facility, not on line yet.

Virginia: Peak-day demand costs allocated on peak-day sales; winter season entitlement allocated on total winter season sales; withdrawals allocated on energy.

Washington: Depends on LDC - part of rate case.

West Virginia: Commodity allocation.

Wisconsin: We use a computerized cost-of-service study by which we allocate costs among appropriate customer classes.

Wyoming: Stored gas and cushion gas are treated as rate base items allocated to all customers either on an Mcf or peak-day basis.

15. Is the cost allocation for storage gas among residential, commercial, and industrial customers different from the regular cost allocation of system gas supplies? Yes _ No _

If yes, please describe the difference.

Alabama: It is the same as the allocation for demand cost, not all gas costs.

Alaska: No.

Arizona: No.

Arkansas: No.

California: Yes. The gas purchased by the LDC for the noncore portfolio for storage is only for UEG customers during the summer. If unused, the gas could be transferred to the core portfolio or could be used for noncore storage banking. For the other LDC, storage gas is only for core customers.

Colorado: No.

Connecticut: No.

Delaware: No.

Georgia: No.

Idaho: Yes. Typically, storage gas would be allocated on the basis of coincident peak or winter therms. Other gas commodity costs are allocated on the basis of total therms.

Illinois: No.

Indiana: No.

Iowa: No.

Kentucky: No.

Maine: No.

Maryland: No.

Massachusetts: No.

Michigan: No.

Mississippi: No.

Missouri: No.

Montana: No. At present there is only the incremental cost of service allocation.

Nevada: Yes. Probably, but no cases have been presented.

New Hampshire: No.

New Jersey: No.

New Mexico: No.

New York: No.

North Carolina: Yes. Storage allocated to customers who use the services during the winter period, or for peak-day periods. Pipeline supplies are spread on peak-and-average basis.

North Dakota: No.

Ohio: No. As indicated in the previous answer, all costs of purchased gas are included in the GCR and applied uniformly to all sales customers' bills.

Oklahoma: Yes. The term system gas supplies are usually allocated by a commodity rate. The storage facilities are typically used for peak demands on the system; accordingly staff consider peak demand as the appropriate method for allocating storage.

Oregon: No.

Pennsylvania: No.

South Carolina: Yes. Cost recovered from firm customers.

South Dakota: Not applicable.

Tennessee: No.

Texas: No.

Utah: Not applicable.

Vermont: Unknown; new facility.

Virginia: No.

Washington: No.

West Virginia: No.

Wisconsin: No.

Wyoming: Yes. System gas supplies are expense items where the gas in storage is rate base. Once gas is removed from storage the cost of the gas is treated as system supply.

16. Is the cost allocation for storage gas between core and noncore customers different from the regular cost allocation of system gas supplies? Yes _ No _

If yes, please describe the difference.

Alabama: No.

Alaska: No.

Arizona: No.

Arkansas: No.

California: Yes. See above.

Colorado: No.

Connecticut: No.

Delaware: No.

Georgia: No.

Idaho: Yes. Typically, storage gas would be allocated on the basis of coincident peak or winter therms. Other gas commodity costs are allocated on the basis of total therms.

Illinois: No.

Indiana: No.

Iowa: No.

Kentucky: No.

Maine: Yes. Our dual-fuel interruptible gas customers are charged a price for gas in relation to their alternate fuel but in no case lower than 5 cents above the commodity price of gas. During off-peak winter months interruptible customers can take gas while underground storage is being sent out, but only at a price above the cost of storage gas.

Maryland: No.

Massachusetts: No.

Michigan: No.

Mississippi: No.

Missouri: No.

Montana: No. At present there is only the incremental cost-of-service allocation.

Nevada: Not tested.

New Hampshire: No.

New Jersey: No.

New Mexico: No.

New York: No. All variable costs associated with the gas supply are allocated on a commodity basis. However, demand costs (related to firm contract gas) and capacity charges are assigned solely to firm (core) customers.

North Carolina: Yes. See question #15.

North Dakota: No.

Ohio: No. There is no distinction between core and noncore customers who purchase gas from the LDC (sales customers). Transportation customers do not pay for the gas which is stored for system supply. The transportation rate, however, is based, currently, on the cost-of-service base rates, so some of the costs of operating storage facilities, if owned by the LDC, may be embedded.

Oklahoma: Yes. Staff considers core customers as firm, accordingly these customers are not interruptible. This means the firm customers have first call on storage gas supply, accordingly the allocation method should reflect the use.

Oregon: No. Storage gas is not allocated to noncore. However, noncore has the option to contract for storage service.

Pennsylvania: No.

South Carolina: Yes. Cost recovered from firm customers.

South Dakota: Not applicable.

Tennessee: No.

Texas: No.

Utah: Not applicable.

Vermont: Unknown; new facility.

Virginia: No.

Washington: No. Commission/LDCs do not use core/noncore categories for cost allocation.

West Virginia: No.

Wisconsin: No.

Wyoming: No. Although industrial interruptible and transportation customers may affect outcome.

17. Does your commission prescribe a different purchased gas adjustment for the gas injected into storage from the one for system gas supplies? Yes _ No _

If yes, please describe the difference.

Alabama: No.

Alaska: No.

Arizona: No.

Arkansas: No.

California: No.

Colorado: No.

Connecticut: No.

Delaware: No.

Georgia: No.

Idaho: No.

Illinois: No.

Indiana: No.

Iowa: No.

Kentucky: No.

Maine: No.

Maryland: No.

Massachusetts: No.

Michigan: No.

Mississippi: No.

Missouri: No.

Montana: No.

Nevada: Not tested.

New Hampshire: No.

New Jersey: No.

New Mexico: No.

New York: No.

North Carolina: No.

North Dakota: No.

Ohio: No.

Oklahoma: No.

Oregon: No. See question #14.

Pennsylvania: No.

South Carolina: No.

South Dakota: Not applicable.

Tennessee: No.

Texas: No.

Utah: Not applicable.

Vermont: No. No PGA clause in Vermont.

Virginia: No.

Washington: No.

West Virginia: No.

Wisconsin: No.

Wyoming: No.

18. Does your commission prescribe financing requirements and procedures for the construction of gas storage facilities that are different from such requirements for other LDC construction projects? Yes _ No _

If yes, please describe any difference.

Alabama: No.

Alaska: No.

Arizona: No.

Arkansas: No.

California: No.

Colorado: No.

Connecticut: Not applicable.

Delaware: No.

Georgia: No.

Idaho: No.

Illinois: No.

Indiana: No.

Iowa: No.

Kentucky: No.

Maine: Not applicable.

Maryland: No.

Massachusetts: No.

Michigan: No.

Mississippi: No.

Missouri: No.

Montana: No.

Nevada: No.

New Hampshire: No.

New Jersey: No.

New Mexico: No.

New York: No.

North Carolina: No.

North Dakota: No.

Ohio: No.

Oklahoma: No.

Oregon: No.

Pennsylvania: No.

South Carolina: No.

South Dakota: No.

Tennessee: No.

Texas: No.

Utah: Not applicable.

Vermont: No.

Virginia: No.

Washington: No.

West Virginia: No.

Wisconsin: No.

Wyoming: No.

19. Does your commission prescribe different cost recovery methods for the construction of gas storage facilities as compared with other LDC construction projects? Yes _ No _

If yes, please describe any difference.

Alabama: No.

Alaska: No.

Arizona: No.

Arkansas: No.

California: No.

Colorado: No.

Connecticut: Not applicable.

Delaware: No.

Georgia: No, not for LNG.

Idaho: No.

Illinois: No.

Indiana: No.

Iowa: No.

Kentucky: No.

Maine: No.

Maryland: No.

Massachusetts: No.

Michigan: No.

Mississippi: No.

Missouri: No.

Montana: No.

Nevada: No.

New Hampshire: No.

New Jersey: No.

New Mexico: No.

New York: No.

North Carolina: No.

North Dakota: No.

Ohio: No.

Oklahoma: No.

Oregon: No.

Pennsylvania: No.

South Carolina: No.

South Dakota: No.

Tennessee: No.

Texas: No.

Utah: Not applicable.

Vermont: No.

Virginia: No.

Washington: No.

West Virginia: No.

Wisconsin: No.

Wyoming: No.

20. Does your commission specify a depreciation rate for gas storage facilities that is different from other LDC construction projects? Yes _ No _

If yes, please describe any difference.

Alabama: Yes. Each subaccount has a different depreciation rate base on a study. The methodology used for storage is no different from any other account.

Alaska: No.

Arizona: No.

Arkansas: No.

California: Yes. Gas storage facilities are categorized in a particular plant category for which average service lives, salvage values, and life curves are estimated. This category is different from transmission facilities, distribution facilities, etc.

Colorado: No.

Connecticut: Not applicable.

Delaware: No.

Georgia: No.

Idaho: No.

Illinois: No.

Indiana: No.

Iowa: No.

Kentucky: No.

Maine: No.

Maryland: No.

Massachusetts: No.

Michigan: Yes. The methodology for determining the depreciation rate for storage facilities is the same as for other projects, but the specific rate may be different.

Mississippi: No.

Missouri: Yes. Each utility plant account has a separate depreciation rate prescribed.

Montana: No.

Nevada: No.

New Hampshire: No.

New Jersey: No.

New Mexico: No.

New York: Yes. The average service life is determined for each gas plant account based on the retirement history of like facilities. Cost of removal and salvage are also based on history, or where there is none, a best estimate of future costs of removal and salvage.

North Carolina: Yes. Each category of plant has different depreciation rates.

North Dakota: No.

Ohio: Yes. Since depreciation rates are set by individual plant account, the depreciation rates set for the storage accounts necessarily will not be the same as those for other projects. The methodology of determining the depreciation rates would be the same as for other plants.

Oklahoma: Yes. Staff has different depreciation rates for plant groups.

Oregon: Yes. Commission recognizes the difference in lives between storage, transmission, distribution, etc.

Pennsylvania: No.

South Carolina: No.

South Dakota: No.

Tennessee: Yes. LNG tanks are analyzed individually to arrive at a depreciation rate.

Texas: No.

Utah: Not applicable.

Vermont: No.

Virginia: No.

Washington: No.

West Virginia: Not applicable.

Wisconsin: No.

Wyoming: No.

21. Does your commission treat cushion gas (the amount of gas preserved in the underground storage cavern in order to maintain working pressure for normal delivery of storage gas) as a capital investment, as an expense, or as some other cost item?
Capital Investment __ Expense __ Other Cost Item __

Please describe the method chosen.

Alabama: No underground storage.

Alaska: Not applicable.

Arizona: Not applicable.

Arkansas: Capital investment.

California: Capital investment. Included in rate base at original cost.

Colorado: Capital investment.

Connecticut: Capital investment.

Delaware: Not applicable.

Georgia: The cost of cushion gas is part of the charges the gas company pays for the storage service.

Idaho: Capital investment - Inventory.

Illinois: Capital investment included in rate base.

Indiana: It is treated as a capital investment and allowed in the materials & supplies component of rate base. The utility is then allowed a return on its rate base.

Iowa: Expense. These are treated as gas cost recovered through the PGA.

Kentucky: Capital investment. Underground gas stored is a component in the calculation of the total original cost rate base. Noncurrent gas is classified as utility plant; current gas is an addition to the calculation.

Maine: Expense.

Maryland: Capital investment. Treated as a component of inventory.

Massachusetts: Not applicable.

Michigan: Capital investment. Included in rate base.

Mississippi: Expense.

Missouri: Capital investment.

Montana: Capital investment. Rate-base treatment with corresponding revenue requirement.

Nevada: Not tested.

New Jersey: Contract - cushion gas not specifically identified.

New Mexico: Capital investment.

New York: Capital investment. The weighted-average cost of cushion gas is allowed in rate base and earns a rate of return the same as other rate-base items.

North Carolina: No storage wells in North Carolina.

North Dakota: Hasn't been addressed.

Ohio: Capital investment. Cushion gas is booked to Account 352.3, Nonrecoverable Natural Gas, Uniform System of Accounts.

Oklahoma: Capital investment.

Oregon: Capital investment.

Pennsylvania: Capital investment. Cushion gas is capitalized because it represents a long-term investment.

South Carolina: None of our customers own storage facilities.

South Dakota: No storage - issue not considered.

Tennessee: Capital investment. Cushion gas is considered a nondepreciable asset.

Texas: Don't know.

Utah: Not applicable.

Vermont: Have not been presented with this issue.

Virginia: Capital investment. Storage commodity only recovered when withdrawn, therefore, all gas injected but not withdrawn, including cushion gas, given rate-base treatment during rate cases.

Washington: Capital investment. Included in rate base (currently).

West Virginia: Not applicable.

Wisconsin: Capital investment. It is considered as a rate-base item and the utility is authorized a return on the investment.

Wyoming: Capital investment. Cushion gas is an element of rate base.

22. Does your commission specify any regulation (such as the "correlative rights" or "rule of capture") for the treatment of underground stored gas leakage or movement? Yes _ No _

If yes, please describe the regulation.

Alabama: No.

Alaska: No.

Arizona: No.

Arkansas: No.

California: No.

Colorado: No.

Connecticut: No.

Delaware: No.

Georgia: No.

Idaho: No.

Illinois: Undetermined at this time.

Indiana: No. The Commission has ruled on this topic in its Order in Cause No. 38239. However, the Commission's Order in this cause has been appealed and the Commission is awaiting a final decision on the appeal. A copy of the Commission's Order on rehearing and reconsideration is enclosed for your reference (see attachment C).

Iowa: No.

Kentucky: No. Kentucky Department of Mines and Minerals determines compliance to correlative rights of mineral owners, well construction and completion, and documentation to protect gas horizons and fresh water supplies in the subsurface. These are the criteria used in looking at the construction of a storage field.

Maine: No.

Maryland: No.

Massachusetts: Not applicable.

Michigan: No.

Mississippi: No.

Missouri: No.

Montana: No.

Nevada: No.

New Hampshire: No.

New Jersey: No.

New Mexico: No.

New York: Yes. An O&M expense account is available to record the amounts of inventory adjustments representing the cost of gas lost or unaccounted-for in underground storage operations due to cumulative inaccuracies of gas measurements or other causes. Further, substantial adjustments may be amortized over future periods with Commission approval.

North Carolina: No.

North Dakota: No.

Ohio: No.

Oklahoma: No.

Oregon: No.

Pennsylvania: No.

South Carolina: No. None in state.

South Dakota: No.

Tennessee: No.

Texas: Don't know.

Utah: Not applicable.

Vermont: Not applicable.

Virginia: No.

Washington: No.

West Virginia: Not applicable.

Wisconsin: No.

Wyoming: No.

If no, do other state agencies prescribe any regulations concerning the treatment of underground gas leakage or movement? Yes _ No _

Please list the names of the agencies and describe their regulations.

Alabama: No.

Alaska: No.

Arizona: Do not know.

Arkansas: No.

California: Yes. The Division of Oil and Gas within the Department of Conservation regulates and monitors wells at underground gas storage facilities. The Division must provide project approval for new wells at these facilities to determine if they meet required technical specifications. The Division also monitors these wells periodically to determine if they are operating properly, within technical specifications.

Colorado: No.

Connecticut: No.

Georgia: No.

Illinois: Any regulation concerning the treatment of underground gas leakage or movement imposed by any other state agency would be between that agency and the utility. The Illinois Commerce Commission would not be involved in that transaction.

Indiana: No.

Iowa: Yes, Department of Natural Resources

Kentucky: No. Kentucky Department of Mines and Minerals determines compliance to correlative rights of mineral owners, well construction and completion, and documentation to protect gas horizons and fresh water supplies in the subsurface. These are the criteria used in looking at the construction of a storage field.

Maine: No.

Maryland: No.

Massachusetts: Not applicable.

Michigan: No.

Mississippi: Yes, Mississippi Oil & Gas Board--well certification.

Missouri: No.

Montana: Yes, Board of Oil & Gas.

Nevada: Unknown--no underground storage in Nevada.

New Jersey: No.

New Mexico: Yes, New Mexico Oil Conservation Commission.

New York: Yes, New York State Department of Environmental Conservation has regulations regarding correlative rights. See attachment #2.

North Carolina: No.

North Dakota: Do not know.

Ohio: No, not to my knowledge.

Oklahoma: No.

Oregon: No.

Pennsylvania: Yes, Pennsylvania Department of Environmental Resources, Bureau of Oil and Gas Management.

South Carolina: No. None in state.

Tennessee: No.

Utah: Not applicable.

Virginia: Yes, State Fire Marshal, however, only for propane storage.

Washington: Possibly Department of Ecology.

West Virginia: Not applicable.

Wisconsin: No.

Wyoming: Yes, Wyoming Oil and Gas Conservation Commission.

23. Does your commission specify any specific way of determining and recovering the cost of gas lost due to leakage and underground movement? Yes _ No _

If yes, please describe the method chosen.

Alabama: No.

Alaska: No.

Arizona: No.

Arkansas: No.

California: No.

Colorado: No.

Connecticut: No.

Delaware: No.

Georgia: No.

Idaho: No.

Illinois: No.

Indiana: Yes. Level of recoverable cost determined in most recent rate filing approved by Commission and allowed in base rates.

Iowa: No.

Kentucky: No.

Maine: No.

Maryland: No.

Massachusetts: Not applicable.

Michigan: No.

Mississippi: No.

Missouri: No.

Montana: No.

Nevada: No.

New Hampshire: No.

New Jersey: No.

New Mexico: No.

New York: Yes. See question #22 above.

North Carolina: No.

North Dakota: No.

Ohio: No. We have only one LDC (East Ohio Gas Company) which has experienced significant storage migration. The Commission has permitted it to write-off its calculation of loss based on expert testimony presented at the GCR audit hearings. See attached Commission Order. All sources of unaccounted-for gas are permitted to be passed through the GCR up to a reasonable level, not to exceed 5 percent UFG.

Oklahoma: Yes. If a loss occurs, staff reviews engineering studies for determining the loss, and also the steps the utility used for correcting and minimizing the cost. Once the cost has been determined, staff recommends an amortization of the cost to be reviewed.

Oregon: No.

Pennsylvania: No.

South Carolina: No. None in state.

South Dakota: No.

Tennessee: No.

Texas: No.

Utah: Not applicable.

Vermont: No.

Virginia: No.

Washington: No.

West Virginia: Not applicable.

Wisconsin: No.

Wyoming: No.

24. Do any of the LDCs under your commission's jurisdiction offer end-user services such as storage or storage banking? Yes _ No _

If yes, please describe these services.

Alabama: No.

Alaska: No.

Arizona: No.

Arkansas: No.

California: Yes. A pilot storage banking program was initiated in April 1989. The program is continuing and is under evaluation. See attachment B for a detailed description. For one of the LDCs, the Commission also allows special UEG storage in the spring. See attachment C. UEG customers will be able to store their own gas for summer withdrawal by October 31. The LDC will also store "back-up" gas for these customers.

Colorado: Not to our knowledge.

Connecticut: No.

Delaware: No.

Georgia: No. One of our LDCs sells LNG by the gallon to gas companies and some final customers.

Idaho: No. The Commission has expressed interest in such services, however, has not promulgated any specific guidelines.

Illinois: Yes.

Indiana: Yes. To date, only one local distribution gas company offers a storage service. The utility, Northern Indiana Public Service Company is offering this service currently on a temporary basis and has requested that the service be continued on an interim basis until it can be made permanent. The tariff sheets for this service have been included herewith as attachment D.

Iowa: No.

Kentucky: Yes, Western Kentucky Gas - Available to customers who have purchased natural gas from Western for the purpose of seasonal storage and require transportation through Western's pipelines to the point of storage and/or utilization.

Maine: No.

Maryland: No.

Massachusetts: No.

Michigan: Yes. Load balancing tolerances of 8.5 percent to 10 percent of annual contract quantity are included within the basic transportation rate. Storage in excess of this tolerance can be purchased from the utility.

Mississippi: No.

Missouri: Yes. The type of banking or storage referred to here is in using the LDC distribution system as a storage field.

Montana: No.

Nevada: No, but do offer standby services.

New Hampshire: No.

New Jersey: Yes. Storage service available - no users.

New Mexico: Yes. Storage to transportation customers is offered on an interruptible basis.

New York: Yes. Thus far, only one utility offers a "balancing service" to its largest interruptible end-users by selling contracted storage capacity that is in excess of the needs of the LDC.

North Carolina: No.

North Dakota: No.

Ohio: Yes. East Ohio Gas offers a load balancing service which requires the use of its storage facilities on a limited basis to transportation customers. If, by storage banking, you mean the banking of transportation gas, there is always some imbalance between receipts and deliveries. Each LDC has provisions for "true up" or balancing in order to minimize the impact on its system supply, i.e., discontinuing transportation, buying positive imbalances.

Oklahoma: No.

Oregon: Yes. See Northwest Natural Tariff Schedule #59 attached.

Pennsylvania: Yes. See attachment 2.

South Carolina: No.

South Dakota: No.

Tennessee: No.

Texas: Do not know.

Utah: Not applicable.

Vermont: No.

Virginia: No, one intrastate pipeline offers LNG storage.

Washington: No LDC under our jurisdiction has fully unbundled services. One LDC does offer storage as a purchasable product to one very large end-user.

West Virginia: Not applicable.

Wisconsin: No.

Wyoming: No.

Has the Commission issued any guidelines or statements about the provision of such services? Yes _ No _

If yes, please describe.

Alabama: No.

Alaska: No.

Arizona: No.

Arkansas: No.

California: Yes. See attachment B and C. The fee for storage banking is determined through a bidding process. An O&M/injection charge is also attached. Storage of UEG does not have any fee except for O&M/injection. Carrying costs of gas in storage are paid for by all customers on a per therm basis.

Colorado: No.

Connecticut: No.

Delaware: No.

Georgia: Yes. A tariff has been published. It lists when, during the year, LNG can be sold, the price to liquefy the gas, and the amount that will be charged for the gas that was converted.

Idaho: No.

Illinois: No.

Indiana: No.

Iowa: No.

Kentucky: Yes. Staff reviewed and Commission approved as tariff filing. Pursuant to Administrative Case No. 297 (Gas Transportation in Kentucky), such service shall be unbundled and non-discriminatory.

Maine: No.

Maryland: No.

Massachusetts: No.

Michigan: Yes. Commission orders setting transportation rates also specify the load balancing tolerance and set the price for additional storage.

Mississippi: No, not applicable.

Missouri: No.

Montana: No.

Nevada: No.

New Hampshire: No.

New Jersey: No.

New Mexico: Yes. The Commission requires a utility to provide storage if available.

New York: Yes. This service must be offered indiscriminately to any qualifying customer. The LDC may impose a size limitation in order to qualify for such service based on available capacity.

North Carolina: No.

North Dakota: No.

Ohio: No. Although the Commission does not have specific guidelines for the offering of storage service, it requires services to transportation customers to be available to all similarly-situated customers, either based on tariff provisions or through individual contracts which are submitted for approval to the Commission pursuant to Section 4905.31 Revised Code which permits reasonable arrangements between public utilities and their customers. The Commission has expected LDCs to operate their transportation offerings so as to prevent system sales customers from absorbing the cost of transportation customer imbalances. This policy has been enunciated through staff positions and Commission Orders in Gas Cost Recovery proceedings.

Oklahoma: No.

Oregon: No.

Pennsylvania: No.

South Carolina: No.

South Dakota: No.

Tennessee: No.

Texas: No.

Utah: Not applicable.

Vermont: No.

Virginia: No.

Washington: No.

Wisconsin: No.

Wyoming: No.

25. Please describe the methods used in determining the rates for storage and storage-related services provided by the LDC for end-users.

Alabama: Not applicable.

Alaska: Not applicable.

Arizona: Not applicable.

Arkansas: Not applicable.

California: See attachment B and C. The fee for storage banking is determined through a bidding process. An O&M/injection charge is also attached. Storage of UEG does not have any fee except for O&M/injection. Carrying costs of gas in storage are paid for by all customers on a per-therm basis.

Colorado: None.

Connecticut: Not applicable.

Delaware: Not applicable.

Georgia: Not done.

Idaho: Moving average.

Illinois: Based on cost-of-service studies.

Indiana: Average embedded cost basis.

Kentucky: Because only one LDC has any kind of storage-related services there are no set methodologies.

Maryland: Not applicable.

Massachusetts: Not applicable.

Michigan: Cost-based rates.

Mississippi: Not applicable.

Missouri: Storage facilities are allocated on seasonal sales basis (seasonal sales = total Mcf sales - specified base level usage). Costs are recovered in the commodity on a cents/Mcf basis.

Nevada: None provided.

New Jersey: Incremental cost.

New Mexico: Cost based.

New York: Average fixed charges and all variable costs are assigned to rates for storage service.

North Carolina: Not applicable.

North Dakota: Not applicable.

Ohio: These rates are determined from the cost of storage included in the LDC's cost-of-service base rates and adjusted based on the level and extent of use of the storage system by that customer.

Oklahoma: Not applicable.

Oregon: Fully allocated cost.

Pennsylvania: Cost of service.

South Carolina: None of our LDCs provide this service.

South Dakota: No such rates exist.

Tennessee: Not applicable.

Utah: Not applicable.

Vermont: Not applicable.

Virginia: Assigned cost of service.

Washington: We have never directly addressed the question of pricing storage.

West Virginia: Not applicable.

Wisconsin: Not applicable.

Wyoming: None being provided.

26. Are storage, storage banking, or other storage-related services being offered as separate services by the LDC or as part of a bundled service that a customer could purchase or both?
Separate ___ Bundled Service ___ Both ___

Alabama: Not offered.

Alaska: Not applicable.

Arizona: Not applicable.

Arkansas: Bundled service.

California: Both.

Colorado: None that we are aware of.

Connecticut: Not applicable.

Delaware: Not applicable.

Georgia: Not offered.

Idaho: Separate, for special contract customers only.

Illinois: Separate and bundled service - depends on LDC.

Indiana: Separate.

Iowa: Not currently offered.

Kentucky: Separate.

Maine: Not applicable.

Maryland: Bundled service.

Massachusetts: Not applicable.

Michigan: Both.

Mississippi: Not applicable.

Missouri: Bundled service.

Montana: Bundled service.

Nevada: Not offered.

New Jersey: Separate.

New Mexico: Separate.

New York: Separate.

North Carolina: Bundled service.

North Dakota: Neither.

Ohio: Both. Bundled for sales customers, but may be unbundled for transportation customers.

Oklahoma: Not applicable.

Oregon: Both.

Pennsylvania: Both.

South Carolina: None of our LDCs provide this service.

South Dakota: Not offered.

Tennessee: Not applicable.

Texas: Don't know.

Utah: Not applicable.

Vermont: Not applicable.

Virginia: Not applicable.

Washington: Bundled service.

West Virginia: Not applicable.

Wisconsin: Not applicable.

Wyoming: Not applicable.

27. Does your commission allow jurisdictional LDCs to lease their storage facilities to end-users? Yes _ No _

If yes, are any special requirements (such as an obligation to provide reliable services for core customers or certain eligibility requirements on the end-users) placed on the LDC or the end-user in the case of such an arrangement? Yes _ No _

If yes, please describe these requirements and typical leasing contract provisions.

Alabama: No, the Commission does not allow LDCs to lease their storage facilities to end-users.

Alaska: No, the Commission does not allow LDCs to lease their storage facilities to end-users.

Arizona: Not applicable.

Arkansas: Yes, the Commission does allow jurisdictional LDCs to lease their storage facilities to end-users. There are no any special requirements placed on the LDC or the end-user in the case of such an arrangement.

California: No. San Diego Gas and Electric Company, an LDC and wholesale customer of Southern California Gas Company, was allocated a share of SoCal's storage facilities, which the Commission authorized through a decision. However, this is neither an acquisition or a lease.

Colorado: Commission has taken no position.

Connecticut: No, the Commission does not allow jurisdictional LDCs to lease their storage facilities to end-users.

Delaware: No, the Commission does not allow jurisdictional LDCs to lease their storage facilities to end-users. There have been no requests made of this nature--no policy is in place.

Georgia: No rules on this as the question has not come up.

Idaho: Yes, the Commission does allow jurisdictional LDCs to lease their storage facilities to end-users. There are no special requirements placed on the LDC or end-user.

Illinois: No, the Commission does not allow jurisdictional LDCs to lease their storage facilities to end-users.

Indiana: Has not been requested to date.

Iowa: No policy as of yet.

Kentucky: No such requests have come before the Commission.

Maine: Not applicable.

Maryland: No, the Commission does not allow jurisdictional LDCs to lease their storage facilities to end-users.

Massachusetts: No, the Commission does not allow jurisdictional LDCs to lease their storage facilities to end-users. There has been no request to do so.

Michigan: Yes, the Commission does allow jurisdictional LDCs to lease their storage facilities to end-users. No special requirements are placed on the LDC or end-user. The obligation to provide reliable service to core customers is a continuing duty for utilities in Michigan, not a "special requirement."

Mississippi: Yes, the Commission does allow jurisdictional LDCs to lease their storage facilities to end-users. No special requirements are placed on the LDC or end-user.

Missouri: No, the Commission does not allow jurisdictional LDCs to lease their facilities to end-users.

Montana: No, the Commission does not allow jurisdictional LDCs to lease their facilities to end-users.

Nevada: Not offered.

New Hampshire: No, the Commission does not allow jurisdictional LDCs to lease their facilities to end-users.

New Jersey: No, the Commission does not allow jurisdictional LDCs to lease their facilities to end-users.

New Mexico: No, the Commission does not allow jurisdictional LDCs to lease their facilities to end-users.

New York: Issue has not been addressed - no experience - see question #28 below.

North Carolina: No, the Commission does not allow jurisdictional LDCs to lease facilities to end-users.

North Dakota: Not applicable.

Ohio: No. There are no regulations of which I am aware which would prohibit such leasing but I do not believe leasing is being provided.

Oklahoma: Yes, the Commission does allow jurisdictional LDCs to lease their storage facilities to end-users. Special requirements are placed on the LDC or end-user. The contract language usually provides for the utility to have first call on gas.

Oregon: Yes, the Commission does allow jurisdictional LDCs to lease their storage facilities to end-users. Special requirements are placed on the LDC or end-user. See NNG Schedule #59 attached.

Pennsylvania: Not an issue.

South Carolina: None in state.

South Dakota: No such facilities.

Tennessee: No.

Texas: Yes, the Commission does allow jurisdictional LDCs to lease their storage facilities to end-users, however, I don't think LDCs lease to any end-users. There are no special requirements.

Utah: Not applicable.

Vermont: Not applicable.

Virginia: No.

Washington: Yes, the Commission does allow jurisdictional LDCs to lease their storage facilities to end-users. There are no special requirements.

West Virginia: Not applicable.

Wisconsin: Not applicable.

Wyoming: No application to date and no determination.

28. Does your commission allow an end-user to operate the storage facilities that it has leased from an LDC? Yes _ No _

If yes, are there any special requirements imposed on the end-user in operating the storage facilities? Yes _ No _

If yes, please describe the special requirements.

Alabama: No, the commission does not allow an end-user to operate the storage facilities that it has leased from an LDC.

Alaska: No, the commission does not allow an end-user to operate the storage facilities that it has leased from an LDC. There are no special requirements imposed on an end-user in operating the storage facilities.

Arizona: Not applicable.

Arkansas: No, the commission does not allow an end-user to operate the storage facilities that it has leased from an LDC. There are not any special requirements imposed on the end-user in operating the storage facilities.

California: Not applicable. San Diego Gas and Electric Company, an LDC and wholesale customer of Southern California Gas Company, was allocated a share of SoCal's storage facilities, which the Commission authorized through a decision. However, this is neither an acquisition or a lease.

Colorado: No knowledge.

Connecticut: Not applicable.

Delaware: Not applicable.

Georgia: No, it has not come up.

Idaho: Not applicable.

Illinois: No, the Commission does not allow an end-user to operate the storage facilities that it has leased from an LDC.

Indiana: Has not been requested to date.

Iowa: No, the Commission does not allow an end-user to operate the storage facilities that it has leased from an LDC.

Kentucky: No such requests have come before the Commission.

Maine: Not applicable.

Maryland: No, the Commission does not allow an end-user to operate the storage facilities that it has leased from an LDC.

Massachusetts: No, the Commission does not allow an end-user to operate the storage facilities that it has leased from an LDC. There has been no request to do so.

Michigan: No, the Commission does not allow an end-user to operate the storage facilities that it has leased from an LDC.

Mississippi: Yes, the Commission does allow an end-user to operate the storage facilities that it has leased from an LDC, however, there are no special requirements imposed on the end-user in operating the storage facilities.

Missouri: No, the Commission does not allow an end-user to operate the storage facilities that it has leased from an LDC.

Montana: No, the Commission does not allow an end-user to operate the storage facilities that it has leased from an LDC.

Nevada: Not offered.

New Jersey: No.

New Mexico: Not applicable.

New York: No. Although no such arrangements exist at the present time, there is no specific law, rule, or regulation to prohibit this. If an LDC and its customers were to enter into such an arrangement where an end-user were to operate a storage facility leased from an LDC, the Commission would review the LDC's participation.

North Carolina: No.

North Dakota: Have never disallowed an end-user to operate the storage facilities that it has leased from an LDC. Haven't addressed any special requirements.

Ohio: Not applicable.

Oklahoma: No.

Oregon: No.

Pennsylvania: Not an issue.

South Carolina: None in state.

South Dakota: Not applicable.

Tennessee: Not applicable.

Texas: Yes, the Commission allows an end-user to operate the storage facilities that it has leased from an LDC. There are no special requirements imposed.

Utah: Not applicable.

Vermont: Not applicable.

Virginia: Not applicable.

Washington: No.

West Virginia: Not applicable.

Wisconsin: Not applicable.

Wyoming: No application and no determination to date.

29. Does your commission oversee or regulate gas storage facilities owned by end-users? Yes _ No _

If yes, are such facilities subject to the same types of regulations as LDC-owned storage facilities? Yes _ No _

Please describe your commission's procedures and regulations dealing with gas storage facilities owned by end-users.

Alabama: No, the Commission does not oversee or regulate end-user-owned storage facilities.

Alaska: No, the Commission does not oversee or regulate end-user-owned storage facilities. Such facilities are not subject to the same types of regulations as LDC-owned storage facilities.

Arizona: No, the Commission does not oversee or regulate end-user-owned storage facilities.

Arkansas: No, the Commission does not oversee or regulate end-user-owned storage facilities. Such facilities are not subject to the same types of regulations as LDC-owned storage facilities.

California: Yes, the Commission oversees/regulates gas storage facilities owned by end-users only to the extent that an end-user (PG&E's electric) is also the same entity as the LDC. Such facilities are subject to the same types of regulation as LDC-owned storage facilities. One of the LDCs in California, Pacific Gas and Electric Company, owns and operates a storage field. Its Electric Department must bid on storage space as would any other noncore end-user.

Colorado: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

Connecticut: Not applicable.

Delaware: Not applicable.

Georgia: No, the Commission does not oversee or regulate gas storage facilities owned by end-users. There is just one in the state--it is not covered.

Idaho: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

Illinois: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

Indiana: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

Iowa: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

Kentucky: The issue has not come before the Commission.

Maine: Not applicable.

Maryland: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

Massachusetts: Not applicable.

Michigan: Yes, the Commission does oversee/regulate gas storage facilities owned by end-users. Such facilities are subject to the same types of regulation as LDC-owned storage facilities. There currently are no storage facilities owned by end-users, but if there were, they would be subject to existing regulations.

Mississippi: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

Missouri: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

Montana: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

Nevada: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

New Hampshire: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

New Jersey: No end-user storage known.

New Mexico: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

New York: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

North Carolina: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

North Dakota: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

Ohio: No. The only regulation or oversight would vest in our gas pipeline safety jurisdiction.

Oklahoma: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

Oregon: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

Pennsylvania: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

South Carolina: None in state.

South Dakota: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

Tennessee: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

Texas: Yes, the Commission oversees/regulates gas storage facilities owned by end-users. These facilities are subject to the same types of regulations as LDC-owned storage facilities.

Utah: Not applicable.

Vermont: Yes, the Commission oversees/regulates gas storage facilities owned by end-users with respect to gas safety. These facilities are subject to the same types of regulations as LDC-owned storage facilities with respect to gas safety.

Virginia: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

Washington: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

West Virginia: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

Wisconsin: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

Wyoming: No, the Commission does not oversee or regulate gas storage facilities owned by end-users.

30. Does any other state agency oversee or regulate gas storage facilities owned by end-users? Yes _ No _

Please list the agencies and describe the regulations.

Alabama: No.

Alaska: No.

Arizona: Do not know; probably not.

Arkansas: No.

California: Yes. The Division of Oil and Gas within the Department of Conservation regulates and monitors wells at underground gas storage facilities. The Division must provide project approval for new wells at these facilities to determine if they meet required technical specifications. The Division also monitors these wells periodically to determine if they are operating properly, within technical specifications.

Colorado: No knowledge.

Connecticut: Not applicable.

Delaware: Not applicable.

Georgia: Yes, the Fire Marshal's office checks all LPG tanks owned by LDCs and others.

Idaho: No.

Illinois: Any such oversight or regulation would be between that agency and the end-user. The Illinois Commerce Commission would not be involved in that transaction.

Indiana: Yes, Indiana Department of Natural Resources. Indiana Administrative Code (310 IAC 7-1, 310 IAC 7-2) (see attachment E).

Iowa: Yes, Department of Natural Resources (DNR).

Kentucky: Yes, Kentucky Department of Mines and Minerals.

Maine: Not applicable.

Maryland: No.

Massachusetts: Not applicable.

Michigan: Yes. Michigan Department of Natural Resources would regulate such facilities if they existed.

Mississippi: Yes. Possibly Oil & Gas Board.

Missouri: No.

Montana: Yes, Board of Oil & Gas.

Nevada: No, but other agencies have environmental responsibility.

New Jersey: No end-user storage known.

New Mexico: No.

New York: Yes. Department of Environmental Conservation oversees development of underground storage fields. PSC regulates safety of pipelines and related facilities going into and out of fields.

North Carolina: No.

North Dakota: No.

Ohio: No, not to my knowledge.

Oklahoma: No.

Oregon: No.

Pennsylvania: Yes, Pennsylvania Department of Environmental Resources, Bureau of Oil and Gas Management.

South Carolina: None in state.

South Dakota: No.

Tennessee: No.

Texas: Yes, but I don't think there are any facilities owned by end-users.

Utah: Unknown.

Vermont: Yes, Environmental Agency - issues regarding environment and DPS and PSB - issues regarding gas safety.

Virginia: No, except for propane -- State Fire Marshal.

Washington: Don't know.

West Virginia: No.

Wisconsin: Yes, The Department of Natural Resources. Please contact them for a description of their regulations.

Wyoming: Yes. None in state. If there were they would be regulated by the Wyoming Oil and Gas Conservation Commission.

31. Does your commission have specific criteria or guidelines for allocating any benefits, such as savings in gas costs, that the LDC might accrue from its use of storage? Yes _ No _

If yes, please describe.

Alabama: No, not specifically for this, but savings realized are an integral part of the PGA as a noncost, if you will.

Alaska: No.

Arizona: No.

Arkansas: No.

California: Yes. Carrying costs of gas in storage are allocated on a per-therm basis to all customers, under the assumption that all customers benefit from storage, even though storage is primarily dedicated to core customers.

Colorado: No.

Connecticut: No.

Delaware: No.

Georgia: No.

Idaho: No.

Illinois: No.

Indiana: Yes. Benefits realized through Gas Cost Adjustments based on design in last rate proceeding before Commission.

Iowa: Yes. Gas cost savings are passed on through lower gas rates.

Kentucky: No.

Maine: No.

Maryland: No.

Massachusetts: No.

Michigan: No.

Mississippi: No.

Missouri: No.

Montana: No, not at present.

Nevada: No.

New Hampshire: Yes. The gas cost savings that result from the use of underground storage gas are assigned totally to winter consumption.

New Jersey: Yes. Benefits from storage used in Purchased Gas Adjustment.

New Mexico: No.

New York: No. The operation of the monthly Gas Cost Adjustment would capture any benefits that might accrue from the LDC's use of storage.

North Carolina: Yes. For many years we have had an inventory appreciation adjustment whereby if a PGA increased rates to the utility customer, the appreciation on stored gas was recovered for the benefit of the consumer.

North Dakota: No.

Ohio: Yes. Gas is to be purchased on a least-cost basis, consistent with reliable supply. To that extent, the benefit of reduced gas costs gained through the use of storage are passed on to the sales customers through the GCR.

Oklahoma: No.

Oregon: Yes. Benefits accrue to ratepayers through PGAs.

Pennsylvania: No.

South Carolina: No.

South Dakota: No.

Tennessee: Yes. Handled through PGA as a refund or surcharge.

Texas: No.

Utah: Not applicable.

Vermont: Yes. The costs/savings analysis would be a consideration in any rate review and savings would be allocated to the customer class served by the facility.

Virginia: No.

Washington: No.

West Virginia: No.

Wisconsin: Yes. This is done as part of a rate case or the savings pass through the PGA to utility customers.

Wyoming: Yes. All "benefits" from gas storage are considered in setting rates in the same manner as revenues from sale of utility services.

32. Based on your knowledge, what is the extent of storage activity (for example, putting additional gas into storage, building new storage facilities, better utilization of existing facilities, etc.) being undertaken by jurisdictional LDCs in your state?

Alabama: One utility operates two LNG plants and keeps a portable LNG plant for emergencies.

Alaska: None.

Arizona: Essentially none. One LDC has considered undertaking a major underground storage project, but has not found it to be economical thus far. There is some storage carried out through line packing.

Arkansas: To maintain peak delivery.

California: The activity is uneven between the two LDCs. PG&E is operating routinely and injecting gas for storage banking. On the other hand, SoCal is currently initiating a new storage program, whereby it injects unusually large volumes of gas, both its own gas and customer-owned gas, in the spring while curtailing UEG customers. During the summer UEG customers would receive service to avoid summer curtailments. Storage banking may be of limited interest.

Colorado: None.

Connecticut: No significant modifications to storage activity have occurred within the past five years.

Delaware: See attachment 2.

Georgia: A large LNG plant was finished two years ago, it is the third plant built by this LDC. Nothing new appears on the near-term horizon.

Idaho: Application before FERC to expand storage (U.G.) at Jackson Prairie. Also trying to better utilize storage.

Illinois: No new storage facilities have been certificated by this agency in at least ten years. Peoples Gas Co. is analyzing increasing its storage field. Central Illinois Public Service (CIPS) has a proposal pending before the Commission to increase one of its fields.

Indiana: Construction of a liquid natural gas facility by Citizens Gas & Coke; better utilization of out-of-state storage service where available.

Iowa: LDCs are considering increased use of gas storage.

Kentucky: Two LDCs, Western Kentucky Gas and Louisville Gas and Electric, utilize gas storage primarily to reduce system-wide gas costs. Each purchases gas in summer, puts such gas in storage, and withdraws this gas in the heating season to reduce the need to purchase winter-priced gas from producers or pipelines.

Maine: No activities are planned to our knowledge.

Maryland: None.

Massachusetts: Not applicable.

Michigan: All of these activities are being undertaken.

Mississippi: Limited activity.

Missouri: Little to no new activity.

Montana: MPC is adding more storage at its Dry Creek storage field.

Nevada: All storage is under interstate pipeline.

New Hampshire: Existing capacity is fully utilized when demands permit. One utility is extending interruptible sales into the shoulder winter months so as to ensure complete withdrawal.

New Jersey: Not applicable.

New Mexico: Activity in the area of leasing storage from an interstate pipeline.

New York: Jurisdictional LDCs are continually evaluating storage needs and some have made inquiries into additional storage from pipelines and shippers in the context of the FERC open season proceedings. Evaluation of storage needs is a

continual process due to long lead times between conception and actual development of fields, etc.

North Carolina: All of our LDCs are seeking winter storage services (five months) from the pipelines that supply North Carolina. The applications are pending before FERC.

North Dakota: No LDC storage in the state.

Ohio: Columbia Gas of Ohio, Inc., Cincinnati Gas & Electric Company, Dayton Power and Light Company, and West Ohio Gas Company have recently acquired gas storage service from Columbia Gas Transmission Corp. through its "Global Settlement." Columbia is also exploring additional storage options on other pipelines. Also, East Ohio Gas Company has been offering the use of its storage capacity to Columbia Gas of Ohio and River Gas Company under short-term agreements, and on a limited basis to certain transportation customers for load balancing purposes.

Oklahoma: OCC jurisdictional utilities utilize the storage gas according to the demands and constraints of the system.

Oregon: Oregon currently has enough storage to meet about half of its peak firm load. Efforts now focus on building additional pipeline capacity.

Pennsylvania: Gas storage has been maintained at status quo for a number of years.

South Carolina: Increasing storage capacity from interstate pipelines.

South Dakota: No.

Tennessee: Two LDCs have LNG, each > 1,000,000 Mcf; one LDC has underground storage.

Texas: See enclosed tables.

Utah: None.

Vermont: Only one facility approved - not on line yet - incomplete data.

Virginia: Purchase of unbundled storage capacity and service from interstate pipelines offering third-party injections.

Washington: Northwest Natural Gas - just completed substantial addition to its own storage capacity; Northwest Pipeline - considering expansion of its facility (co-owned with Washington Natural Gas and Washington Water Power) at Jackson Prairie.

Wisconsin: This issue is currently being studied by most of our utilities and the Commission.

Wyoming: None at present.

Has your commission encouraged this activity and in what way?

Alabama: Publicity of use of portable LNG plant.

Alaska: No.

Arizona: No.

Arkansas: No.

California: Yes. Commission just issued Decision 90-03-037 on March 14, 1990. That decision requires SoCal to set aside storage space for UEGs and to allow the UEGs to inject their own gas in the spring, in order to avoid summer curtailments.

Colorado: No.

Connecticut: No.

Delaware: Not applicable.

Georgia: In early 1980s had LDC do a projection of their storage needs for 1985.

Idaho: Yes. The Commission has promoted least-cost planning efforts.

Illinois: The Commission's management audit of People's recommended this study.

Indiana: No.

Iowa: Yes, through the annual review of gas procurements.

Kentucky: Nothing directly.

Michigan: Not specifically.

Mississippi: No.

New Mexico: Review of utility's gas procurement practices.

New York: The Commission has been supportive of LDC's efforts to prudently meet peak-day obligations. Sufficient storage is one way of attaining this end.

North Carolina: Yes.

North Dakota: No.

Ohio: We have encouraged the use of storage by LDCs to maximize the benefits of purchasing spot gas in the summer, thereby reducing the LDC's WACOG, allowing it the potential to reduce pipeline CD levels, and providing greater peak-day security. The Commission has endorsed this position in its Orders in Gas Cost Recovery proceedings.

Oklahoma: If staff considered the use of a facility as imprudent, staff would address the issue during a rate proceeding or during a Purchase Gas Adjustment hearing.

Oregon: Storage costs have been recognized in rates.

South Carolina: No.

South Dakota: No.

Tennessee: No.

Utah: No.

Vermont: Not applicable.

Virginia: Not specifically.

Washington: No.

Wisconsin: Information not readily available.

Wyoming: No.

33. Based on your knowledge, have jurisdictional LDCs used storage as a part of a strategy to achieve least-cost gas purchases? Yes _ No _

If yes, please describe.

Alabama: Yes, gas is injected during months of peak spot purchases.

Alaska: No.

Arizona: No. They have from time-to-time considered the feasibility of constructing storage facilities.

Arkansas: No.

California: Yes. To an extent. Storage allows core customers to be served, while allowing space on interstate pipelines. LDCs may be able to purchase greater spot supplies when prices are favorable. It may also allow LDCs to reduce more costly purchases.

Colorado: No knowledge.

Connecticut: Yes. By purchasing and injecting spot gas into storage during the summer the inventory cost is minimized and when withdrawn, results in lower gas costs.

Delaware: See attachment 3.

Georgia: Maybe, but the main use has been to have enough gas during peak usage.

Idaho: Yes. Supply to meet peaks in winter. Also purchase less expensive gas in summer and release in winter.

Illinois: Yes. LDCs look at their options when making gas purchase decisions. Storage may be an option.

Indiana: Yes. Utilized to reduce peak-day demand requirements.

Iowa: Yes. Lower-cost gas is purchased off season and withdrawn during peak periods.

Kentucky: Yes. See question #32.

Maine: Yes. Spot gas purchased to meet winter peak periods.

Maryland: Yes. Reduce commodity purchases during winter periods.

Massachusetts: Yes, by purchasing low-cost spot gas supplies and injecting them into underground storage for peak-season delivery.

Michigan: Yes. Storage is used to reduce the level of pipeline demand charges and to purchase gas in the summer when it is cheaper for use in the winter.

Mississippi: No.

Missouri: Yes. Inject in summer in order to get lowest price and maximize on contract demand. Withdraw in winter to supplement gas delivery and supplies.

Montana: Yes. MDU is buying gas from third parties, the price for which reflects MDU's ability to rely on WBIP's storage facilities to meet peak demands.

Nevada: No.

New Hampshire: Yes. Underground storage services allow New Hampshire jurisdictional LDCs to displace expensive LNG and propane and hence minimize gas purchases.

New Jersey: Yes. Load balancing together with spot purchases used to off-set contracts.

New Mexico: Yes.

New York: Yes. All gas utilities are under statutory obligation to adopt a least-cost reliable gas purchasing strategy. Storage has been "turned over" at rates in excess of system needs, in order to take advantage of low-cost spot gas opportunities.

North Carolina: Yes. The LDCs have been putting spot gas supplies into storage which has reduced the cost of storage service.

North Dakota: No.

Ohio: Yes, as described in previous answer.

Oklahoma: No. The use of storage by OCC jurisdictional utilities is strictly an operational use of the transmission system. Staff is concerned about utilities being able to serve the ratepayers during peak demands.

Oregon: Yes. Our LDCs use storage for peak shaving so that pipeline capacity and base-load supplies will have a higher load factor (about 50 percent) which translates into a lower cost.

Pennsylvania: Yes. Purchased gas is stored during periods of low demand and withdrawn during periods of high demand.

South Carolina: No.

South Dakota: No.

Tennessee: No.

Texas: Don't know.

Utah: No.

Vermont: No.

Virginia: Yes, clearly as a means of capturing rents from seasonal price differentials.

Washington: No.

West Virginia: Yes, Mountaineer Gas acquired storage rights with Columbia and will purchase currently stored gas at old embedded costs.

Wisconsin: Yes. Use the storage to store cheap off-peak gas for winter peak-period usage.

Wyoming: Yes. See attached case (Northern Gas Company *et al.*)

34. Based on your knowledge, have any of the jurisdictional LDCs been hampered in their efforts to procure storage services or facilities from pipelines or other distributors? Yes __ No __

If yes, please describe the possible hindrances.

Alabama: No.

Alaska: No.

Arizona: No.

Arkansas: No.

California: Not applicable.

Colorado: No knowledge.

Connecticut: No.

Delaware: No.

Georgia: They do not seem to need any.

Idaho: No.

Illinois: Yes. As part of FERC dockets, LDCs are attempting to gain access to pipeline storage.

Indiana: No.

Iowa: Yes. LDCs have had difficulty injecting third-party gas into pipeline storage.

Kentucky: No.

Maine: No.

Maryland: No. Capacity constraints on interstate pipelines.

Massachusetts: No.

Michigan: No.

Mississippi: No.

Missouri: No.

Montana: No.

Nevada: No.

New Hampshire: Yes. LDCs are hampered in two ways. First through the shortage of firm storage capacity and second through the shortage of firm transportation capacity.

New Jersey: No.

New Mexico: No.

New York: No.

North Carolina: Only the problem of getting FERC approval of the specific projects.

North Dakota: No.

Ohio: Yes. Not all pipelines are offering storage service to new customers.

Oklahoma: No.

Oregon: Yes. The only unused storage available has been on the wrong side of the pipeline's bottleneck.

Pennsylvania: No.

South Carolina: No.

South Dakota: No.

Tennessee: No.

Texas: Don't know.

Utah: No.

Vermont: No.

Virginia: Yes, access to storage capacity for third-party injections has been a problem. However, now becoming more available.

Washington: No.

West Virginia: No.

Wisconsin: Yes. The rates and conditions of service have been unknown.

Wyoming: Yes. Cost, contractual obligations.

35. Based on your knowledge, have any of the jurisdictional LDCs purchased or leased storage service or facilities from pipelines or other sources on behalf of particular end-users? Yes _ No _

If yes, please describe.

Alabama: No.

Alaska: No.

Arizona: No.

Arkansas: No.

California: No.

Colorado: No knowledge.

Connecticut: No.

Delaware: No.

Georgia: No.

Idaho: No.

Illinois: No.

Indiana: No.

Iowa: No.

Kentucky: No LDCs.

Maine: No.

Maryland: No.

Massachusetts: No.

Michigan: No.

Mississippi: No.

Missouri: No.

Montana: No.

Nevada: No.

New Hampshire: No.

New Jersey: No.

New Mexico: No.

New York: No.

North Carolina: No.

North Dakota: No.

Ohio: No.

Oklahoma: No.

Oregon: No.

Pennsylvania: No.

South Carolina: No.

South Dakota: No.

Tennessee: No.

Texas: Don't know.

Utah: No.

Vermont: No.

Virginia: No. Gas fired electric generation by utilities, cogenerators, and IPPs have secured upstream storage.

Washington: No, except Washington Water Power for end-user Potlatch Corporation (see question #24).

West Virginia: No.

Wisconsin: No.

Wyoming: No.

36. Based on your knowledge, have any of the jurisdictional LDCs used gas storage to bargain with pipelines in the procurement of system gas supply? Yes _ No _

If yes, please describe.

Alabama: No.

Alaska: No.

Arizona: Do not know.

Arkansas: No.

California: No.

Colorado: If this is the case we are not aware of it.

Connecticut: No.

Delaware: No.

Georgia: No.

Idaho: No.

Illinois: No. But both sides would look at options available in negotiations.

Indiana: No.

Iowa: No.

Kentucky: No.

Maine: No.

Maryland: No.

Massachusetts: No.

Michigan: Yes. Because of the large volume of storage available, major LDCs are able to purchase at 100 percent load factor, which reduces their reliance on the pipeline for peak-day service.

Mississippi: No. To date "No," but storage is being discussed as a bargaining mechanism.

Missouri: No.

Montana: No.

Nevada: No.

New Hampshire: No.

New Jersey: No, based on limited knowledge.

New Mexico: No.

New York: Yes, the Commission has only a general knowledge that storage has been used to bargain with pipelines but has no specific knowledge to that effect.

North Carolina: No.

North Dakota: No. To my knowledge, the only type of storage (LDC or end-user) in the state is propane. The Commission has not addressed the issue of natural gas storage facilities, but does conduct safety inspections of certain propane storage facilities.

Ohio: Yes. Columbia Gas of Ohio, Cincinnati Gas & Electric Company, Dayton Power and Light Company and West Ohio Gas Company were able to obtain gas storage service in exchange for other rate and service concessions in the "Global Settlement" negotiations with Columbia Gas Transmission Corp.

Oklahoma: No.

Oregon: Yes. Storage allows LDC to command a lower system gas price because system-gas load factors are higher.

Pennsylvania: No.

South Carolina: No.

South Dakota: No.

Tennessee: No.

Texas: Don't know.

Utah: No.

Vermont: No.

Virginia: No.

Washington: No.

West Virginia: No.

Wisconsin: No.

Wyoming: No.

APPENDIX B

NEW YORK MERCANTILE EXCHANGE NATURAL GAS FUTURES CONTRACT SPECIFICATIONS

Contract Unit	10,000 MMBtu (million British thermal units).
Price Quotation	Dollars and cents per MMBtu. For example, $2.000/MMBtu.
Minimum Price Fluctuation	$0.001 per MMBtu ($10 per contract).
Maximum Daily Limits	$0.10 (110 cents) per MMBtu ($1,000 per contract). There is no maximum daily limit during the month preceding delivery (first nearby futures contract).
Trading Hours	9:20 a.m. -- 2:30 p.m. (New York time).
Trading Months	Twelve consecutive months.
Last Trading Day	Trading terminates at the close of business eight business days prior to the first calendar day of the delivery month.
Delivery	Sabine Pipe Line Company's Henry Hub in Louisiana. Seller is responsible for the movement of the gas through the Hub, and buyer, from the Hub. The $0.02/MMBtu Hub fee will be paid by the seller.
Delivery Procedures	By 3:00 p.m. preceding the delivery month on the first business day after the final day of trading, buyer files a Notice of Intention to Accept and seller files a Delivery Notice. Exchange Clearing House then matches buyers and sellers and allocates delivery notices on the morning of the next business day.
Timing of Delivery	Delivery shall take place no earlier than the first calendar day of the delivery month and shall be completed no later than the last calendar day of the delivery month. All deliveries shall be at as uniform an hourly and daily rate of flow over the course of the delivery month as possible under the operating procedures and conditions of the transportating pipeline(s).
Quality Specifications	Pipeline specifications in effect at time of delivery.
Payment	Buyer shall pay the seller by Federal Funds Wire Transfer by 12:00 noon (New York time) by the 20th calendar day of the month following the delivery month.

Exchange Of Futures For Physicals (EFP)	The EFP transaction allows a buyer or seller to exchange a futures position for a physical position outside the Exchange's standard delivery mechanism. With an EFP, buyers and sellers can negotiate the terms of delivery for the physical transaction including: the price, location, and timing of physical delivery.
Alternative Delivery Procedure (ADP)	After buyer and seller have been matched for delivery by the NYMEX Clearing Department, they are afforded the option of executing an Alternative Delivery Procedure (ADP). This permits the parties to make their own delivery arrangements, but in turn releases Clearing Members and the Exchange from their obligations under general delivery rules.

Source: New York Mercantile Exchange

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