

**Natural Gas Storage Utilization:
Current Market Drivers and Probable Trends**

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Introduction

Natural gas storage is an integral part of a user's gas supply portfolio. The interest in and demand for natural gas storage services are evolving due to a number of factors, including fundamental market shifts in the demand for natural gas and regulatory changes.

Objective

Since the understanding of these shifts is fundamental to GRI's and DOE's allocation of funding for Research and Development in the area of natural gas storage, International Gas Consulting, Inc. (IGC) was asked to analyze current market drivers for and probable trends in the utilization of natural gas storage. This was accomplished using direct contacts with representatives from across U.S. industry and geographical segments in order to support GRI's research investments in the storage sector.

Approach

The study consisted of a telephone survey of natural gas storage users and providers to determine the current needs for various types of storage services and probable trends for the next five years. The questions were structured to elicit the following from each of the respondents:

- The expectation of infrastructure and pricing changes in the natural gas industry;
- Present and projected natural gas supply mix;
- Storage criteria; and
- External factors expected to impact natural gas storage use, including unbundling, regulatory changes, environmental issues, supply/demand balance, delivery infrastructure, reliability, new project timing, and substitution.

Approximately 400 representatives from various types of natural gas users and suppliers were contacted, with 187 responding. The total of all respondents' natural gas usage was nearly 20 trillion cubic feet annually. In some cases, IGC contacted a single company representative or several from different divisions (e.g., a Pipeline/Producer/Marketer might have an Industrial or Cogen division or subsidiary). Even considering the double-counting likely from crossing various industry segments, IGC estimates that survey respondents represent well over half of the natural gas consumed in the United States. The results were then analyzed both from an industry and from a regional segmentation perspective.

Results

Industry Segmentation

The industry segments included Local Distribution Companies (LDCs), Utility Electric Generating Companies (UEGs), combination utilities (LDC/UEGs), both gas and electric Municipal utilities (Municipals), and Industrial Gas Users (Industrials). Pipelines, Producers, and Marketers (PPMs) were also included, and for purposes of this analysis,

grouped together. Three of the segments, LDCs, UEGs, and LDC/UEGs, were further divided to segregate smaller units, based on annual natural gas throughput. The criteria was designated as 15 Bcf per year for LDCs, and 100 Bcf for UEGs and LDC/UEGs.

A discussion of some of the findings follows, with a summary of survey results by industry segment provided in Table 1.

Table 1. Industry Segment Response Summary

	Annual Throughput Criteria	Supply/Demand Change	Price Increase	Baseload Increase	Peak Day Increase	Storage Term	Most Important Storage
Small Local Distribution	Less than 15 Bcf	30%	60%	60%	70%	More than	Security/
Local Distribution	More than 15 Bcf	49%	76%	78%	79%	More than	Security/
Small Combination	Less than 100 Bcf	36%	50%	71%	71%	More than	Security/
Combination Utilities	More than 100 Bcf	67%	75%	100%	75%	Less than one year	Security/Reliability
Small Utility Electric	Less than 100 Bcf	38%	50%	63%	63%	Less than	Price
Utility Electric	More than 100 Bcf	67%	50%	67%	78%	Less than	Price
Municipal Utilities	None	40%	47%	50%	53%	Less than one year	Price Security/
Cogeneration Facilities	None	15%	31%	36%	23%	Very long	Price
Pipeline/Producer/Marketers	None	70%	62%	50%	82%	Less than one year	Security/Reliability Price
Industrial End Users	None	17%	63%	38%	23%	Less than one year	Price Security/

Small Local Distribution Companies (S-LDC). The S-LDC segment respondents anticipate few changes in the overall supply/demand for natural gas, although a majority do anticipate an increase in prices. A majority also anticipated an increase in both baseload and peak day requirements, to be met by increasing firm transportation and natural gas storage. General storage term contracts are for periods in excess of one year, with security/reliability being the most important factor. Over the next five years, about half of the respondents expect unbundling to have the greatest impact on natural gas storage use.

On balance, the S-LDC Segment is conservative in their gas supply planning profile, both now and for the future. They are generally price takers and view themselves as being subject to the evolution of market and regulatory factors. Members of this segment tend to rely on the supply mix with which they are familiar, with reliability being of greatest concern.

Local Distribution Companies (LDCs). About half of the LDC segment respondents expect there to be a change in the supply/demand balance, with three-quarters anticipating increased prices. About three-quarters of the respondents also expect increases in baseload and peak day requirements, to be met with increases in storage and peak shaving. All of the respondents indicated that their storage terms were for periods in excess of one year, with security/reliability being the most important decision factor. Unbundling and other regulatory changes are expected to have the most impact on natural gas storage use.

In most areas, LDC natural gas sales growth is coming from residential market penetration. The price sensitivity of industrial users will make by-pass a continuing concern for LDCs. Both of these trends will make LDC's natural gas requirements more peak-day oriented, and will shift natural gas storage requirements from seasonal toward peak shaving services for the residential sector. The industrial sector may or may not be affected by this, based upon each state's unbundling process and the LDC's latitude to resell storage held for residential customers.

Small Combination Utilities (S-LDC/UEGs). Only about one-third of the S-LDC/UEGs expect changes in the overall supply/demand balance, although half of the respondents indicated that price increases were likely. Over 70% indicated an expectation of higher baseload and peak day requirements, to be met with increases in firm and interruptible transportation, as well as storage. Storage terms exceed one year, with security/reliability being the most important selection criteria. Unbundling is expected to provide the greatest future impetus to changes in storage usage.

As with the LDC Segments, the S-LDC/UEG Segments expect to use those supply mix elements with which they are familiar. This segment is also affected by residential growth, contributing to greater peak day needs for the future.

Combination Utilities (LDC/UEGs). About two-thirds of the LDC/UEG segment believe that there will be a change in the supply and demand for natural gas, with three-quarters anticipating a price increase. All of the respondents expect an increase in baseload requirements, with three-quarters expecting peak-day increases. All of the respondents in this segment indicate that increased storage use is expected over the next five years, and their storage terms are generally less than one year, with security/reliability and price being the most important selection factors. This is the only segment where substitution for natural gas is expected to have an impact on the use of storage.

The LDC/UEG segment respondents show the greatest propensity to reduce their transportation protocols over the next five years. This could be attributed to the anticipation of pending regulatory changes and an expectation that these changes will be responsive to industry conditions. However, while generally conservative in the gas supply planning methodology, the natural gas users in this segment appear to be the willing to review other options, and increase their use of natural gas storage.

Small Utility Electric Generators (S-UEGs). The S-UEG segment indicated the lowest

usage of natural gas storage. Slightly more than one-third indicated an expectation of changes in the supply and demand outlook for natural gas, with one-half of all respondents expecting price increases. However, nearly two-thirds expect both their baseload and peak day requirements to increase. Demand is expected to be met by increases in Firm and Interruptible Transportation, Storage, and Peak Shaving. A majority of respondents indicated that natural gas storage service contracts are for less than one year, with price being the primary determinant of service selections. Respondents in this segment do not expect external factors to have a strong influence on their use of storage.

With fewer than half utilizing storage or other peaking tools, the S-UEG respondents demonstrate their price-sensitive approach to gas supply planning. This is also indicative of their dis-inclination to use natural gas as a primary fuel and the ready availability of Interruptible Services during their counter-cyclical seasons.

Utility Electric Generators (UEGs). Two-thirds of the UEG segment respondents expressed the belief that there would be changes in the natural gas supply and demand balance. About two-thirds expect their baseload requirements to increase, with over three-quarters anticipating greater peak day requirements over the next five years. The supply mix is expected to include increased Interruptible Transportation, Storage, and No-Notice Service to meet this demand. Half of the respondents indicated that storage terms are for less than one year, with the other half indicating the use of multiple year contracts, with Price being the determining factor. Regulatory change is the only external factor expected to have an impact on the use of storage.

The UEG Segment respondents show a greater inclination than the S-UEG Segment to utilize balancing and peak load management tools, as evidenced by their use of Storage, No-Notice Services, and Peak Shaving. As the use of natural gas increases as a primary fuel and as the electrical industry deregulates, these elements should take a greater role in the overall supply mix, with an anticipated need for increased peaking supplies.

The UEG Segment is price-sensitive and very knowledgeable of market issues. As a result, showing the application of storage efficiencies will have a high utility to this group. It should also be noted that the major natural gas-burning UEGs are located in producing states with significant intrastate pipeline systems as well as extremely competitive storage markets. Thus, their price sensitivity and use of short term storage and IT is consistent with prevailing gas supply opportunities.

Municipal Utilities (Municipals). Less than half of the Municipal respondents expect changes in either the supply and demand for natural gas or in the price. About half expect higher baseload and peak day requirements, to be fulfilled with additional Firm Transportation, Storage, No-Notice Service, and Peak Shaving. Three-quarters indicated that contracts for natural gas storage service are for less than one year, with price and security/reliability being the key factors. External factors are not expected to have a major role in the use of storage over the next five years.

Municipal utilities are not forced to compete in the same manner as the other utility segments included in this study. However, like the LDCs, natural gas users in the Municipal Utility Segment tend to rely on those supply mix elements with which they are familiar. This is not likely to change over the next five years, since the Municipals' funding sources are extremely conservative and reliability is a major issue.

Cogeneration Facilities (Cogens). Very few of the respondents in the Cogen segment expect changes in the supply and demand balance for natural gas, with fewer than one-third anticipating increased prices. This segment anticipates the lowest growth in baseload and peak day requirements. Consistent with cogen agreements, storage terms tend to be over twenty years, with price the most important factor. External factors are not expected to be major considerations in storage use.

Cogeneration Facilities have not been major users of natural gas storage services, since they tend to be “flat burners”. However, as electric companies buy out the contracts for Qualifying Facilities and cogenerators expand their role as suppliers of peaking electrical power, there is an expanding opportunity for Cogens and natural gas storage service suppliers to work together.

Pipeline/Producer/Marketers (PPMs). The respondents in the PPM segment were most likely to expect supply/demand changes in the natural gas industry over the next five years, with over half expecting price increases. While only half anticipate an increase in baseload requirements, over three-quarters expect peak day requirements to increase, to be met by greater use of No-Notice Service and Peak Shaving. Storage contracts are generally less than one year, with security/reliability, price, and location having equal importance.

The PPM Segment is an important consumer and provider of natural gas storage services, particularly for value-added gas services, including No-Notice Services and Warranty Gas Sales. As state-level deregulation evolves, if LDCs and UEGs do not provide these services to their constituents, there is an opportunity for the PPM Segment to increase its service sales levels, particularly to the larger end users. In addition, the PPM Segment also tends to use storage as a financial hedging tool.

Industrial End Users (Industrials). The respondents in the industrial segment indicated that they expect little change in the overall supply and demand for natural gas, although more than half anticipate a price increase over the next five years. This segment expects the lowest growth rate in baseload and peak day requirements, indicative of ongoing energy management. Almost all respondents indicated that storage contracts were for less than one year, with price and security/reliability being the most important factors. Potential substitution for natural gas is the only external factor expected to have any significant impact on storage use over the next five years.

The future for the Industrial User Segment is the least well-defined, since there is no clear choice in the evolving state level deregulation environment. As some of the larger Industrial Users by-pass their local LDCs, there will be an increased need for dedicated

storage or for value-added natural gas services, but this will depend on the particular gas supply options available to each entity.

Industrial Users have benefited from significant savings in their total natural gas supply cost. Commodity gas prices, pipeline transportation costs, and LDC charges are all declining with competition. Thus, the industrial segment is looking forward to electric cost savings to have a greater impact over the next five years than will incremental gas supply cost savings.

Industry Segmentation Summary. The results of the Industry Segmentation indicate the following:

- There is generally a breakout between smaller and larger users of natural gas. Smaller users tend to be less aggressive and are more likely to have a shorter planning horizon and tend to be price-takers. Larger users are more concerned with regulations and industry trends.
- Electric generators and industrial users tend to be more sensitive on storage price and location than other groups.
- New and redeveloped storage services must be efficient and flexible to respond to cost and service quality trade-offs.

Regional Segmentation

The regional segments were analyzed according to the Energy Information Administration (EIA) definitions, with two exceptions: the two “Mountain” regions were combined and California was combined with the Pacific region. Figure 1 shows the geographic delineations used for the analysis, while Table 2 provides a summary of the responses by regional segment.

Table 2. Regional Segment Response Summary

	Supply/ Demand Change	Price Increase	Baseload Increase	Peak Day Increase	Storage Term	Most Important Storage
New England	29%	71%	64%	86%	More than	Security/
Middle Atlantic	74%	65%	70%	78%	More than one year	Security/ Reliability
South Atlantic	42%	65%	80%	73%	More than one year	Security/ Reliability
East North Central	29%	65%	56%	45%	More than one year	Security/ Reliability
East South Central	67%	75%	56%	56%	About one year	Security/ Reliability
West North Central	30%	70%	50%	60%	More than	Security/
West South Central	43%	64%	67%	70%	Less than one year	Price Security/
Mountain	50%	43%	58%	79%	About one	Security/
Pacific	23%	36%	39%	26%	Less than	Price

New England (NE). Since it is the only region without underground natural gas storage facilities within its boundaries, the NE Region is different from any of the others evaluated in this study. However, natural gas storage and peak shaving facilities play a significant role in the gas supply planning mix.

Less than one-third of the respondents for the NE Region indicated that they expect a change in the supply/demand balance over the next five years, but nearly three-quarters expect prices to increase. A majority of respondents expect increases in both baseload and peak day requirements, to be met with additional Firm Transportation, Storage, and Peak Shaving. Storage terms are all in excess of one year, with security/reliability being the primary selection factor.

The New England Region is constrained by two factors: being at the end of the pipeline and having a dearth of underground natural gas storage capacity. This creates a role for peaking services being provided by LNG and Propane-air, which are perceived as meeting these needs better than pipeline services. Fuel oil also functions as synthetic storage for those consumers able to switch fuels. For the foreseeable future, no major changes are expected in the overall gas supply mix, with an emphasis on reducing costs and improving operational flexibility.

Middle Atlantic (MA). The MA Region has both underground natural gas storage and peaking capacity. Nearly three-quarters of respondents expect changes in supply and demand, with almost two-thirds projecting increased prices. Increased baseload and peak day requirements are anticipated by a majority of respondents, to be met with increased Storage and Firm Transportation. Storage contract terms are generally greater than one year, with security/reliability and price being the most important factors. Unbundling and reliability/cost trade-offs are the external factors expected to have the greatest impact on storage use.

The Middle Atlantic Region is also characterized by occasional capacity constraints in a market defined by high seasonal residential loads. Some of the respondents indicate that the pipelines are not being customer-friendly in meeting market needs. As with the New England Region, fuel oil functions as synthetic storage. Flexibility provides the key for future services, an expressed need for a greater diversity of natural gas supplies.

South Atlantic (SA). The South Atlantic Region has both natural gas storage and LNG peaking capacity. Less than half of this region's respondents expect supply/demand changes over the next five years, while nearly two-thirds expect price increases. Three-fourths expect increases in baseload and peak day requirements, to be met with increased Storage, Firm Transportation, and Peak Shaving. Storage terms tend to be more than one year, with security/reliability and price being the most important factors.

In the South Atlantic Region, the ownership of storage and the subscription of excess transportation capacity is considered to be cost effective. Alternatives to natural gas storage include fuel switching, particularly for industrial groups and electric generators (in Florida), and No-Notice Service. The value of natural gas storage for the long term is tied to electric generation growth opportunities, which are driven, in turn, by residential growth. The latter is primarily for air conditioning, demand for which is counter-cyclical to the northeastern and midwestern winters.

East North Central (ENC). As the result of favorable geological conditions, this region has the greatest amount of storage capacity and deliverability. Less than one-third of respondents expect changes in natural gas supply and demand, while two-thirds anticipate price increases. About half of the respondents expect baseload and peak day requirements to increase. The new demand for services is expected to be met by Interruptible Transportation, Storage, and Peak Shaving. Storage contracts are usually for terms in excess of one year, with security/reliability and price being the most important factors.

The East North Central Region enjoys the combination of having few pipeline capacity constraints with an abundance of natural gas storage capacity. There is increasing pressure on natural gas buyers to maximize transportation load factors, as evidenced by the de-contracting of transportation capacity to the pipelines as long-term commitments expire. Natural gas storage is considered by many users to have the greatest utility when located on the LDC system. Over the long term, electricity wheeling could increase the use of natural gas storage for cost-effective gas supply operation by the UEG community.

East South Central (ESC). At the present time, the ESC Region has very little storage capacity, since their position on the pipeline precluded its need. Two-thirds of respondents expect changes in supply and demand, while three-quarters are projecting price increases. Over half of respondents expect both baseload and peak day requirements to increase, to be met with increased Firm Transportation, Storage, and Peak Shaving. Half of the respondents indicated that storage contracts were for terms less than one year, with the other half indicating the use of multi-year contracts. Security/reliability and price were cited as the most important service factors. The delivery infrastructure is the only external factor expected to have a major impact on storage use over the next five years.

In the East South Central region, coal is a significant player in the electric generation market. However, it is anticipated that a significant portion of the peaking demand growth will be met with combined cycle technology, which provides a significant opportunity for natural gas. In turn, this will enhance the use of natural gas storage as a tool for summer peaking as well as intra-day gas supply requirements.

West North Central (WNC). With the exception of anticipated price increases, most respondents in this region do not expect major changes in the natural gas industry over the next five years. Over half expect increases in both baseload and peak day requirements, to be met with increases in Storage and Peak Shaving. All respondents indicated that storage contracts were in excess of one year, with security/reliability being the most important selection factor.

Competing pipelines in the WNC Region offer differing storage services to their customers. In addition, the availability of relatively inexpensive No-Notice Services helps to create a perceived natural gas storage surplus. Finally, natural gas storage use appears to be shifting from base deliverability to peaking.

West South Central (WSC). With its large production capacity, the WNC region also

enjoys a large amount of underground storage. Less than half of the respondents in this region anticipate supply/demand changes, while almost two-thirds expect price increases. Over two-thirds also expect baseload and peak day requirements to increase, to be met with increases in Firm Transportation, Interruptible Transportation, Storage, and No-Notice Service. Storage contracts are generally less than one year, with price and security/reliability being the most important factors. Less than half of respondents expect external factors to have a major impact in storage use over the next five years.

With the supply availability in the WSC Region, natural gas storage is used to provide both balancing and capture arbitrage profit opportunities to a greater degree than any other region. In addition, storage is viewed as more of a commodity item in the region, with the market outlook calling for shorter term contracts and lower profit margins. However, the area remains a critical element of the nation's natural gas supply portfolio, and actions taken in this Region will affect the remainder of the country.

Mountain (MNT). The MNT Region has both underground and LNG storage capability. Over the next five years, half of the respondents in this region anticipate supply/demand changes, but less than half expect higher prices. Over half expect increased baseload requirements, while more than three-quarters expect higher peak day requirements, to be met with Firm Transportation, Storage, and No-Notice Service. Half of the respondents indicated that storage contracts were for terms less than one year, with the other half indicating multi-year contracts were used, with security/reliability having the highest rank for usage.

Natural gas supplies in the Mountain Region are viewed as being reliable and readily available on a year-round basis. The area's southern segment has a summer peaking profile, so some natural gas users believe that Firm Transportation capacity can be substituted with Interruptible Transportation. On balance, most of the natural gas demand growth is projected to come from the use of combined cycle plants.

Pacific (PAC). Respondents in the PAC Region indicated that they do not expect major changes in the natural gas industry over the next five years: less than one-quarter believe that there will be supply/demand imbalances, and only about one-third anticipate higher prices. Fewer PAC region respondents also anticipate higher baseload and peak day requirements. Storage terms in this region tend to be for less than one year, with price being the most important factor.

Natural gas users in the southern half of the Pacific Region believe that there are ample supplies of natural gas, which offsets the need for traditional storage. This is not the case for the Pacific Northwest, where areas of shortfall exist, some of which are being met with storage services provided in California, with backhaul transportation service. Deliverability, however, is now and is expected to continue to be the primary focus for the PAC Region.

Regional Segmentation Summary. The regional analyses indicate the following:

- There is a tendency for all segments of the natural gas industry to accept what they have and a desire to seek similar services, albeit less expensive. Thus, vendors of new services may expect to have an educational as well as a sales mission when attempting to penetrate a region with an unfamiliar product. This presents a role for GRI in the education and validation of “soft” technologies, such as portfolio management, with and without No-Notice Services.
- The areas with the greatest available pipeline capacity show the most inclination for price sensitivity and storage and transportation service competition.

Results

Based on this survey, there are several conclusions that will impact GRI’s and DOE’s programs for the next five years:

- The regional trends and responses regarding present and anticipated natural gas storage requirements closely parallel the historical availability of those services (e.g., respondents in areas of shortage value availability over cost and respondents in areas of abundant supply value price over other criteria).
- Storage use is not expected to decline significantly in any industrial or regional segment, but price and term pressure is developing.
- With the projected increases in peak day requirements for most industrial and regional segments, flexibility in storage deliverability services will be critical, and a need for cost-effective peaking service is evident.
- The demand for natural gas storage services will continue to be tailored to specific industrial and regional requirements. As an example, there is a need for more services of all kinds across industrial sectors in the New England and Middle Atlantic Regions and in the Pacific Northwest.
- The LDC/UEG, S-UEG, and UEG industry segments are prime targets for education regarding the enhanced utilization of storage as a key element of a natural gas supply portfolio. The UEG segment appears likely to provide the largest storage service sales opening.
- Pipeline de-contracting will likely affect how storage is utilized, particularly in the ENC region.
- Intrastate unbundling will provide holders of storage assets with the opportunity of generating revenues from incremental clients if the new services are cost competitive.

Future Activities

The storage research, development, and commercialization programs for GRI and DOE have adapted to recent changes in storage use. This study provides confidence that the expected evolution over the next five years is consistent with current program strategy and gives insight into future areas. It is recognized, however, that the use of storage in the future will be affected by market and regulatory shifts. Therefore, this study will need to be repeated periodically.