

U.S. Storage Drawdown Analysis Report

This report examines contract terms that require owners of natural gas in storage to reduce their holdings of working gas to specified levels by certain dates or risk incurring penalties. If they were sufficiently restrictive, such constraints could result in the introduction of significant natural gas volumes into the market toward the end of the heating season. Although many tariffs or service agreements include these restrictions, they are not pervasive and their impact may be less than previously expected. This report was prepared by William Trapmann of the Energy Information Administration. The author would like to acknowledge the significant contributions of Michael Tita to this article. Questions or comments should be directed to William Trapmann at william.trapmann@eia.doe.gov or (202)586-6408.

Major Findings

- Estimated maximum allowable working gas in storage at the end of the 2007-2008 heating season may be as low as 2,001 billion cubic feet (Bcf).
- Limits on maximum allowable stored natural gas do not appear to drive end-of-season storage balances, since historical end-of-season working gas levels have been lower than the volume allowed.
- Terms of service impact slightly more than half of U.S. working gas capacity and limit the amount of natural gas firm storage customers may hold at the end of the withdrawal season or contract period.¹
- The allowable volume of natural gas stored in facilities where there are end-of-season volume restrictions is less than 20 percent of working gas capacity.
- The storage operators that impose limits tend to have larger facilities. The working gas capacity for individual companies with end-of-season limits average 80 Bcf and range from 2 Bcf to 413 Bcf.
- Thirty-four companies representing 37 percent of working gas capacity do not limit the volume of natural gas customers may retain in storage at the end of the withdrawal season.

Overview of Storage

Storage plays a number of roles: it maintains reliability of gas supplies during periods of high demand (including both winter and summer peak days); it supports load balancing for pipelines; and it provides opportunities for owners of natural gas in storage (LDCs, marketers, and other

¹ The research team could not find specific or sufficient information to determine any restriction regarding end-of-season volumes for a select group of storage companies. This group comprised 51 companies that have 442 Bcf or 11 percent of total storage capacity. All cited percentages refer to shares of the total population including the group without good information.

third parties) to synchronize their buying and selling activities more effectively with market needs while minimizing their business costs.

Natural gas consumption has a strong seasonal pattern due to its use as a heating fuel. For this reason, natural gas is generally injected into storage during the nonheating or injection season (April-October) and withdrawn from storage during the heating or withdrawal season (November-March).² Storage service providers often include clauses in their storage service tariffs requiring customers to reduce natural gas in storage to a specified percentage of their contract volumes by the end of the withdrawal season to prepare for the injection season and to protect the recovery of natural gas held in storage. These drawdown requirements mandate the withdrawal of certain amounts of natural gas even if demand was low during the heating season. Consequently, some think that a relatively large amount of working gas in storage held late in the heating season may result in a significant amount of incremental natural gas supplies being introduced into the market as customers withdraw natural gas to avoid penalties. The additional supply from storage at such times could result in downward pressure on natural gas spot prices.

Recent research by the Energy Information Administration (EIA) indicates that many storage service providers do not have strict drawdown requirements. Possibly to enhance their storage service by offering more flexibility to their customers, some operators appear to have eliminated the traditional end-of-season storage limits. Thus, the limits on stored natural gas at the end of heating season do not appear to drive end-of-season storage balances, since end-of-season working gas levels in recent years have been lower than the volume allowed.

The Role of Storage

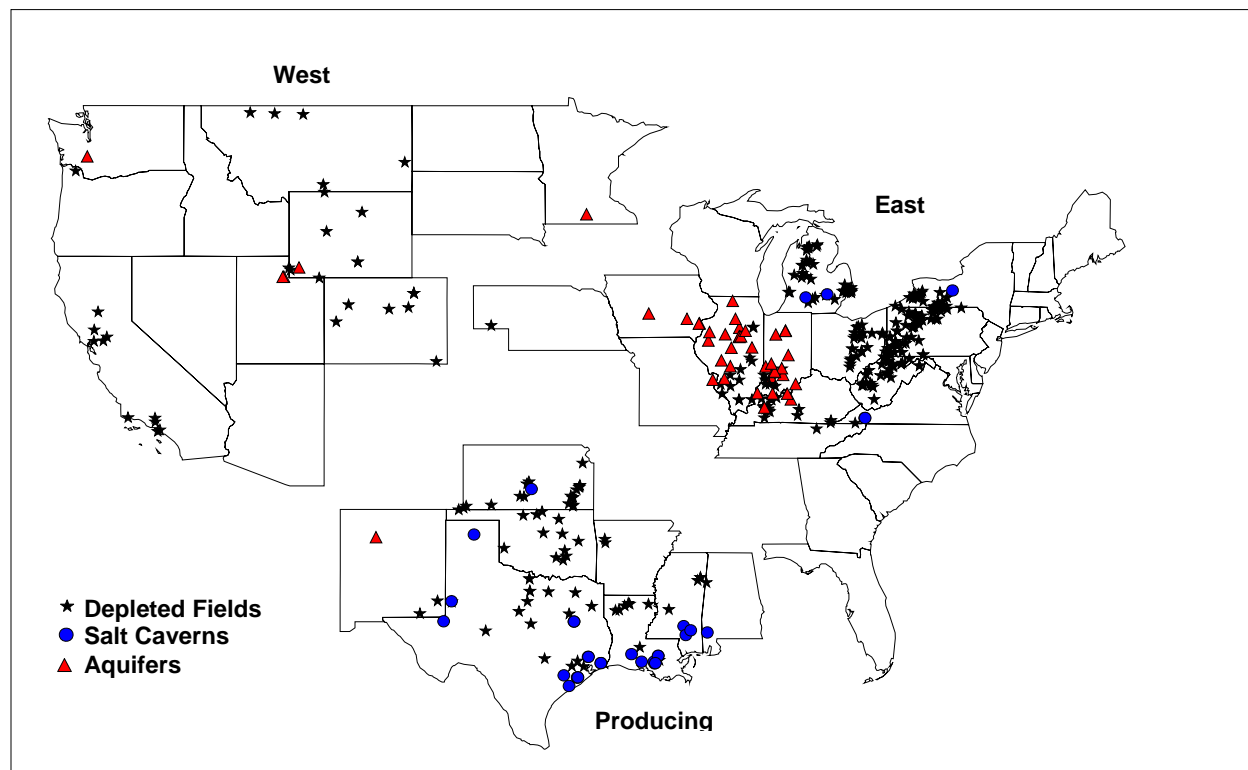
Storage plays two main roles for natural gas end users. First, it supports the delivery of natural gas during periods of high demand, which enhances supply security. When possible, storage facilities are located near market centers to accomplish this purpose (Figure 1). Significantly more investment in long-distance transportation and production capacity would be needed to satisfy the same peak demand without stored natural gas. Because peak demand periods are short-lived, the additional capacity needed in lieu of storage would be underutilized most of the year. Therefore, storage supports the delivery of natural gas by improving the economics of the delivery system.

The second role of storage is to mitigate price risk. Storage service is a successful price management tool in two respects. It serves as a price stabilization tool since a customer can purchase natural gas at a set price and pay the storage charges—thus establishing a known cost per unit of natural gas for future consumption. The use of storage also can reduce the average cost of natural gas if the sum of the nonheating season price of natural gas and the cost of storage is less than the heating season price of natural gas that the customer would have otherwise paid.

² In practice, natural gas is injected into and withdrawn from storage throughout most of the year. However, the general pattern for the industry is for net injections to occur from April through October and net withdrawals from November through March.

Customers have become more sophisticated in their purchasing practices by developing portfolios of stored natural gas, long-term contracts, spot purchases, and futures contracts to minimize natural gas costs while maintaining supply stability. Customers have begun to use storage more efficiently, as the cost of inventories has increased with the rise in prices.

Figure 1. Natural Gas Storage Fields in the Lower 48 States By Type



Source: Energy Information Administration, Office of Oil and Gas. More information on storage field types is available in the EIA report, *The Basics of Underground Natural Gas Storage* (http://www.eia.doe.gov/pub/oil_gas/natural_gas/analysis_publications/storagebasics/storagebasics.html).

Storage service providers have addressed customers' changing needs with additional storage services. As with other services, the price of the storage service increases as reliability and flexibility increase. Customers normally pay four different rates associated with the elements of firm storage service. These rates include a charge for the maximum storage space reserved (capacity charge), a charge for the maximum daily volume that may be withdrawn during the withdrawal season (reservation charge), a charge for each unit injected into storage (injection charge), and a charge for each unit withdrawn (withdrawal rate).

Description of the Study

This study focuses on drawdown requirements for the end of the storage-withdrawal season imposed by companies that provide firm storage service to third parties. Tariffs and service agreements of storage operators were reviewed to find tariff or contractual clauses that require

customers to reduce the amount of natural gas in storage by the end of the withdrawal season or face a penalty. The study identified and focused on companies that both imposed a storage limit and had in place penalties should the customer not meet the limit. An end-of-season storage volume limit that was to be met by the customer's best efforts alone was not considered restrictive enough to constitute a true limit. The target quantity of natural gas allowed to remain in storage is normally stated as a percent of the customer's maximum storage space.

Need for Storage Drawdown

Storage service providers require customers to draw down the amount of natural gas in storage at the end of the withdrawal season for operational reasons. Storage activities exhibit a strong seasonal trend because storage is used predominately to supplement natural gas supplies during the heating season. As such, storage pressure and volume are optimized to improve efficiencies year-round and to maximize withdrawal rates during the heating season. Therefore, heating season drawdown is required by some facilities to relinquish space and allow for the gradual increase in operating pressure.³

Another reason that customers may be required to draw down their stored natural gas is to avoid migration of the natural gas into unrecoverable areas of the storage reservoir. Depending on the physical characteristics of the reservoir, maintaining a volume that is near storage capacity could force natural gas into areas of the formation from which it cannot be extracted. Some storage service providers may require cycling to avoid these losses.

Penalties

The incentives for customers to reduce their natural gas in storage are normally in the form of penalties imposed by the companies. The penalties range from moderate to fairly substantial. As an example of a moderate penalty, if a firm storage customer has natural gas in storage at the end of its contract period, the customer's storage is converted to interruptible service. The new terms for lesser quality service might result in other restrictions on the owner of the natural gas. However, the terms of the initial firm service agreements themselves were considered not restrictive. In most cases, the company takes possession of the volume of the customers' natural gas that exceeds a specified limit either by purchasing it at a discount or by outright confiscation. Ten of the 27 companies with end-of-season limits confiscate the customers' natural gas that exceeds the allowed limit without any compensation in return.

Analysis of the Data

The data depict the conditions associated with firm storage service. This information supports estimation of how much natural gas may be held in storage at the end of the heating season. The estimation proceeded by applying firm storage service drawdown requirements to the respective working gas capacity of storage companies that impose these limits. Given that some portion of working gas will be associated with high priority customers, own-company operations, and interruptible service volumes not subject to the end-of-season drawdown requirements, the actual

³ See Columbia Gas Transmission Corporation, FERC Docket No. CP06-430-001.

maximum allowable working gas volume may exceed the estimated requirement from this analysis.

The estimates are subject to uncertainty because of limitations in the data regarding the overall storage operations.

- The share of total storage committed to firm storage services and information on the other uses of storage capacity are often unavailable.
- Some natural gas may remain in storage to meet the needs of higher priority customers (e.g., No-Notice Service).
- In addition, some portion of the working gas capacity may be retained by the storage company for other services such as transportation and load balancing. These volumes would increase the level of the aggregate end-of-season volume for these companies beyond levels estimated from a strict application of the firm service restrictions.
- Interruptible storage customers may not be under the same contractual requirement to drawdown all of their stored natural gas by March 31. A review of firm storage contract penalties shows that some storage service providers will convert firm service volumes that have not been withdrawn by the end of the contract period to interruptible service, but the natural gas may still remain in storage.

These situations would tend to result in more natural gas remaining in storage for the end of the 2007-2008 winter than this estimation would show. Nonetheless, the estimated maximum allowable working gas volume serves as a useful reference point for the end-of-the-heating-season level because the maximum is not a binding constraint based on historical data.

Findings of the Analysis

Companies With End-of-Season Restrictions

This study examined information available for the 112 storage operators in the United States with 4,129 Bcf of working gas capacity. Twenty-seven or about one-quarter of the storage service companies, representing slightly more than half of U.S. working gas capacity, have limits on the amount of natural gas firm storage customers may hold in storage at the end of the withdrawal season or contract period (Table 1).⁴ These companies operate 2,162 Bcf of working gas capacity. The limits usually are stated as a percent of the storage space contracted by the customer and range from allowing use of no more than 35 percent of the contracted space to requiring the withdrawal of all natural gas by a predetermined date. In about 80 percent of the cases the observed end of the storage cycle was March 31, which coincides with the traditional end of the U.S. heating season.⁵

⁴ All percentages in this report refer to shares of the total population including the group with insufficient information. Discussion of this group is provided in a later section of this report.

⁵ In most cases customers have to draw the amount of gas in storage down to the imposed limit by the end the withdrawal season (March 31 of each year). However, in some cases the company designated that the storage limit must be met by the end of the contract period. In many cases, the contract end date coincided with the end of the withdrawal season, but some companies did not designate a contract end date. For simplicity, the analysis is based

Table 1. Summary of End-of-Season Limits by Storage Service Provider

	Number of Companies	Average Working Gas Capacity (Bcf)	Aggregate Working Gas Capacity (Bcf)
With End-of-Season Storage Provision	27	80	2,162
Without End-of-Season Storage Provision	34	45	1,525
Insufficient Information	51	9	442
Total	112	37	4,129

Source: Energy Information Administration, Office of Oil and Gas.

The companies that impose limits tend to have larger facilities as measured by working gas capacity. The working gas capacity for companies with end-of-season limits average 80 Bcf and range from 2 Bcf to 413 Bcf.

The estimated maximum allowable volume for end-of-season working gas for companies with end-of-season restrictions would be 395 Bcf or about 18 percent of the total (2,262 Bcf). This estimate for allowable natural gas levels in storage may be lower than the required level in practice because it assumes that all of the working gas capacity is being used for contracted firm storage service and does not allow for retention of natural gas to support higher priority storage service or other operations.

Companies Without End-of-Season Restrictions

Thirty-four companies (30 percent of all companies) representing 1,525 Bcf or 37 percent of the working gas capacity do not have restrictions on the volume of natural gas customers may retain in storage at the end of the withdrawal season. The storage facilities for these companies are geographically diverse with facilities located in each of the three storage regions.⁶ These companies tended to be smaller, in terms of working gas capacity, than the companies that impose an end-of-season limit. The working gas capacity for companies without end-of-season limits averaged 45 Bcf and ranged from 0.6 Bcf to 268 Bcf.

Companies With Insufficient Information

Specific or sufficient information to determine any restriction regarding end-of-season volumes could not be found for 51 companies that have 442 Bcf or 11 percent of total storage capacity. It appears that many of these companies use their storage facilities to support their transportation services and do not offer standalone firm storage service to third parties. As such it is unclear whether they would self impose an end-of-season limit on the volume of natural gas held in storage.

on the assumption that the end-of-season limit applies to March 31 of each year for all companies with storage balance limits.

⁶ The three storage regions are those depicted in Figure 1.

It is unlikely that there are requirements to reduce working gas volumes to specific levels for these small-volume storage operators. However, for purposes of this analysis, an approach to estimation that recognized the possibility of restrictions on even these volumes seemed most appropriate. So the estimation of allowable end-of-season volumes accounts for the operator group with insufficient information by applying the average percentage for those units with specific limits. This yields an estimated maximum allowable volume of 81 Bcf for this group.

Estimated Allowable U.S. Working Gas Levels at the End of the Heating Season

An estimate for maximum allowable natural gas in storage at the end of the 2007-2008 heating season is 2,001 billion cubic feet (Bcf). That comprises 395 Bcf from companies that clearly impose limits, 1,525 Bcf from companies that do not impose limits, and 81 Bcf for companies with insufficient information. This estimate reflects the identified restrictions on storage management practices and the key assumptions that restrictions apply to all capacity in the field and operators for which information was unavailable conform to the practices of those that apply limits.

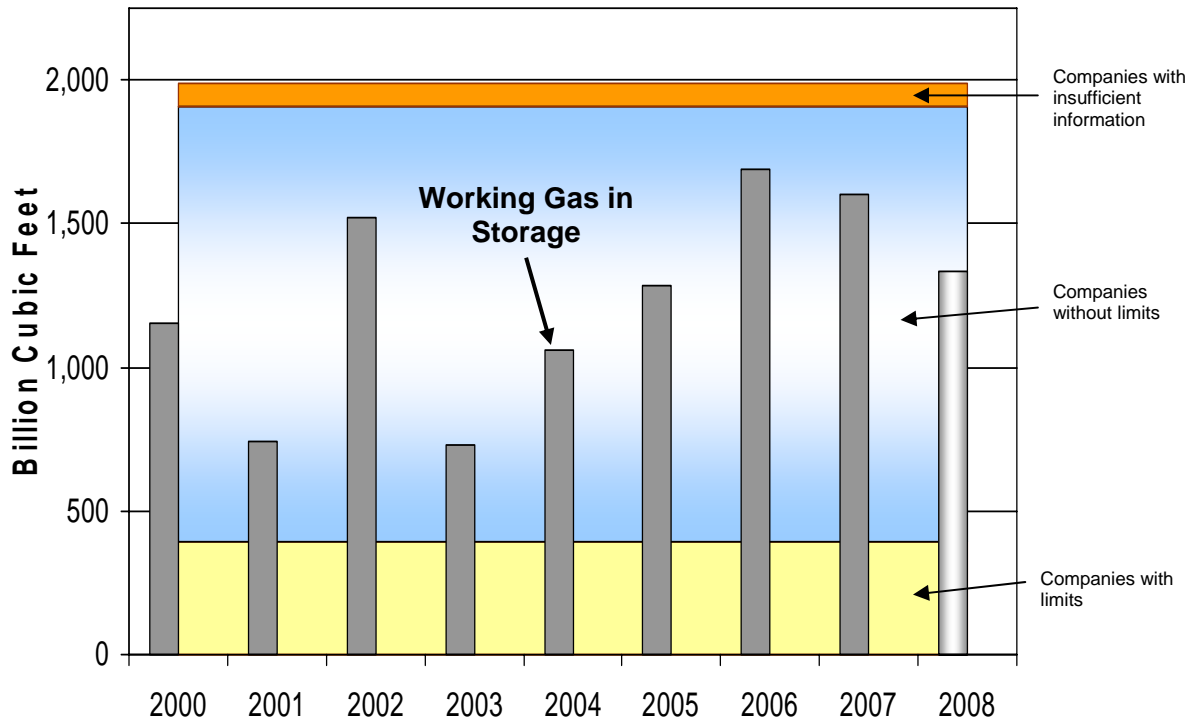
The maximum allowable volume of 2,001 Bcf is believed to be low relative to actual industry practices for a number of reasons.

- The parameters yielded from the data or established by assumption were applied to the entire capacity of a company. The limits specified for firm service by certain operators may not be applicable to all capacity in their storage fields. At least some of these operators likely retain an amount of natural gas in storage to support high priority service, load-balancing needs, or other purposes.
- The assumption that the small-volume operators with insufficient information conform to the average restrictions imposed by the large-volume operators probably is too restrictive.
- A few companies have later dates by which customers must reduce their working gas. Therefore, more natural gas may remain in storage on March 31 than is indicated by the limit.

Conclusions

The contractual requirements for customers to reduce their end-of-season storage levels do not appear to be a major driver that determines the aggregate end-of-season storage levels in the United States. A comparison of working gas storage volumes at the end of the heating season (March 31) in recent years with the current estimate for maximum allowable shows that remaining volumes have been well below the estimated limit (Figure 2). Absent dramatic changes in terms of service over the years, it appears that operators voluntarily reduce their storage volumes below specified limits. This behavior reflects the economics of storage. Given the significant carrying charges to cover the commodity costs, along with storage fees, owners of natural gas in storage would work to avoid carrying amounts of natural gas in storage between heating seasons unnecessarily.

Figure 2. End-of-Season Working Gas in Storage Compared with Estimated Contractual Limits, 2000-2008



Note: Columns represent yearly stocks as of March 31 of each year. Maximum allowable working gas values are based on estimated 2007 working gas capacity and current firm storage contractual limits to gas in storage. Working gas capacity and contractual requirements differ in earlier years. Source: Energy Information Administration, Office of Oil and Gas.

It seems unlikely that the contractual limits on end-of-season storage levels in the United States have much impact on overall natural gas markets and national prices, given that the aggregate withdrawals surpass the requirements. However, there may be local markets where these requirements influence prices at times. Nonetheless, if market conditions in a limited area are not consistent with those in surrounding areas, competitive forces will work to limit the magnitude, duration, and scope of any price impact.