Estimates of Peak Underground Working Gas Storage Capacity in the United States

This report provides estimates for aggregate peak capacity for U.S. natural gas storage as of mid-2008. The estimates for national and regional peak capacity are based on the reported maximum reported working gas volumes for individual active facilities from January 2003 to May 2008. Peak storage estimates are based on monthly data by field from the EIA-191 survey, "Monthly Underground Storage Report," which collects data on storage volumes as of the end of the report month. Questions or comments on the contents of this article should be directed to William Trapmann at william.trapmann@eia.doe.gov or (202) 586-6408.

Natural gas demand is highly cyclical, while current supplies (primarily domestic production and net imports) tend to be relatively stable. Periods of high demand, such as those that occur during the winter season, are met with natural gas that has been stored underground typically during warmer months when demand is lower.[1] Natural gas commonly is injected into storage during April through October, when current supplies generally exceed demand, for use during the following winter. The capability of storage operators to hold natural gas in storage is of general interest because it is one indicator of the system's capability to satisfy winter demand. Additionally, as the end of the refill season approaches, market participants become concerned about the limits for storing more natural gas. If storage is nearing its capacity, a stable flow of current supplies may contribute to downward price pressure, at least until winter demand arrives.[2]

This report presents regional and national estimates of peak working gas volumes.[3] Key findings of this analysis are:

- Peak working gas storage capacity as of mid-2008 is 3,789 billion cubic feet (Bcf), an increase of 86 Bcf from last year.
- This estimate is conservative because it is based on the maximum reported level of natural gas in storage in each pre-existing field, which often is less than the maximum working gas capacity for the field.
- The increase in estimated peak storage capacity is attributable to capacity at new facilities, expansion at previous facilities, and greater use of already existing storage facilities during the past year.
- Estimated peak working gas capacity is almost 92 percent of designed working gas capacity on average.[4]

[1] A more detailed discussion of the uses of underground storage, terminology, and facilities and operations is available in the Energy Information Administration report, *The Basics of Underground Storage*, http://www.eia.doe.gov/pub/oil_gas/natural_gas/analysis_publications/storagebasics/storagebasics.html.

[2] *Working gas* is the volume of natural gas in the reservoir that is in addition to the base gas, which is the volume of natural gas intended as permanent inventory in a storage reservoir to maintain adequate pressure and deliverability rates throughout the withdrawal season.

[3] The regions in this report are those used for Energy Information Administration's *Weekly Natural Gas Storage Report*; see http://www.eia.doe.gov/oil_gas/natural_gas/ngs/notes.html.

[4] Working gas capacity is calculated as the difference between total storage capacity and base gas.

Methodology

The regional and national estimates of peak working gas capacity equal the sums of the maximum volumes for the relevant storage fields reported at any time from the beginning of 2003 through May 2008. These non-coincident peak volumes generally exceed the largest reported working gas volumes in the regions for any given month because not all fields held their highest volumes at the same time.[5] Although the non-coincident peak volumes exceed levels actually observed for the regions, it is a data-driven estimate that reflects actual operator experience and can serve as a useful proxy for the possible limits of industry capacity. However, although the field-level volumes were the largest ones reported for each storage field, the fields were not necessarily at their maximum capacities. Also, actual peaks may occur within the month rather than on the last day of the month, which is the point of measurement for monthly data reported to EIA. Consequently, numerous fields likely can hold more gas than reported, which suggests that this calculation should be construed as a somewhat conservative result. Despite these limitations, peak storage capacity is a useful measure because it provides a benchmark for reasonable limits to the industry's ability to hold natural gas in inventory while accounting for limits on individual field volumes.

The Relationship of Peak and Maximum Capacities

This report refers to the values calculated based on national and regional storage levels as "peak" rather than "maximum" capacity. This terminology was selected to underscore the fact that the estimate does not represent a true maximum. The sum of working gas design capacity for all fields represents an upper bound on the absolute maximum volume that can be held in storage.[6] However, the maximum volume of working gas held in storage is likely to be below this upper bound because logistical difficulties and other practical considerations constrain volumes in a number of fields below the working gas capacity. The use of storage fields below working gas capacity levels can be partially explained by the following factors:

- Pipelines, both mainline and local distribution systems, need spare storage capacity to operate efficiently, so some capacity is held in reserve.
- Some facilities are not operated at working gas capacity because of operational guidelines based on working experience.
- Shippers holding capacity rights may elect to hold a portion of capacity in reserve for reasons particular to their companies' objectives.
- Some storage facilities may be temporarily unavailable because of maintenance or for construction upgrades.
- Some storage facilities are shutting down, so the operators are removing the natural gas without intending to replace withdrawn volumes with injections.

[5] *Non-coincident* means that the months of measurement for the storage volumes by field differ; i.e., the months don't coincide. As such, the non-coincident peak for any region is at least as big as any monthly volume in the historical record.

[6] Even this isn't absolutely true in practice, because some fields have reported volumes for working gas and base gas that exceeded the available total capacity.

Estimates of Peak Working Gas Capacity

Peak capacity for all fields in the lower-48 States as of mid-2008 is estimated to be 3,789 Bcf (Table 1). This volume equals 92 percent of working gas capacity and is 86 Bcf larger than EIA's estimate of peak storage capacity as of mid-2007.[7] Regional peak capacity values range from a low of 490 Bcf in the West Region to a high of 2,153 Bcf in the East Region. The estimated peak working gas capacity is 96.8 percent of working gas capacity in the East Region and 91.6 percent in the Producing Region. The relative magnitude of estimated peak capacity in the West Region is 74.2 percent of working gas capacity. The lower average use of working gas capacity in the West is a result of a number of still-active fields that have experienced a shift in their primary role from seasonal storage to other functions, such as pipeline load balancing, and fields that are being drawn down to take out of service.

Working gas in storage in the lower-48 States hit a record-high level of 3,567 Bcf at the end of October 2007. Most analysts do not expect working gas in storage this year to approach a beginning-of-heating-season level comparable to last year. For example, according to EIA's *Short-Term Energy Outlook* (October 2008), the end-of-October volume is expected to be 3,373 Bcf, which would be 89 percent of peak capacity as of mid-2008.

Table 1. Working Gas Capacity and Peak Gas Capacity as of Mid-2008, Peak Gas as Percent of Working Gas Capacity, and Historical Maximum Volumes (billion cubic feet, unless otherwise noted)

Region	Working Gas Capacity	Estimated Peak Gas Capacity	Peak Gas as Percent of Working Gas Capacity	Historical Maximum Volumes
East	2,225	2,153	96.8%	2,032
Producing	1,251	1,146	91.6%	1,070
West	660	490	74.2%	470
Lower 48	4,136	3,789	91.6%	3,567

Note: The historical maximum volume for the lower-48 States does not equal the sum of the regional volumes because the regional data represent values in different months.
Source: Energy Information Administration (EIA), Natural Gas Division. Working gas capacity: derived from data in the *Natural Gas Monthly* (DOE/EIA-0130), July 2008, Table 11. Peak gas capacity: derived from data reported on the EIA-191M, "Monthly Underground Gas Storage Report."

Conclusion

There are several different ways to estimate natural gas storage capacity. Maximum capacity, the sum of engineering estimates for working gas capacity for all facilities, is not relevant for practical analysis because the industry is extremely unlikely to approach this level because of logistical difficulties and other factors. The determination of a proper adjustment that would

[7] The mid-2007 estimate is from the Energy Information Administration report, *Estimate of Maximum Underground Working Gas Storage Capacity in the United States: 2007 Update* (October 25, 2007), available at http://www.eia.doe.gov/pub/oil_gas/natural_gas/feature_articles/2007/maxstorage/maxstorage.pdf.

reduce this figure to account directly for limiting factors is confounded by site-specific considerations and regional variation in market and industry conditions. The estimated peak volume of 3,789 Bcf is based on non-coincident data by field from 2003 to mid-2008. The peak capacity provides a somewhat conservative estimate for available working gas capacity, since some facilities during the period of examination may not have been at their working gas capacity. Nonetheless, estimates of peak storage capacity are a useful measure when considering industry capability or market conditions.