

Appendix F

**Existing and Proposed
Underground Storage Facilities**

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This appendix provides additional information on the underground storage segment of the natural gas industry. Storage is extremely important to the efficient and reliable delivery of natural gas supply to end users during peak-demand periods and as backup during system emergencies. It is also becoming increasingly important as a tool for pipeline companies, market centers, and shippers to maintain flow balances and inventory control in a restructured and more complex national transmission and distribution network.

Overall Changes

At the end of 1995, 403 underground storage sites were in operation in the United States (Table F1) and 11 in Canada. Pennsylvania (60), Michigan (47), and Texas (38) had the largest number of sites; the latter two States together represent 30 percent of overall working gas capacity (Figure F1). Five new sites were placed in operation during 1995, and expansions at seven sites were completed (Chapter 1, Figure 7). The new sites are located in Texas, Louisiana, Kansas, Michigan, and Kentucky. The seven completed projects represented an increase of 47 billion cubic feet in working gas capacity and 1,395 million cubic feet of daily deliverability over 1994 levels.

During 1995, 10 underground sites were also abandoned (taken out of service). Five of the abandoned sites were in the Central Region (one in Colorado and three in Kansas) and three were in the Northeast (one in New York and two in Pennsylvania). The amount of capacity represented by the abandoned sites was 16 billion cubic feet of working gas and 85 million cubic feet per day of deliverability.

Based upon current information, perhaps 21 more sites will be placed in operation by the early part of the next decade (Table F2) and 37 existing sites could be expanded. These 58 sites would represent an increase of 14 percent in both working gas capacity (268 billion cubic feet) and in daily deliverability (9.9 million cubic feet per day).

Three principal types of underground storage sites are in operation in the United States today: depleted reservoirs in oil and/or gas fields (337), aquifers (40), and salt cavern formations (26). Some supplemental gas supplies stored at liquefied natural gas and propane-air facilities and used primarily for peaking services are not covered in this

appendix. The capability of an underground storage facility is primarily measured by its working gas capacity, that is, the amount of gas in inventory that can be readily withdrawn for delivery to customers, and the amount of gas that can be withdrawn from that inventory on a peak-day basis, also referred to as daily deliverability. Those sites that can rapidly deplete their inventory, primarily salt cavern facilities, are known as high-deliverability sites.

Growth in High-Deliverability Storage

Although salt cavern storage still represents a small percentage of total U.S. working gas capacity, its share of total daily deliverability has grown to 14 percent, from 6 percent in 1992.¹³⁰ Today the industry, especially market centers, finds that high-deliverability storage is an integral part of their successful operation. Of the 19 salt cavern facilities located in the production area of the Southwest, 13 are used by market centers (see Chapter 3). High-deliverability storage is also an ideal supply source for electric utilities and large industrial users, because their usage patterns match well with the salt cavern's peaking and short-notice withdrawal capabilities.

Over the next several years additional storage facilities, 7 of which are high-deliverability sites, are planned to be developed and placed in service (Table F3). An additional 14 facilities are to be expanded. By the end of the decade, salt cavern working gas capacity could increase by 7 percent, or 73 billion cubic feet, and daily deliverability by 60 percent, or 5.9 billion cubic feet per day. The most likely projects to be completed will be those that support market center operations or supplement local seasonal needs.

Additional daily deliverability will also be developed at a number of conventional (depleted field) storage facilities. While expansions will add only 461 million cubic feet per day of deliverability to these sites, new sites could add as much as 3,250 million cubic feet per day to this type of storage. This

¹³⁰Energy Information Administration, "The Expanding Role of Underground Storage," *Natural Gas Monthly*, DOE/EIA-0130(93-10) (Washington, DC, October 1993).

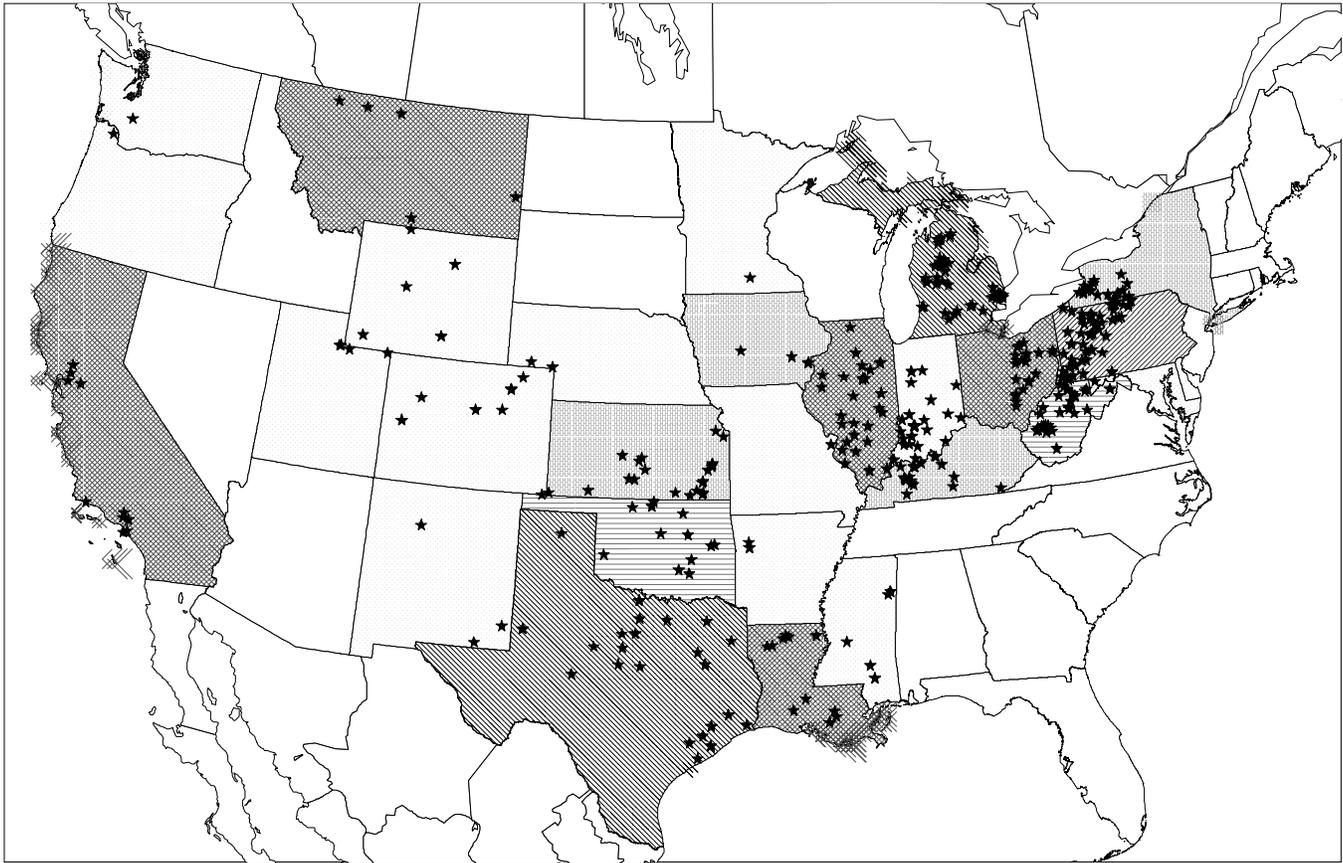
Table F1. Summary of Existing Underground Natural Gas Storage, by Region and Type of Reservoir and Operator, 1995

Region/ Operator	Depleted Gas/Oil			Aquifer Storage			Salt Cavern Storage			Total		
	Number of Sites	Working Gas Capacity (Bcf)	Daily Deliver- ability (MMcf/d)									
Northeast												
Interstate	93	602	10,956	0	0	0	0	0	0	93	602	10,956
Intrastate	0	0	0	0	0	0	0	0	0	0	0	0
LDC	23	29	506	0	0	0	0	0	0	23	29	506
Independent	2	11	99	0	0	0	0	0	0	2	11	99
Total	118	643	11,562	0	0	0	0	0	0	118	643	11,562
Southeast												
Interstate	7	114	2,164	0	0	0	1	5	1,500	8	119	3,664
Intrastate	0	0	0	0	0	0	0	0	0	0	0	0
LDC	16	23	523	2	5	65	1	2	120	19	30	709
Independent	1	1	3	0	0	0	2	5	670	3	6	673
Total	24	137	2,691	2	5	65	4	12	2,290	30	154	5,046
Midwest												
Interstate	35	455	6,489	6	52	1,383	0	0	0	41	508	7,872
Intrastate	0	0	0	0	0	0	0	0	0	0	0	0
LDC	54	401	8,997	22	196	3,486	2	2	85	78	599	12,568
Independent	8	115	1,517	0	0	0	0	0	0	8	115	1,517
Total	97	971	17,004	28	249	4,869	2	2	85	127	1,222	21,959
Central												
Interstate	21	380	3,710	7	88	1,215	0	0	0	28	469	4,925
Intrastate	0	0	0	0	0	0	0	0	0	0	0	0
LDC	16	90	358	1	9	350	0	0	0	17	99	708
Independent	2	5	56	0	0	0	1	2	100	3	7	156
Total	39	475	4,124	8	97	1,565	1	2	100	48	574	5,789
Southwest												
Interstate	15	478	5,594	0	0	0	3	15	1,000	18	493	6,594
Intrastate	12	167	2,766	0	0	0	2	8	1,200	14	175	3,966
LDC	14	117	1,350	1	6	15	4	20	1,414	19	143	2,780
Independent	7	147	1,015	0	0	0	10	31	3,915	17	178	4,930
Total	48	910	10,726	1	6	15	19	74	7,529	68	990	18,271
Western												
Interstate	0	0	0	0	0	0	0	0	0	0	0	0
Intrastate	0	0	0	0	0	0	0	0	0	0	0	0
LDC	10	226	6,480	1	12	525	0	0	0	11	238	7,005
Independent	1	7	5	0	0	0	0	0	0	1	7	5
Total	11	232	6,485	1	11	525	0	0	0	12	244	7,010
United States												
Interstate	171	2,030	28,915	13	141	2,598	4	20	2,500	188	2,191	34,013
Intrastate	12	167	2,766	0	0	0	2	8	1,200	14	175	3,966
LDC	133	886	18,215	27	228	4,441	7	24	1,619	167	1,139	24,277
Independent	21	285	2,696	0	0	0	13	38	4,685	34	323	7,381
Total	337	3,368	52,592	40	369	7,039	26	90	10,004	403	3,828	69,637

Bcf = Billion cubic feet. MMcf/d = Million cubic feet per day.

Source: Energy Information Administration (EIA), EIAGIS-SD Geographic Information System, Underground Natural Gas Storage Database, as of December 1995, based on data from EIA Form 191, "Underground Gas Storage Report."

Figure F1. Locations and Working Gas Capacity of U.S. Underground Storage Sites, 1995



Source: Energy Information Administration (EIA), EIA GIS-NG Geographic Information System, Natural Gas Underground Storage Database, compiled from Form EIA-191, "Underground Gas Storage Report."

is more than 1 ½ times as much as planned new salt cavern sites and almost as much as the planned expansions to salt cavern storage. In the area of expansions alone, Columbia Gas Transmission Company will be upgrading its facilities at 13 of its 43 sites and increasing daily deliverability by more than 326 million cubic feet per day during the heating season.

Ownership of Storage

There has been a substantial shift in the percentage of working gas capacity and daily deliverability owned by the various types of storage operators. Because the new salt cavern sites have been developed primarily by independent operators, the growth in this category of storage has increased the amount of capacity and deliverability owned by this group to more than 8 percent, compared with only 4 percent in 1992.

The majority of the existing storage working gas capacity is located in the Midwest Region, which is also the largest market for natural gas in the United States. The second largest working gas capacity is in the Southwest Region, which is the source of much of the Nation's gas production. The Southwest is also the same region where the greatest amount of new storage capability is planned. Through 1999, more than 91 additional billion cubic feet of new working gas capacity and 4.3 billion cubic feet per day deliverability is planned, the largest of any region.

Regional Developments

The production area of the Southwest Region accounted for three of the five new sites that became operational during 1995. These new sites are located in the production areas of Texas and Louisiana. Alone, they represent about 87 percent

Table F2. Proposed Underground Natural Gas Storage, by Planned In-Service Year and Type of Project, 1996-2000

Year / Type	Depleted Gas/Oil			Aquifer Storage			Salt Cavern Storage			Total		
	Number of Sites	Working Gas Capacity (Bcf)	Daily Deliverability (MMcf/d)	Number of Sites	Working Gas Capacity (Bcf)	Daily Deliverability (MMcf/d)	Number of Sites	Working Gas Capacity (Bcf)	Daily Deliverability (MMcf/d)	Number of Sites	Working Gas Capacity (Bcf)	Daily Deliverability (MMcf/d)
Existing End of 1995	337	3,368	52,592	40	369	7,039	26	90	10,004	403	3,828	69,637
1996												
New	5	103	2,070	0	0	0	2	1	105	7	104	2,175
Expansion	2	2	65	1	1	0	5	8	575	8	12	640
Total	7	105	2,135	1	1	0	7	9	680	15	116	2,815
1997												
New	2	15	500	1	4	100	2	3	445	5	22	1,045
Expansion	6	5	252	1	2	50	4	20	2,370	11	27	2,672
Total	8	20	752	2	6	150	6	23	2,815	16	50	3,717
1998												
New	2	31	400	0	0	0	2	17	900	4	48	1,300
Expansion	3	0	33	1	2	50	2	3	300	6	5	383
Total	5	31	433	1	2	50	4	20	1,200	10	53	1,683
1999												
New	4	24	280	0	0	0	0	0	0	4	24	280
Expansion	6	1	111	1	2	50	3	10	680	10	13	841
Total	10	25	391	1	2	50	3	10	680	14	37	1,121
2000												
New	0	0	0	0	0	0	1	5	500	1	5	500
Expansion	0	0	0	2	4	100	0	0	0	2	4	100
Total	0	0	0	2	4	100	1	5	500	3	9	600
Grand Total												
New	13	173	3,250	1	4	100	7	27	1,950	21	205	5,300
Expansion	17	8	461	6	11	250	14	42	3,925	37	62	4,636
Total	30	181	3,711	7	15	350	21	69	5,875	58	268	9,936

Bcf = Billion cubic feet. MMcf/d = Million cubic feet per day.

Source: Energy Information Administration (EIA), EIAGIS-SD Geographic Information System, Proposed Underground Natural Gas Storage Database, as of September 1996, based on Federal Energy Regulatory Commission filings and information compiled from various industry news sources.

of national new-site working gas capacity (28 billion cubic feet) and 89 percent of new-site daily deliverability (850 million cubic feet per day). Completed expansion projects in the region accounted for an additional 6.3 billion cubic feet in working gas capacity and 300 million cubic feet per day in deliverability, almost all of it at high-deliverability sites. Most

of these sites were operational during the past heating season and, with their high-deliverability features and increased tie-in with market center operations, provided additional support to the needs of customers in the Northeast and Midwest markets during the cold snaps in early 1996.

Table F3. Summary of Proposed Underground Natural Gas Storage, by Region and Type of Reservoir and Operator, 1996-2000

Region/ Operator	Depleted Gas/Oil			Aquifer Storage			Salt Cavern Storage			Total		
	Number of Sites	Working Gas Capacity (Bcf)	Daily Deliver- ability (MMcf/d)									
Northeast												
Interstate	9	1	225	0	0	0	4	5	525	13	7	780
Intrastate	1	1	60	0	0	0	1	0	80	2	2	140
LDC	0	0	0	0	0	0	0	0	0	0	0	0
Independent	2	6	70	0	0	0	2	5	550	4	11	620
Total	12	9	385	0	0	0	7	11	1,155	19	21	1,540
Southeast												
Interstate	0	0	0	0	0	0	0	0	0	0	0	0
Intrastate	0	0	0	0	0	0	0	0	0	0	0	0
LDC	0	0	0	0	0	0	0	0	0	0	0	0
Independent	5	24	280	0	0	0	1	2	220	6	26	500
Total	5	24	280	0	0	0	1	2	220	6	26	500
Midwest												
Interstate	7	42	876	0	0	0	0	0	0	7	42	876
Intrastate	0	0	0	0	0	0	0	0	0	0	0	0
LDC	1	17	200	1	1	0	0	0	0	2	18	200
Independent	0	0	0	1	4	100	1	15	350	2	19	450
Total	8	59	1,076	2	5	100	1	15	350	5	79	1,526
Central												
Interstate	0	0	0	0	0	0	1	5	500	1	5	500
Intrastate	0	0	0	0	0	0	0	0	0	0	0	0
LDC	0	0	0	0	0	0	0	0	0	0	0	0
Independent	1	3	120	0	0	0	4	5	500	5	9	620
Total	1	3	120	0	0	0	5	10	1,000	6	14	1,120
Southwest												
Interstate	0	0	0	0	0	0	1	7	600	1	7	600
Intrastate	0	0	0	0	0	0	2	13	1,000	3	16	1,000
LDC	0	0	0	0	0	0	0	0	0	0	0	0
Independent	2	57	1,150	0	0	0	4	10	1,550	7	67	2,700
Total	2	57	1,150	0	0	0	7	30	3,150	11	91	4,300
Western												
Interstate	0	0	0	0	0	0	0	0	0	0	0	0
Intrastate	0	0	0	0	0	0	0	0	0	0	0	0
LDC	0	0	0	5	10	250	0	0	0	5	10	250
Independent	2	29	700	0	0	0	0	0	0	2	29	700
Total	2	29	700	5	10	250	0	0	0	7	39	950
United States												
Interstate	16	43	1,131	0	0	0	6	17	1,625	22	61	2,756
Intrastate	1	1	60	0	0	0	3	14	1,080	4	16	1,140
LDC	1	17	200	6	11	250	0	0	0	7	28	450
Independent	12	120	2,320	1	4	100	12	37	3,170	25	162	5,590
Total	30	181	3,711	7	15	350	21	69	5,875	58	268	9,936

Bcf = Billion cubic feet. MMcf/d = Million cubic feet per day.

Source: Energy Information Administration (EIA), EIAGIS-SD Geographic Information System, Proposed Underground Natural Gas Storage Database, as of September 1996, based on Federal Energy Regulatory Commission filings and information compiled from various industry news sources.