

4. Deliverability to Markets

Each regional market in the United States has widely varying patterns of energy use and natural gas requirements. Different regional demographics, weather patterns, and distinct natural gas customer profiles result in different market needs and consumption levels. The numerous natural gas pipeline systems that have evolved over time to provide transportation services to and within these end-use markets are designed to accommodate these variations. For instance, in the colder, seasonal markets, regional natural gas distribution systems are designed to meet space-heating demands by residential and commercial customers and are interlaced with wintertime backup (underground storage) and peaking facilities. In less weather-sensitive markets where natural gas demand is mainly for electric power generation and/or industrial usage, storage is needed less for backup and more to support some short-term fluctuations in demand and pipeline transportation system balancing.

Except for those markets in the vicinity of major natural gas production areas, shippers depend upon major longhaul pipeline systems to provide their link between suppliers and the regional pipeline network that directs the natural gas to the eventual consumer. The capability of the longhaul “trunkline” usually reflects the needs of regional “grid” pipeline distributors, which sometimes are other major interstate companies but most often are local distribution companies.

This chapter discusses natural gas deliverability to end users in six U.S. geographic market areas: the Central, Midwest, Northeast, Southeast, Southwest, and Western regions. The emphasis is upon the capabilities, that is, the capacity and utilization, of the interstate natural gas pipelines supplying natural gas to and within each region (see Appendix A for a detailed listing of the pipeline companies serving individual States). Changes in deliverability since 1990 and planned expansions through 2000 are also highlighted.

The profile of the customer base is addressed to provide some insight into the current operation of pipeline and storage facilities in the market area. Each regional market is unique.

- **Central:** This market is the largest in area but is the least populated and produces more natural gas than it consumes, despite having the coldest weather (on average) of the regions. As a result, it is a net export market (Figure 13). Most of the capacity entering the region from Canada and the Southwest actually ends in the Midwest market.
- **Midwest:** More natural gas pipeline capacity enters this market than any other, 24.8 million cubic feet per day

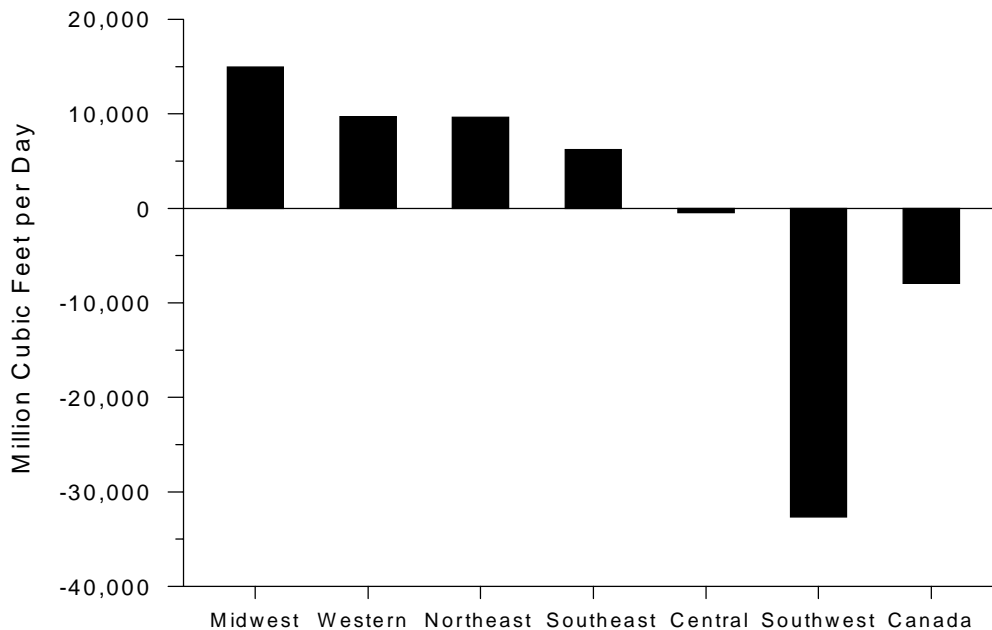
(Table 9). It is the second coldest region (Table 10) and has a substantial spaceheating market. Residential and industrial customers in the Midwest consume more natural gas as a percentage of total energy (25 percent) than any other regional market except the major production area of the Southwest (Table 11).

- **Northeast:** This region is the most heavily populated and is the largest consumer of energy. Yet natural gas represents only 21 percent of all energy consumed, a comparatively low percentage (Table 11), especially since the region has very cold winters. However, natural gas use has increased at an annual rate of 4.9 percent since 1990. Coincidentally, this market is a principal target for Canadian import expansions during the next several years (Appendix B).
- **Southeast:** This region has some of the warmest States in the Nation and consumes the second smallest amount of natural gas behind the Central Region (Table 11). However, almost all of the pipeline systems coming out of the Southwest (Texas and Louisiana) en route to Midwest and Northeast markets travel through the Southeast Region. Industrial use of natural gas is the largest consuming sector in this region, with 44 percent of the market (Table 12).
- **Southwest:** This region not only produces the most natural gas but also consumes the most. The industrial sector’s share of the natural gas market is 53 percent, eight times that of the residential (Table 12). Export pipeline capacity exceeds incoming by a factor of 12 to 1, with 16 major interstate pipeline companies beginning in the region (Appendix A, Table A5). Much of the deliverability within the market is handled by a large network of intrastate pipeline companies.
- **Western:** The Western Region is served by the least number of interstate pipeline companies (seven) and has the least amount of pipeline capacity entering the region, 10.1 million cubic feet per day. However, almost all natural gas coming into the region is consumed there. The market is a large consumer of Canadian natural gas.

Major Market Changes, 1990-1996

From 1990 through 1996, natural gas pipeline deliverability to the major U.S. markets increased significantly. On the interstate pipeline system alone, deliverability increased by

Figure 13. Net Natural Gas Pipeline Capacity Entering (-Exiting) Each Region, December 1997



Source: Energy Information Administration, EIAGIS-NG Geographic Information System, Natural Gas Pipeline Capacity Database, as of December 1997.

more than 15 percent, or 10.9 billion cubic feet per day (Table 9), about the same rate as overall growth in natural gas consumption, 3.0 percent per year (Table 11). This increase reflects the growing demand for natural gas and its increasing contribution to the total national energy consumption picture. Some of the major changes include:

- Expansion of pipeline capacity to high demand markets.** The largest increase in interregional capacity during the 6 years was in deliverability to the Western Region, 3.2 billion cubic feet per day or 45 percent. Second largest was a 24-percent increase into the Northeast Region, or 2.4 billion cubic feet per day (Table 9). The development of so much capacity in the West led to a surplus of capacity and an overall drop in the pipeline capacity usage rate, whereas in the Northeast, demand growth fully supported the increase. In fact, pipelines into the Northeast saw a substantial increase in average daily usage rates, up 6 percentage points from 1990 levels.
- Higher pipeline utilization rates.** During the period, interregional usage rates increased by 7 percentage points, reaching a high of 75 percent (on an average day) in 1996. Pipeline usage rates within several major market areas also grew significantly. For instance, usage rates into the Midwest rose 14 percentage points to an average

of 78 percent,⁶⁵ while into the Central Region, rates rose 13 points. The overall rate fell only along routes into the Western and Southwest regions. In some areas of only limited capacity expansion, the increase in pipeline usage rates reflects a greater use of existing capacity that had been previously underutilized because of previous overbuilding or a temporary drop in demand.

- Elimination of some previous deliverability bottlenecks.** Although average usage rates have increased, the reported occurrence of market area deliverability constraint is rare.⁶⁶ In fact, many of the capacity additions in recent years have been to improve the capability of the regional pipeline systems and their service to local markets. In 1997 alone, excluding the exporting Southwest Region, 19 of the 31 completed expansion projects affected service totally within the market area. The Northeast had the highest, with 11 of 12 projects fitting into this category. Currently, capacity

⁶⁵Based only upon pipelines for which some flow was reported for a known State-to-State capability.

⁶⁶The number and instances of pipeline service curtailments have decreased in recent years because of improved deliverability and system efficiencies, but serious system instabilities still occur that limit, and sometimes restrict, the free flow of natural gas to customers. When system instabilities do occur, pipeline operators have the option of executing what are known as operational flow orders (see Box, "Operational Flow Orders" in Chapter 1).

Table 9. Interregional Pipeline Import Capacity, Average Daily Flows, and Usage Rates, 1990 and 1996

Receiving Region	Sending Region	Capacity (MMcf per Day)			Average Flow (MMcf per Day)			Usage Rate ¹ (percent)		
		1990	1996	Percent Change	1990	1996	Percent Change	1990	1996	Change
Canada	Central	66	66	0	44	4	-99	67	4	-63
	Midwest	1,211	2,543	110	961	1,626	69	79	68	-11
Total into Region		1,277	2,609	104	1,005	1,630	62	79	68	-11
Mexico	Southwest	354	844	138	38	83	117	11	10	-1
	Western	45	45	0	5	9	86	11	21	9
Total into Region		399	889	123	43	92	113	11	10	-1
Central	Canada	1,254	1,563	25	941	1,542	64	75	99	24
	Midwest	1,765	2,354	33	974	1,564	61	86	94	8
	Southwest	8,555	8,609	1	4,119	4,993	21	49	60	11
	Western	250	298	19	196	4	--	78	0	--
Total into Region		11,824	12,824	8	6,230	8,099	30	57	70	13
Midwest	Canada	2,161	3,049	41	1,733	2,581	49	84	85	1
	Central	8,988	9,879	10	5,684	7,714	36	63	78	15
	Northeast	2,024	2,038	1	714	910	27	45	45	0
	Southeast	9,645	9,821	2	6,134	8,020	31	64	82	18
Total into Region		22,818	24,787	9	14,265	19,224	35	64	78	14
Northeast	Canada	467	2,393	412	309	1,834	494	66	77	11
	Midwest	4,584	4,887	7	3,474	4,220	21	76	86	11
	Southeast	4,971	5,149	4	4,091	4,431	8	82	86	4
Total into Region		10,022	12,429	24	7,874	10,485	33	79	85	6
Southeast	Northeast	100	520	417	63	15	-78	63	60	-3
	Southwest	19,801	20,846	5	14,613	16,063	10	74	77	3
Total into Region		19,901	21,366	7	14,676	16,078	10	74	77	3
Southwest	Central	1,283	2,114	64	572	1,267	122	68	70	2
	Mexico	350	350	0	0	37	--	0	11	--
	Southeast	405	405	0	75	60	-20	79	86	7
Total into Region		2,048	2,869	40	647	1,364	111	69	61	-8
Western	Canada	2,421	3,786	56	1,874	3,275	75	77	87	10
	Central	365	1,194	227	196	713	264	54	95	41
	Southwest	4,340	5,351	23	3,910	2,415	-38	90	45	-45
Total into Region		7,126	10,331	45	5,980	6,403	7	84	62	-22
Total Within Lower 48 States		73,739	84,606	15	49,672	61,655	24	68	75	7

¹Usage Rate shown may not equal the average daily flows divided by capacity because in some cases no throughput volumes were reported for known border crossings. This capacity was not included in the computation of usage rate.

MMcf = Million cubic feet. -- = Not applicable.

Sources: Energy Information Administration (EIA). **Pipeline Capacity:** EIAGIS-NG Geographic Information System, Natural Gas Pipeline State Border Capacity Database, as of December 1997. **Average Flow:** Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition." **Usage Rate:** Office of Oil and Gas, derived from Pipeline Capacity and Average Flow.

constraints appear to be limited mainly to production areas, a fact that is reflected in the number of planned expansions through 2000 that address this problem.

- **Larger natural gas share of energy market.** On an annual percentage change basis, the increase in natural gas

consumption is larger than the growth in total energy use in the United States. The increase has been especially noticeable in the Northeast market, where natural gas use grew at an annual rate of 4.9 percent while overall energy use increased at a rate of only 1.2 percent (Table 11). The difference is even more dramatic in the Western Region,

Table 10. Regional Weather and Gas Storage Profile, 1996

Region	Number of Interstate Pipelines Operating in Region	Normal Heating Degree Days (1960-1990)	Weather Ranking Among States (1 = Coldest)	Natural Gas Underground Storage								LNG Peaking Supplies	
				Working Gas Capacity (MMcf)	Peak-Day Withdrawal Capability (Deliverability)					Percent LDC Owned and Operated	Capacity (MMcf)	Peak-Day Support (MMcf/d)	
					Total (MMcf/d)	From Conventional Storage (percent)	From High-Deliverability Storage (percent)	Percent Operated by Interstate Pipeline	Percent Operated by Independents				
Central	21	7,061	1	565,894	6,037	97	3	81	3	16	4,921	416	
Midwest	17	6,867	2	1,130,475	24,000	99	1	33	6	61	17,722	2,685	
Northeast	15	6,029	3	669,842	11,701	98	2	94	0	6	31,765	3,759	
Southeast	18	2,946	6	173,717	5,220	53	47	70	13	17	25,044	2,841	
Southwest	35	3,096	5	982,532	20,500	59	41	38	29	33	6,588	669	
Western	10	4,517	4	244,206	7,120	100	0	0	0	100	6,780	811	
U.S. Total	--	--	--	3,766,666	74,578	85	15	70	13	17	92,820	11,181	

MMcf/d = Million cubic feet per day. LDC = Local distribution company. LNG = Liquefied natural gas. -- Not applicable.

Sources: **Normal Heating Degree Days:** U.S. Department of Commerce, National Oceanic and Atmospheric Administration, "State Regional, and National Monthly and Seasonal Heating Degree Days Weighted by Population." **Natural Gas Underground Storage:** Energy Information Administration (EIA), Form EIA-191, "Underground Gas Storage Report." **Liquefied Natural Gas:** EIA GIS-NG Geographic Information System, LNG Database, as of December 1997.

Table 11. Regional Energy Profile Comparison of Annual Average Change, 1990-1995 or 1990-1996

Region	Population		Overall Energy Consumption			Natural Gas Consumption				Ratio of Natural Gas Production (1996) to Consumption
	1996 Estimated (millions)	1990-96 Percent Annual Change	Quantity 1995 (trillion Btu)	U.S. Ranking 1995	1990-95 Percent Annual Change	As Percent of Total Energy Consumed	Quantity 1995 (trillion Btu)	U.S. Ranking (Natural Gas Consumption)	1990-95 Percent Annual Change	
Central	20,995	2.1	7,435	6	2.1	24	1,749	6	3.8	1.39
Midwest	48,272	1.2	16,963	3	1.1	25	4,302	2	2.9	0.08
Northeast	66,421	0.7	18,433	1	1.2	21	3,850	3	4.9	0.10
Southeast	48,967	2.7	16,497	4	2.2	15	2,415	5	2.9	0.28
Southwest	31,003	2.9	17,258	2	1.3	39	6,797	1	0.2	2.25
Western	47,835	2.9	12,836	5	0.3	21	2,642	4	4.0	0.11
U.S. Total	263,493	1.9	89,422	--	1.3	24	21,753	--	3.0	0.88

-- Not applicable.

Sources: **Natural Gas Production and Consumption:** Energy Information Administration (EIA), Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition." **Energy Consumption:** EIA, *State Energy Data Report, Consumption Estimates 1980-1995* (December 1997). **Population:** U.S. Department of Commerce, Bureau of the Census.

where natural gas use increased annually by 4.0 percent while total energy grew by only 0.3 percent. California experienced a 0.4 percent drop per year in overall energy production during its economic slowdown of the early 1990s, a drop that brought down the regional average (Appendix C, Table C2). But as a percentage of total energy consumption, natural gas still retained its 21-percent share of the Western regional energy market, the same as in 1990.

- **Decrease in natural gas use by electric utilities.** The electric utility sector's share of the U.S. natural gas

market fell 2 percentage points between 1990 and 1996, with the largest decreases occurring in the Western (6 points) and Northeast (5 points) marketplaces (Table 12), usually heavy markets for electric power generation. Actual natural gas consumption by electric utilities also decreased nationally but only slightly, at an annual average rate of 0.4 percent during the same period. The only markets to show a gain in electric utility consumption were the Southeast and Midwest regions, 8 and 10 percent per year, respectively. Only in the

Table 12. Regional Natural Gas Customer Market Share Changes, 1990-1996
(1996 Volumes Consumed -- Billion Cubic Feet)

Region (Consumption)	1996 Share of the Natural Gas Market (percent)					Share Change Since 1990 (percentage point)					Average Annual Change in Consumption (percent)				
	Resi- dential (vol.)	Com- mercial (vol.)	Indus- trial (vol.)	Electric Utilities (vol.)	Other ¹ (vol.)	Resi- dential	Com- mercial	Indus- trial	Electric Utilities	Other ¹	Resi- dential	Com- mercial	Indus- trial	Electric Utilities	Other ¹
Central (1,779)	33 (589)	21 (362)	30 (540)	2 (41)	14 (247)	0	-1	2	-1	-1	3.5	2.8	4.6	-4.3	2.3
Midwest (4,413)	40 (1,782)	20 (899)	35 (1,557)	2 (78)	2 (97)	1	-1	0	0	0	3.7	2.3	3.4	10.3	5.4
Northeast (3,702)	35 (1,300)	23 (859)	31 (1,131)	8 (300)	3 (112)	-3	2	6	-5	0	3.3	5.6	8.4	-4.7	6.2
Southeast (2,377)	20 (476)	14 (331)	44 (1,023)	16 (384)	7 (163)	2	0	-3	2	-1	5.8	4.0	3.2	8.3	3.1
Southwest (6,715)	7 (443)	5 (307)	53 (3,552)	22 (1,492)	14 (921)	^a	0	6	-2	-4	1.9	1.4	3.2	-0.1	-3.6
Western (2,527)	25 (635)	15 (370)	39 (991)	16 (405)	5 (126)	-2	-2	8	-6	1	0.0	-1.2	5.0	-4.6	9.6
U.S. Total (21,513)	24 (5,225)	15 (3,128)	41 (8,794)	13 (2,700)	8 (1,666)	1	0	3	-2	-1	3.0	2..8	4.0	-0.4	-0.5

¹Includes natural gas used as a vehicle fuel, in pipeline and natural gas plant operations, and in association with production and gathering facilities.

^aBetween plus 0.5 percent and minus 0.5 percent.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition."

Southeast Region did the electric utility sector increase its share of the natural gas market.

- **Substantial growth in industrial gas consumption, especially for electricity cogeneration.**⁶⁷ The industrial sector's use of natural gas increased substantially in several markets,⁶⁸ principally because of significant growth in electricity cogeneration, which is primarily natural-gas based, and also because of the relatively low natural gas prices in comparison with other fuels.⁶⁹ In the Northeastern States of New Jersey, New York, and Massachusetts, which have a large number of

cogeneration facilities,⁷⁰ the industrial sector's share of the natural gas market increased to 33, 29, and 28 percent, respectively (Appendix C, Table C3). The average use per industrial customer increased the most in the Southwest Region, at an average annual rate of 16.0 percent (Table 13). Average industrial consumption per customer in the Western and Northeast regions increased at an annual rate of 8.4 and 9.7 percent, respectively, yet the number of industrial customers in these markets actually fell. The number of industrial consumers increased in the other regions.

- **Increased deliverability from storage.** A major increase in deliverability from underground storage facilities since 1990 has complemented pipeline expansions in several markets. Since 1993 alone, daily deliverability from storage increased by 12 percent, with the largest increase occurring in the Southwest, most of it high-deliverability storage.⁷¹ This type of storage is used extensively in the

⁶⁷Natural gas used in cogeneration facilities is categorized and included in the industrial sector rather than the electric utility sector, because cogeneration represents electricity generated as a byproduct of industrial/commercial processes.

⁶⁸While the number of natural gas industrial customers has declined since 1990 by about 1.0 percent per year, this sector's consumption of natural gas rose by more than 3 percent per year between 1990 and 1996 as average usage per customer rose 5.1 percent per year (Table 13).

⁶⁹In 1995, nonutilities (cogenerators) accounted for 13 percent of all electric power generated in the United States, up from 7 percent in 1990. In 1996, 60 percent of cogenerated power was created by burning natural gas. Derived from Energy Information Administration, Form EIA-867, "Annual Nonutility Power Producer Report."

⁷⁰More than 600 nonutility generating facilities are currently operating in the Northeast Region, up about 12 percent since 1992—New York has 183; New Jersey, 61; and Massachusetts, 68.

⁷¹See, Energy Information Administration, "U.S. Underground Storage of Natural Gas in 1997: Existing and Proposed," *Natural Gas Monthly*, DOE/EIA-0130(97)/9 (Washington, DC, September 1997).

Table 13. Regional Natural Gas Customers, Average Annual Change, 1990-1996

Region	Residential Customers			Commercial Firms			Industrial Firms			Electric Utilities			
	Number in 1996	Annual Change (percent)		Number in 1996	Annual Change (percent)		Number in 1996	Annual Change (percent)		Annual Change ¹ (percent)			
		In Number of Users	In Average Use		In Number of Users	In Average Use		In Number of Users	In Average Use	In Number of All Type Units	In Number of Gas-Fired Units	In Total Summer Capacity	In Gas-Fired Capacity
Central	5,562,943	1.8	1.5	608,800	1.9	0.8	15,004	1.5	3.2	-1.3	-1.0	-0.5	1.2
Midwest	13,220,238	1.6	2.0	1,113,287	1.6	0.7	65,024	0.8	2.6	-0.6	0.3	0.3	8.0
Northeast	12,829,400	1.1	2.1	1,154,093	1.8	3.8	50,795	-1.5	9.7	-1.1	0.4	0.1	4.4
Southeast	5,908,364	2.9	2.7	600,971	2.6	1.3	17,251	1.9	1.4	0.1	3.2	1.2	4.2
Southwest	6,282,924	1.2	0.6	586,329	2.2	-0.9	15,936	-7.8	11.0	0.1	-0.1	0.5	1.4
Western	11,347,439	1.7	-1.7	641,192	0.9	-2.1	41,837	-3.4	8.4	0.3	0.9	0.1	0.3
U.S. Total	55,151,308	1.6	1.4	4,704,672	1.8	1.0	205,845	-1.0	5.1	-0.5	0.3	0.3	2.5

¹Includes both primary and secondary generating units.

Source: **Natural Gas Usage:** Energy Information Administration (EIA), Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition." **Electric Generation Capacity:** EIA, Form EIA-860, "Annual Electric Generation Report" (1990-1996).

region not only to support the swing demands of local industrial and electric utility customers but also to support short-term transportation-balancing needs and provide incremental peaking supply for customers in distant markets, such as the Northeast and Midwest. In the Northeast market, where open-access interstate storage deliverability represents 94 percent of all available, several of the largest proposed pipeline expansion projects include improved access to existing storage sites and expansion of their deliverability (Table 10).

Regional Overviews

The natural gas pipeline capacity profile of each region in the country has evolved over time to meet its particular requirements. Each region differs in climate, underground storage capacity, number of pipeline companies, and availability of local production. Additionally, the varying demographics of each region dictate different patterns of gas use and potential for growth.

Central Regional Market

The Central Region produces more gas than it consumes and therefore is a net exporter of natural gas.⁷² Its 1996 natural gas

⁷²Still, 4 of the 10 States in the region, Iowa, Missouri, Nebraska, and South Dakota, are almost totally dependent on the interstate pipeline network for their supplies of natural gas (Appendix C, Table C2).

production of about 2.3 trillion cubic feet accounted for approximately 11 percent of the total gas consumed in the Nation.⁷³ Its exported production represented about 2 percent of the natural gas consumed elsewhere in the country. This region had the largest production increase in the Nation between 1990 and 1996—0.5 trillion cubic feet, or 30 percent.

The region is the largest in area and the least populated. The total volume of gas consumed in the region in 1996, 1.8 billion cubic feet, was also the least consumed in the six regions. Much of this gas is consumed for space heating, as it has the second highest percentage of households using natural gas.

The region's cold winters, combined with the lowest residential prices for natural gas of any region, help make the residential sector a very large consumer of natural gas. The residential sector accounted for 33 percent of all natural gas consumed in the region in 1996 (Table 12). Plentiful supplies from production and storage sites within the region and adequate capacity on local transmission and distribution lines ensure that peak demands of residential customers are met during the winter.

The industrial sector is also a large consumer of natural gas (30 percent), while natural gas use for electric power generation in the region constitutes only 2 percent of natural gas usage, one of the lowest rates among the six regions. Because it is a major producer of natural gas, almost 14 percent of gas consumption in the region in 1996 was

⁷³See, Energy Information Administration, *Natural Gas Annual 1996*, DOE/EIA-0131 (Washington, DC, September 1997) and previous editions.

devoted to natural gas production and transportation-related activities (Table 12).

Although it is not as highly populated as the other regions, the Central Region has several large metropolitan markets, which are major customers of the interstate pipeline network. To name the largest: Denver, Colorado; Salt Lake City, Utah; Kansas City, Kansas and Missouri; and St. Louis, Missouri. Large underground natural gas storage facilities are located in proximity to these areas. The local distribution companies (LDCs) serving these markets account for about 16 percent of the total storage deliverability in the region (Table 10). LNG peaking supplies are found only in Iowa and Nebraska, two States with limited underground storage capacity and no local production capabilities (Appendix C, Table C1).

Entering/Exiting Capacity

In 1996, approximately 12.8 billion cubic feet (Bcf) per day of pipeline capacity entered the Central Region (Figure 14), 8 percent above the 1990 level (Table 9). Only about 10 percent of that capacity was destined for markets within the region. Twelve pipeline systems enter the region from the south and east, while four enter from the north carrying Canadian supplies (Appendix A, Figure A1). The average utilization rates for pipelines transporting Canadian gas tend to be higher than those carrying domestic supply, 99 percent versus about 60 percent from the Southwest and 94 percent from the Midwest (Table 9). Nevertheless, because of an increase in regional production and in natural gas demand in both the Midwest and Central regions during the past 5 years, capacity usage on lines transporting domestic supply from the south and east also increased substantially, about 10 percentage points since 1990. Another factor in the increased pipeline usage rates has been the more efficient use of capacity during off-peak periods via the capacity release market.

Most of the capacity exiting the region (52 percent) flows to Illinois in the Midwest Region, with the pipeline systems involved operating at average utilization rates of 83 percent in 1996 (Appendix A, Table A1). Since 1993, Central Region supplies have also flowed into the Western Region to serve markets in California and Nevada, with the pipelines serving these markets operating at average utilization rates of nearly 95 percent.

Deliverability Within the Region

Eight of the interstate pipeline companies traversing the Central Region also have major service commitments within the region (Figure 14), accounting for 80 percent of their peak-day deliveries. In 1996, these pipeline systems operated at an average utilization rate of about 80 percent, delivering

10.3 Bcf on their individual system peak days at 1,742 delivery and/or pipeline interconnect points. In addition, a number of intrastate pipeline companies provide deliveries and/or interconnections with the interstate system to support local markets.⁷⁴ The largest service commitments of the interstate pipeline companies are for deliveries to other interstate pipelines within the region rather than to LDCs. For instance, Northern Border Pipeline Company delivers more than two-thirds of its shipped volumes to other interstate pipeline companies, while the rest is delivered to small customers in the region.

Of the regional interstate pipeline companies, the largest State-to-State capacity is 972 million cubic feet per day on Williams Natural Gas Company's line from Kansas to Missouri (Appendix A, Table A1). However, the average usage rate on this and similar service lines in the area is low, primarily because of the seasonal nature of the service; low summertime flows tend to offset the high winter flows. In 1996, for instance, capacity utilization on Williams' line from Kansas to Missouri was only 27 percent. Of all the interstate pipeline companies serving the region, Northern Natural Gas Company has the largest State-to-State pipeline capacity, 2.1 Bcf per day from Kansas to Nebraska.

Kansas Power & Light Company is the largest LDC in the region and the 13th largest LDC, in terms of sales, in the United States. It serves primarily the Kansas City, Missouri, area and has demands on interstate pipeline capacity of up to 1.5 Bcf per day, mostly supplied by Williams Natural Gas Company. Kansas Power & Light also accounts for two-thirds of the reserved capacity on the interstate system in Kansas and one-third of the total in Missouri.

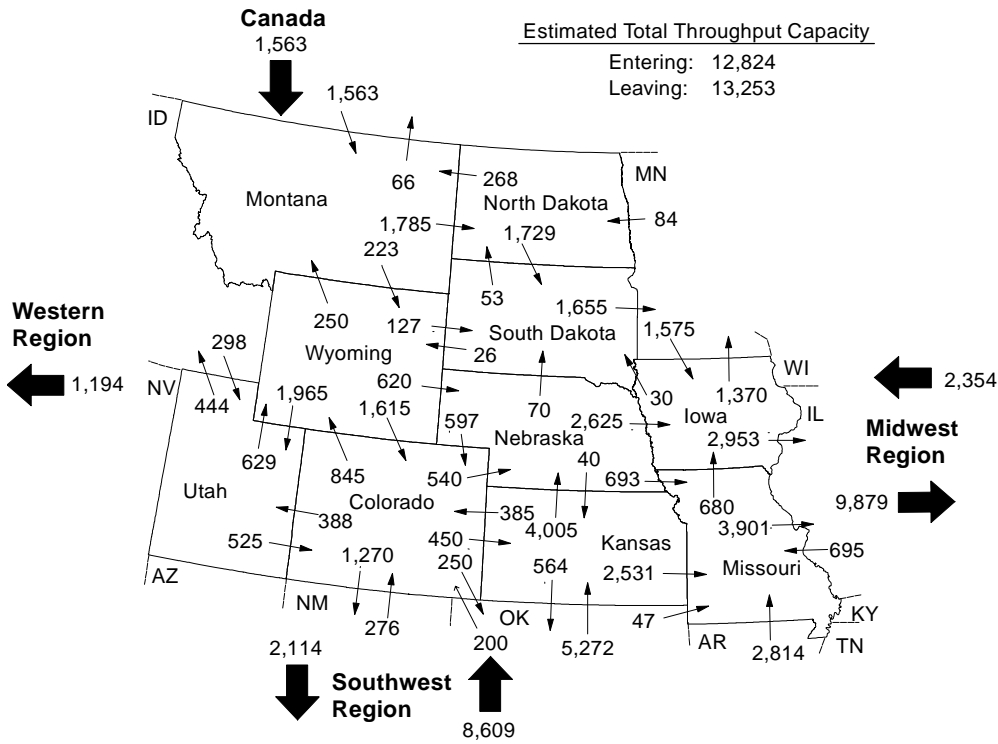
A major LDC in the western part of this region is Mountain Fuel Supply Company, which serves the Salt Lake City area and accounts for 99 percent of the total shipments on interstate natural gas pipelines operating in Utah. Questar Pipeline Company, an affiliate, supplies the needs of this distribution company. The Public Service Company of Colorado is the major distributor of gas in Colorado, with more single-State end-use customers than any other company in the region. Colorado Interstate Gas Company provides nearly all of the gas to this LDC.

Storage Deliverability

Underground natural gas storage in the Central Region is notable for several reasons. First, most of the storage facilities are used to store excess production rather than to serve as a supply source for local markets. Second, the region has the

⁷⁴Energy Information Administration, Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition."

Figure 14. Interstate Natural Gas Capacity Summary for the Central Region, 1996
(Volumes in Million Cubic Feet per Day)



Principal Interstate Natural Gas Pipeline Companies Operating in the Central Region

Pipeline Name	Regional Supply Source(s)	Primary/Secondary System Configuration ²	Regional Service Level			Systemwide Utilization Rates ¹ %		
			Percent of System Peak-day Deliveries ³	Number of Delivery Points	Number of Interconnects	12-Month Average ⁴	Peak Day ⁵	Summer Offpeak ⁶
Regional Pipelines								
Colorado Interstate Gas Co	CE, SW	Trunk/Grid	94	120	17	82	104	76
KN Interstate Gas Co	CE, SW	Trunk/Grid	80	381	13	79	91	69
Mississippi River Transmission Corp.	SW	Trunk/Grid	16	21	0	85	92	59
Northern Border Pipeline Co	Canada	Trunk	90	12	3	98	105	96
Northern Natural Gas Co	SW	Trunk/Grid	41	219	3	92	107	80
Questar Pipeline Co	CE	Grid/Trunk	100	29	13	79	81	62
Trailblazer Pipeline Co	CE	Trunk	100	3	3	97	132	89
Williams Natural Gas Co	SW, CE	Grid	96	811	16	75	82	42
Williston Basin Interstate PL Co	CE	Grid/Trunk	100	271	4	83	98	40
Wyoming Interstate Gas Co	CE	Trunk	100	0	3	93	107	86
Supplemental Pipeline Service								
ANR Pipeline Co	SW	Trunk/Grid	1	69	2	70	100	66
Kern River Gas Transmission Co	CE	Trunk	1	9	0	98	109	96
Natural Gas Pipeline Co of America	CE, SW	Trunk/Grid	7	74	13	84	96	80
Noram Gas Transmission Co	SW	Grid/Trunk	1	3	1	56	86	61
Northwest Pipeline Co	Canada	Trunk/Grid	34	46	9	90	94	54
Panhandle Eastern Pipeline Co	SW	Trunk	11	41	4	78	98	58
Texas Eastern Transmission Co	SW	Trunk	1	10	0	84	109	49
Viking Gas Transmission Co	Canada	Trunk	3	3	0	85	105	82

¹ Usage rates are based upon capacity and transportation volumes for the whole system and do not represent regional service only.

² "Trunk" systems are long-distance trunklines that generally tie supply areas to market areas. "Grid" systems are usually a network of many interconnections and delivery points that operate in and serve major market areas. Some systems are a combination of the two.

³ Represents the percent of total pipeline system volume delivered within the region on the system peak-day occurring in the 1996-97 heating year.

⁴ Represents total system capacity divided by the total annual volumes (divided by 366 days) delivered in 1996 as reported in FERC Form 2.

⁵ Represents total system capacity divided by the single peak-day volumes delivered in the 1996-97 heating year as reported in FERC Form 2.

⁶ Represents a summer (nonheating season) usage level, using the sum of volumes delivered during the nonshoulder months of May through September (based on FERC Form 11 gas delivery data for 1995) divided by 153 days. April and October are considered to be months that "shoulder" the heating season of November-March.

Sources: **Capacity:** Federal Energy Regulatory Commission, FERC 567 Capacity Report, "System Flow Diagram" and Annual Capacity Report (18 CFR §284.12); Energy Information Administration, EIAGIS-NG Geographic Information System, Natural Gas Pipeline State Border Capacity, as of December 1997. **Delivery and Transport Volumes:** Federal Energy Regulatory Commission, FERC Form 11, "Natural Gas Pipeline Company Monthly Statement" and FERC Form 2, "Annual Report of Major Natural Gas Companies."

Nation's largest storage site, the Baker/Cedar Creek Field in Montana, with a working gas capacity of 164 Bcf. However, the total regional working gas storage capacity (approximately 566 Bcf) is only 15 percent of the U.S. total (Table 10), while daily deliverability from storage is only 6 Bcf per day, or 8 percent of the U.S. total.

Storage facilities in Kansas provide a major service to the interstate pipeline systems that move natural gas to the Midwest Region, but they are also integral to regional requirements. For example, about 35 percent of the State's working gas storage capacity of approximately 109 Bcf is owned and operated by Williams Natural Gas Company, which is primarily a regional pipeline system. About 96 percent of the State's storage capacity is available to customers and shippers on other interstate trunklines, while the remaining 4 percent is devoted to local distribution and production field service (Appendix C, Table C1). About 41 percent of the daily peak-day storage deliverability in the State, or 960 million cubic feet per day, is available to the two interstate pipeline companies traversing the region, Northern Natural Gas and Panhandle Eastern Pipe Line Company.

Storage facilities in the rest of the region serve primarily as seasonal supply sources for local markets. Storage fields in Utah provide service to shippers using the Questar Pipeline system as well as to the Salt Lake City area. The storage fields in Colorado and portions of Wyoming serve the Denver area through the Colorado Interstate Gas Company system.

End-Use Consumption

Within the region, natural gas has gained a slightly larger share of the energy marketplace since 1990, rising 1 percentage point to 24 percent (Table 11). Consumption increased at an annual rate of 3.8 percent from 1990 through 1996, while total energy production rose at a 2.1 percent rate. In every State in the region, natural gas experienced a growth in market share, with North and South Dakota and Utah having the largest increase.⁷⁵ In each of these States, access to greater local production was a major contributing factor. Also, the ratio of State production to consumption at least doubled in each State compared with that in 1990 (Appendix C, Table C2). Greater consumption of local supplies was supported in part by low prices⁷⁶ brought on by an inability by producers to ship their gas elsewhere because of capacity limitations on several of the longhaul trunklines exiting the region.

⁷⁵Energy Information Administration, *Capacity and Service on the Interstate Natural Gas Pipeline System, 1990: Profiles and Analyses*, DOE/EIA-0556 (Washington, DC, June 1992), Table 16, p. 47.

⁷⁶Energy Information Administration, *Natural Gas 1996: Issues and Trends*, DOE/EIA-0560(96) (Washington, DC, December 1996), Chapter 5.

In all States in the region, the number of residential and commercial customers increased, whereas in three States the number of industrial customers dropped by more than 6 percent per year (Appendix C, Table C4). Yet, the average use by industrial customers increased at an annual rate of 3.2 percent and total use increased at an annual rate of 4.6 percent (Table 12). Reflecting this, the industrial sector's share of the regional market increased from 28 percent in 1990 to 30 percent in 1996.

Natural gas use still remains only a very small percentage of the total energy used for electricity generation. While the installation of gas-fired generating capacity at utilities within the region increased at an annual rate of 1.2 percent during the first part of the decade, its share of the natural gas market fell 1 percentage point and actual consumption fell by 4.3 percent per year (Table 12). One reason is that utilities in this region depend primarily on coal, which is generally available at a relatively low cost. However, local environmental needs, linked with technological constraints, could have an impact on future development planning. Montana, North Dakota, and Utah have some of the major coal basins in the United States.

Although the industrial sector has gained a larger share of overall natural gas use in the region, the residential sector still represents the major share of gas use. The overall growth of natural gas consumption in the region, about 3.8 percent annually from 1990 through 1995, along with the growth in regional pipeline average utilization rates, from 57 percent in 1990 to 70 percent in 1996 (Table 9), would seem to indicate the need for some expansion in the near future. There are signs that some actions are already being taken in this regard.

Recent and Proposed Expansions

In 1997, eight pipeline expansion projects were completed in the Central Region, the largest of which was the new Pony Express line owned and operated by KN Interstate Pipeline Company (Appendix B, Table B1). The new line runs from southern Wyoming to the Kansas City, Missouri, area and helps alleviate some of the capacity restraint problems experienced by Rocky Mountain producers in recent years. Also completed were the Trailblazer system expansion and several area expansions by Colorado Interstate Pipeline Company that addressed the same constraint problems and expanded the flow of area gas toward the Midwest.

While completion of these projects helped resolve some production-side demands for capacity, consumer demands in the area have spurred several additional expansion proposals (Appendix B, Table B2). Growth in the Denver, Colorado, metropolitan area, for instance, has generated similar proposals from two of the area's largest systems: KN

Interstate Pipeline Company and Public Service Company of Colorado. The proposals call for developing new lines and expanding old ones to bring expanding northern Wyoming gas production to the Denver area. The principal question is whether both projects, as currently designed, will be competitive and nonduplicative enough to be built.

Midwestern Regional Market

The Midwest Region is the Nation's second largest market for natural gas and is served by an extensive regional pipeline network (Table 11). The region is weather-sensitive, with cold winters and moderate summers. Minnesota and Wisconsin are among the coldest States in the Nation, while the other four States in the region are colder than the national average (Table 10). The region also has a number of major population centers and is the third largest of the six regions in population.

The large number of residential space-heating customers, combined with the cold winters, result in large residential requirements for natural gas. Yet, the region's geographic position between the Central and Northeast regions has resulted in a significant portion of the region's pipeline system capabilities being reserved for deliveries beyond its borders.

The region's two northernmost States, Wisconsin and Minnesota, as well as portions of Michigan, are served by pipelines importing Canadian supplies, while the southern portion of the region is served primarily by major trunklines coming from the Southwest. Regional production, principally from Ohio and Michigan, provides a little more than 8 percent of the gas consumed in the region (Table 11).

The Midwest Region also has the largest amount of underground storage capacity and daily deliverability from storage of any region, more than 30 percent each of the U.S. total. Regional LDCs control about 61 percent of daily deliverability, more than any region but the Western.

Entering/Exiting Capacity

Today 18 interstate pipeline companies have the capacity to move 24.8 Bcf of gas into the Midwest per day (Appendix A, Table A2). The total capacity of the interstate pipeline companies entering the region is more than for any other region. Of that amount, 35 percent enters through Illinois, 26 percent through Ohio, 23 percent through Minnesota, and the remainder through Indiana (Figure 15).

Capacity additions into the Midwest Region from 1991 through 1996 totaled 2.0 Bcf per day, an increase of 9 percent over 1990 levels (Table 9). Two new major interstate

pipelines (Crossroads and Bluewater) were constructed in the region (Figure 10, Chapter 3), and a number of expansion projects were completed. The primary expansions included additions to the Great Lakes Transmission System (a 41-percent increase in capacity), the Northern Border Pipeline (36 percent), and ANR Pipeline Company (18 percent in Michigan and Indiana).

Regional peak-day deliveries by the interstate pipelines on behalf of shippers approximated 19.8 Bcf per day during the 1996-97 heating season, which is equivalent to about 80 percent of the capacity into the region (Figure 15). When deliveries to other interconnecting interstate pipelines are included, the peak-day total is equivalent to 99 percent of capacity. Although some demand is satisfied through intraregional production and deliveries, the vast majority of natural gas service in the region is dependent on the interstate system.

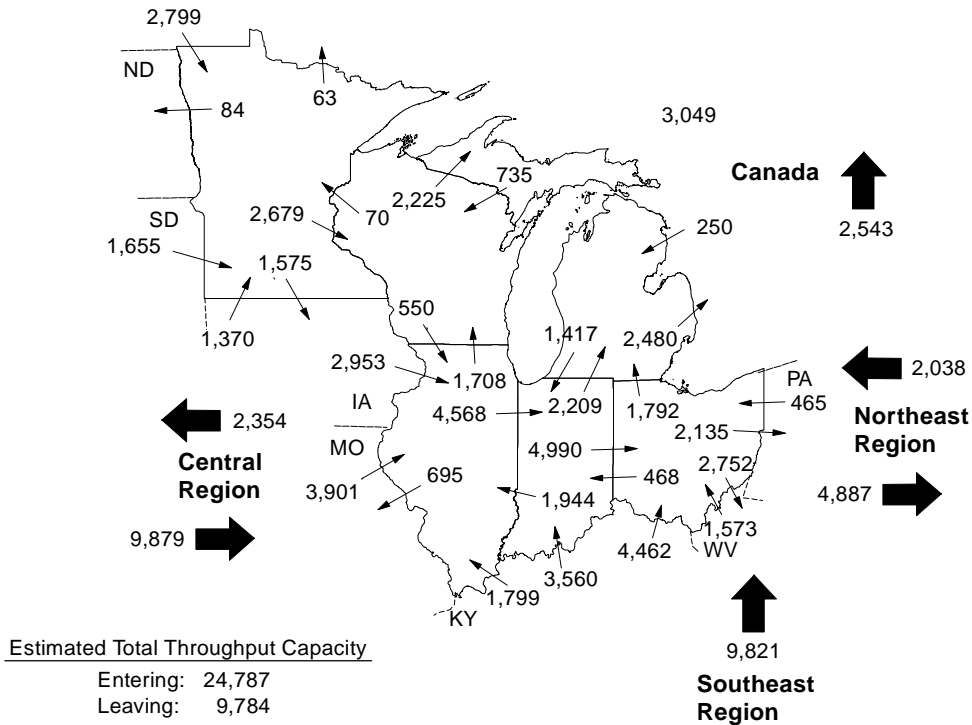
In 1996, utilization of total capacity entering the region was 78 percent (Table 9), the second highest of the gas-importing regions. This is a dramatic change from 1990, when the utilization rate was the second lowest. Natural Gas Pipeline Company of America has about 14 percent of the total throughput capacity into the Midwest, primarily with connections into Illinois (Appendix A, Table A2). Other major players are: Texas Eastern Transmission Corporation with 10 percent, and ANR Pipeline Company and Trunkline Pipeline Company with 8 percent each. Texas Eastern Transmission Corporation moves most of its gas through to markets in the Northeast. On the other hand, almost all of the contract commitments of the other companies represent commitments for deliveries within the Midwest market only.

On pipelines entering the region from Canada, the average daily utilization rate in 1996 was 85 percent (Table 9). Average utilization levels on lines entering from the Southeast Region (into Illinois, Indiana, and Ohio) and from the Central Region (into Minnesota and Illinois) were somewhat lower: 82 percent and 78 percent, respectively. Many of the pipelines with the highest utilization rates into the Midwest from the Southeast Region are heavily involved in transporting gas to the Northeast Region or to storage sites during the nonheating season and for meeting system-load balancing need.

Deliverability Within the Region

Nine of the interstate pipeline companies entering the Midwest terminate and deliver most of their gas for shippers within the region (Figure 15). For instance, ANR Pipeline Company operates in all States in the region except Minnesota and can import 2.0 Bcf per day into the region. In 1996, it had a systemwide average flow rate of about 70 percent. But the largest regional pipeline is Natural Gas

Figure 15. Interstate Natural Gas Capacity Summary for the Midwest Region, 1996
(Volumes in Million Cubic Feet per Day)



Principal Interstate Natural Gas Pipeline Companies Operating in the Midwest Region

Principal Market Region / Pipeline Name	Regional Supply Source(s)	Primary/ Secondary System Configuration ²	Regional Service Level			Systemwide Utilization Rates ¹ %		
			Percent of System Peak-day Deliveries ³	Number of Delivery Points	Number of Interconnects	12-Month Average ⁴	Peak Day ⁵	Summer Offpeak ⁶
Regional Pipelines								
ANR Pipeline Co	SW	Trunk	79	259	10	70	100	66
Crossroads Pipeline Co	SW	Trunk	100	NA	1	NA	NA	NA
Great Lakes Gas Transmission Co	Canada	Trunk	100	206	14	94	132	59
Midwestern Gas Transmissions Co	SW	Trunk	94	18	6	89	104	80
Natural Gas Pipeline Co of America	SW	Trunk	75	165	4	84	96	80
Panhandle Eastern Pipeline Co	SW	Trunk	88	67	3	78	98	58
Texas Gas Transmission Corp	SW	Trunk	28	103	5	79	111	58
Trunkline Gas Co	SW	Trunk	67	53	6	74	90	66
Viking Gas Transmission Co	Canada	Trunk	97	39	4	94	105	82
Supplemental Pipeline Service								
Columbia Gas Transmission Corp	SW, NE	Grid	38	121	1	73	98	26
CNG Transmission Corp	SW, NE	Grid	13	15	0	80	92	25
Mississippi River Transmission Co	SW	Trunk	39	13	0	85	92	59
Northern Natural Gas Co	SW, Canada	Trunk/Grid	56	129	2	92	107	80
Tennessee Gas Pipeline Co	SW	Trunk	4	6	7	90	111	70
Texas Eastern Transmission Co	SW	Trunk	1	50	12	84	109	49

¹ Usage rates are based upon capacity and transportation volumes for the whole system and do not represent regional service only.
² "Trunk" systems are long-distance trunklines that generally tie supply areas to market areas. "Grid" systems are usually a network of many interconnections and delivery points that operate in and serve major market areas. Some systems are a combination of the two.
³ Represents the percent of total pipeline system volume delivered within the region on the system peak-day occurring in the 1996-97 heating year.
⁴ Represents total system capacity divided by the total annual volumes (divided by 366 days) delivered in 1996 as reported in FERC Form 2.
⁵ Represents total system capacity divided by the single peak-day volumes delivered in the 1996-97 heating year as reported in FERC Form 2.
⁶ Represents a summer (nonheating season) usage level, using the sum of volumes delivered during the nonshoulder months of May through September (based on FERC Form 11 gas delivery data for 1995) divided by 153 days. April and October are considered to be months that "shoulder" the heating season of November-March. NA = Not available.

Sources: **Capacity:** Federal Energy Regulatory Commission, FERC 567 Capacity Report, "System Flow Diagram" and Annual Capacity Report (18 CFR §284.12); Energy Information Administration, EIAGIS-NG Geographic Information System, Natural Gas Pipeline State Border Capacity, as of December 1997. **Delivery and Transport Volumes:** Federal Energy Regulatory Commission, FERC Form 11, "Natural Gas Pipeline Company Monthly Statement" and FERC Form 2, "Annual Report of Major Natural Gas Companies."

Pipeline Company of America, with 3.3 Bcf per day. In 1996, its average daily usage rate within the region was 84 percent. However, Natural Gas Pipeline Company of America is second to ANR Pipeline in the amount of regional peak deliveries (almost all in Illinois).

Those pipeline systems involved in extensive trade with Canada had some of the highest systemwide average flow rates in the region (Appendix A, Table A2). In 1996, the average flow rates for both the Great Lakes Gas Transmission and the Viking Transmission pipelines were 94 percent.

In contrast to utilization rates on lines entering the region or moving gas to the Northeast, intraregional utilization rates averaged only 53 percent in 1996. This is the combined average utilization of all flows from one State within the region to another. This statistic, combined with the generally low systemwide flow rates for the pipelines serving the Midwest in 1990, seems to indicate that most pipeline companies have sufficient throughput capacity to accommodate any additional demand for natural gas in the near term.

A relatively few large shippers account for the bulk of the gas delivered by interstate pipeline companies within the region. In Illinois and Ohio, the demands of the two largest LDCs represent 47 and 55 percent, respectively, of the total interstate system volumes delivered in each State and the equivalent of 25 and 30 percent, respectively, of the total capacity entering those States.⁷⁷

In Illinois and Indiana, the largest LDCs each interconnect with at least three major pipeline systems, providing flexibility in their purchase and transportation strategies. On the other hand, in Minnesota, the major LDCs acquire gas from only one interstate pipeline company, Northern Natural Gas.

Storage Deliverability

The Midwest has the highest level of working gas storage capacity of any region, 1.1 trillion cubic feet (Table 10). During the 1996-97 heating season, storage withdrawals in this region averaged 2.0 Bcf per day, with much greater levels on peak days (approximately 3.8 Bcf).⁷⁸

⁷⁷Derived from data reported to the Energy Information Administration on Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition," and the ELAGIS-NG Geographic Information System, Natural Gas Pipeline State Border Capacity, as of December 1997.

⁷⁸Energy Information Administration, Form EIA-191, "Monthly Underground Gas Storage Report."

Michigan and Illinois have the largest number of gas storage facilities in the region. Their combined working gas storage capacity in 1996 was approximately 0.9 trillion cubic feet, or 78 percent of the total regional storage capacity (Appendix C, Table C1). This represents a peak-day deliverability rate of 18 Bcf, or 77 percent of the area's capability. In Illinois, 71 percent of the daily deliverability from storage is held by three large LDCs: Northern Illinois Gas Company, Illinois Power Company, and Central Illinois Public Service Company. Northern Illinois Gas Company also uses part of its working gas storage (the excess) to support shippers using its Chicago market center.

Great Lakes Gas Transmission and ANR Pipeline companies use Michigan storage facilities extensively to support their shippers needs. In the first case, the Great Lakes system transports most of its volumes eventually to markets in Ontario, Canada, but uses Michigan storage sites to store supplies shipped for Canadian customers during the summer for redelivery during winter peak periods. ANR provides essentially the same service but for domestic shippers who need to supply customers throughout the Midwest during peak periods. These activities help maintain high load factors on these systems during the summer months.

Because of the region's relatively cold and volatile weather, LDCs in this market also have come to rely on LNG peaking facilities to supplement or substitute for unavailable local underground storage capacity. The Midwest is the third largest source of LNG storage, with about 18 Bcf of storage capacity and 2.7 Bcf of peak-day deliverability.

End-Use Consumption

Natural gas usage accounts for about 25 percent of overall energy consumption in the Midwest, which is second only to the 39 percent level in the Southwest Region, the major U.S. production area (Table 11). Since 1990, the natural gas share in the region increased by 1 percent. The levels in the individual States of the region range from 21 percent to as high as 31 percent of overall consumption (Appendix C, Table C2).

Natural gas consumption in the region increased at an annual rate of 2.9 percent from 1990 through 1995. All customer sectors showed an increase, but a major contributor to this gain has been the growth in the use of natural gas by electric utilities within the region (Table 12). Although electric utilities account for only 2 percent of regional natural gas consumption, the amount of electric generating capacity fired by natural gas grew at an annual rate of 8 percent, while the number of gas-fired units increased at an annual rate of 0.3 percent during the period (Table 13).

Although the region's population base grew by only 3 percent during the 1980s (the smallest increase of the six regions) and 1.2 percent annually in the early 1990s (Table 11), residential consumption of natural gas in the region increased at an annual rate of 3.7 percent between 1990 and 1996. This growth was second only to the increase in this sector in the Southeast Region (Table 12). The cold winters in the Midwest account for the residential sector using 40 percent of the natural gas delivered to the region each year (up 1 percentage point since 1990). The number of residential customers in the region increased during the period as did the average use per customer (Table 13).

Industrial sector consumption increased at a 3.4 percent annual rate as well, although its share of the regional natural gas market fell slightly (Table 12). There had been some speculation that industrial gas demand in the Midwest would decrease because of a trend toward greater service industry development, displacing heavy industries that tend to be greater users of natural gas, but the average use per industrial customer actually increased at an annual rate of 2.6 percent. The number of industrial customers grew slightly during the period.

Recent market patterns suggest that natural gas demand in the Midwest will continue to increase into the next century but probably at a slower rate than demand growth in some of the regions. Although major plans are underway to increase deliverability to the Chicago market area, it is likely that much of that capacity will be forwarded to the Northeast.

Recent and Proposed Expansions

Three pipeline expansion projects into the Midwest Region were completed during 1997, providing 441 million cubic feet per day of additional interstate service (Appendix B). Only one of these projects, the ANR Michigan Leg expansion, affected the major Chicago market. The other two provide additional service to growing markets in Wisconsin and Minnesota.

Several large new pipelines and major expansion projects into the region have been proposed, primarily to transport Canadian natural gas from expanding production fields in Alberta and British Columbia to the Chicago area. What is noteworthy about this effort is that the ultimate market for much of this new capacity will be beyond the region, in eastern Canada and the U.S. Northeast. Indeed, if these projects were targeted only toward gaining market share within the Midwest Region, an excess of capacity would develop over the next several years. Planned capacity expansion from the Southwest, which remains the largest source of Midwest market gas supply, is minimal.

Northeast Regional Market

The Northeast consumes more energy than any other region, although only 21 percent (up 3 percent since 1990) is in the form of natural gas (Table 11). It is the most heavily and densely populated of the six regions. At one time, the Northeast was a major source of natural gas and, as a result, a large distribution network of pipelines has been in place for many years. Similarly, the region has considerable access to underground storage since gas storage fields were first developed and used commercially in the area. Still, the New England States have only truly had access to natural gas supplies since the 1950s.

The region has large swings in gas demand because of weather. Overall, it is the third coldest of the regions (Table 10), with some of the coldest States in the Nation at its northern limits. Withdrawals from storage are necessary to meet peak demand, as total capacity entering the region plus regional gas production are only about two-thirds of the region's peak demand.

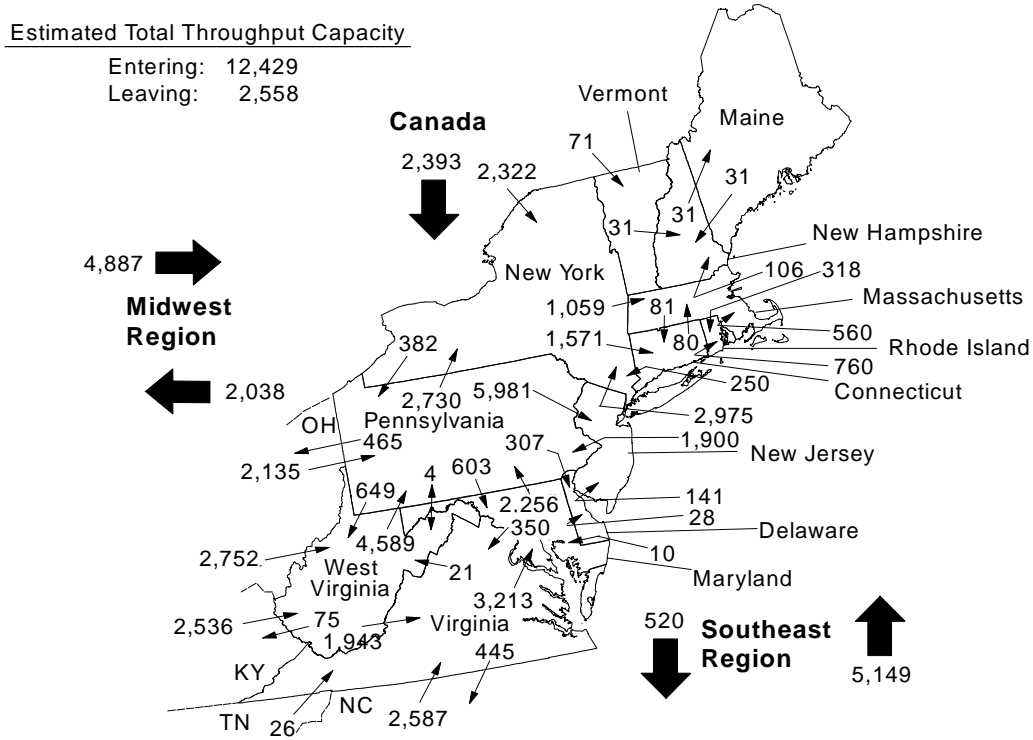
Residential and commercial natural gas consumption (mostly space-heating demand) accounts for the largest share of the regional natural gas market although the industrial and electric utility sectors also represent large users of natural gas, with 31 and 8 percent, respectively (Table 12). The major markets in the region are the metropolitan areas of Boston, Massachusetts; New York City; Philadelphia/Trenton; Baltimore/Washington; Richmond, Virginia; and the corridor from Erie, Pennsylvania, to Buffalo, New York.

Entering/Exiting Capacity

Today the interstate pipeline companies serving the Northeast have access to supplies from all major domestic gas-producing areas and from Canada. The two main flows of gas into the region are from the Southeast into Virginia and West Virginia, and from the Midwest into West Virginia and Pennsylvania (Figure 16). Much of this capacity moves within the region toward New York City and Boston. In 1996, the interstate pipeline system had the capacity to move approximately 5 Bcf per day along routes coming out of both the Southeast and Midwest regions. In addition, limited amounts of liquefied natural gas (LNG) is imported into Massachusetts from the Middle East.

Transportation capacity into the Northeast increased by more than 2.4 Bcf per day (24 percent) between 1990 and 1996 (Table 9), second only to the increase in the Western Region. Most of this new capacity provided greater access to Canadian supplies. Some of the larger projects included completion of the Empire Pipeline (0.5 Bcf per day), which

Figure 16. Interstate Natural Gas Capacity Summary for the Northeast Region, 1996
(Volumes in Million Cubic Feet per Day)



Principal Interstate Natural Gas Pipeline Companies Operating in the Northeast Region

Principal Market Region / Pipeline Name	Regional Supply Source(s)	Primary/Secondary System Configuration ²	Regional Service Level			Systemwide Utilization Rates ¹ %		
			Percent of System Peak-day Deliveries ³	Number of Delivery Points	Number of Interconnects	12-Month Average ⁴	Peak Day ⁵	Summer Offpeak ⁶
Regional Pipelines								
Algonquin Gas Transmission Co	SW	Trunk/Grid	100	97	5	72	89	45
CNG Transmission Corp	SW, NE	Grid	87	110	25	80	92	25
Columbia Gas Transmission Co	SW, NE	Grid	51	293	16	73	98	26
Eastern Shore Natural Gas Co	SW	Grid/Trunk	100	NA	NA	NA	NA	NA
Equitrans Inc	SW, NE	Grid	100	132	10	70	78	23
Granite State Gas Transmission Co	Canada	Grid/Trunk	100	NA	NA	NA	NA	NA
Iroquois Gas Transmission Co	Canada	Trunk	100	10	4	102	122	99
National Fuel Gas Supply Corp	SW, Canada	Grid/Trunk	100	98	3	75	92	29
Tennessee Gas Pipeline Co	SW, Canada	Trunk	55	116	51	90	111	70
Texas Eastern Transmission Corp	SW	Trunk	88	69	18	84	109	49
Transcontinental Gas Pipeline Co	SW	Trunk	69	124	10	83	99	81
Vermont Gas Systems Inc	Canada	Trunk	100	NA	NA	NA	NA	NA
Supplemental Pipeline Service								
East Tennessee Natural Gas Co	SW	Trunk/Grid	8	25	0	84	88	37

¹ Usage rates are based upon capacity and transportation volumes for the whole system and do not represent regional service only.

² "Trunk" systems are long-distance trunklines that generally tie supply areas to market areas. "Grid" systems are usually a network of many interconnections and delivery points that operate in and serve major market areas. Some systems are a combination of the two.

³ Represents the percent of total pipeline system volume delivered within the region on the system peak-day occurring in the 1996-97 heating year.

⁴ Represents total system capacity divided by the total annual volumes (divided by 366 days) delivered in 1996 as reported in FERC Form 2.

⁵ Represents total system capacity divided by the single peak-day volumes delivered in the 1996-97 heating year as reported in FERC Form 2.

⁶ Represents a summer (nonheating season) usage level, using the sum of volumes delivered during the nonshoulder months of May through September (based on FERC Form 11 gas delivery data for 1995) divided by 153 days. April and October are considered to be months that "shoulder" the heating season of November-March. NA = Not available.

Sources: **Capacity:** Federal Energy Regulatory Commission, FERC 567 Capacity Report, "System Flow Diagram" and Annual Capacity Report (18 CFR §284.12); Energy Information Administration, EIAGIS-NG Geographic Information System, Natural Gas Pipeline State Border Capacity, as of December 1997. **Delivery and Transport Volumes:** Federal Energy Regulatory Commission, FERC Form 11, "Natural Gas Pipeline Company Monthly Statement" and FERC Form 2, "Annual Report of Major Natural Gas Companies."

is an intrastate affiliate with ANR Pipeline Company, the Iroquois Pipeline (0.9 Bcf per day), and Tennessee Gas Pipeline Company's expansion of its Niagara import facilities (by 0.5 Bcf per day).

In addition, several interstate pipelines serving the region were significantly expanded. The largest expansion was on the Texas Eastern Pipeline system (0.5 Bcf per day) serving Pennsylvania, New York, and New Jersey, as well as southern New England through service to its affiliate, Algonquin Gas Transmission Company (which itself added about 122 million cubic feet (MMcf) per day of capacity). Transcontinental Gas Pipeline Company, a major supplier to the region, added approximately 165 MMcf per day in the Pennsylvania/New York area to improve its local capabilities. Its larger contribution to regional service, however, was a major expansion in the Virginia/North Carolina area where more than 420 MMcf per day was added (1993). The latter project coincided with improvements along much of the Transco system extending from Louisiana to Virginia.

About three-quarters of the capacity into the region is supplied somewhat equally by three trunkline systems: Transcontinental Gas Pipe Line Corporation, Texas Eastern Transmission Corporation, and Tennessee Gas Pipeline Company. In 1996, the utilization rates on these pipeline systems as they entered the region averaged 80 percent. Tennessee Gas Pipeline had the highest utilization (90 percent) and the highest actual volume (2.8 Bcf per day) into the region (Appendix A, Table A3).

Deliverability Within the Region

Almost all of the interstate pipelines entering or operating within the Northeast Region terminate there; all have major delivery commitments in the region (Figure 16). The largest systems target the New York City area as their primary market. The States of Pennsylvania and New York are the key transit points for gas deliveries within the region. These States, along with West Virginia, have the largest underground storage capacity in the region (Appendix C, Table C1), as well as some of the largest entering and exiting capacities and annual flow rates (Appendix A, Table A3). More pipeline capacity exits these States than enters, reflecting their major storage capability as a seasonal supply source for the States north and east.

The largest major regional pipeline companies, CNG Transmission and Columbia Gas Transmission, have an extensive infrastructure and network of local delivery points and pipeline interconnections. They also have a number of receipt points, where they bring in local production sources to augment supplies from the Southwest and Canada. In

addition, each company has access to numerous underground storage facilities, allowing their shipper/customers to develop inventories of seasonal gas supplies for winter use.

Both companies are also the major suppliers of some of the largest LDCs in the region, many of which are affiliates. From 1990 through 1996, Columbia added between 150 to 200 MMcf per day of capacity and CNG added about 100 MMcf to their systems. The primary expansion motivation in these two cases was to attract additional customers and improve overall service in the region.

Utilization rates tend to be much lower on the more dispersed, grid-type pipeline systems, such as CNG and Columbia Gas Transmission. Grid systems function as distribution companies to the LDCs as well as transmission companies. The capacity to supply gas in one portion of the grid depends upon how much is being supplied out of the system by other portions of the grid. Both CNG and Columbia Gas Transmission have multiple lines crossing the State borders within the region, allowing gas to flow in both directions at the same time. The only high average-day utilization rate on Columbia Gas Transmission's system is at the Kentucky border, where it receives Gulf-of-Mexico gas from its major trunkline transporter, Columbia Gulf Transmission Company. CNG Transmission's lines serving the region, however, are part of the grid and operated at an average utilization rate of about 31 percent in 1996.

The flow of gas out of the region is almost exclusively to the Midwest (although some lines have bidirectional service) over the many lines that were built around the turn of the century to move local production. West Virginia, western Pennsylvania, and southwestern New York were once the region's and the Nation's largest producing areas and, consequently, have many local gathering, distribution, and storage interconnections. These areas also have many interconnections with operations in Ohio, which is the reason for the 2.0 Bcf per day of capacity exiting the region to the Midwest.

In addition to the interstate pipeline companies that bring gas into the region from the Midwest and Southeast, several smaller interstate pipeline companies operate totally within the region (Figure 16). Foremost among these is Algonquin Gas Transmission Company, which has the capacity to move 1.2 Bcf per day from New Jersey into New York (Appendix A, Table A3). During the 1996-97 heating season, peak-day deliveries for its entire system totaled about 1.5 million cubic feet. Algonquin, with 1,056 miles of trunk transmission lines, distributes the gas received in New Jersey to New York, Connecticut, Rhode Island, and Massachusetts.

The remaining small interstate pipeline companies averaged only 32 MMcf per day of interstate transmission in 1996.⁷⁹

Storage Deliverability

Many of the depleted gas fields in New York, Pennsylvania, and West Virginia are now used for storage, which is essential for balancing gas supplies for the region (Table 10). Interstate capacity into the region, 12.4 Bcf per day, combined with local production (approximately 1 Bcf per day on average in 1996) is the equivalent of only about two-thirds of the peak-day requirements within the region. The difference between this available system capacity and shipper and consumer demand is designed to be met by withdrawals from storage. During the 1996-97 heating season, average daily withdrawals in the region were about 4.9 Bcf; during January 1997, the month with the highest average, storage deliverability averaged 7.7 Bcf per day.⁸⁰

The growth in the Northeast market has also spurred numerous storage projects. Plans are underway to increase storage deliverability in the region 17 percent by 2000; this would include new installations or expansions at 37 or more of the 121 storage sites in the region.⁸¹ Almost all of the expansions would be at 35 sites owned and operated by Columbia Gas Transmission Company. LNG storage is also being increased in the New England market to provide peaking support to those LDCs that will be receiving supplies along new pipeline routes which are not convenient to underground storage facilities.

Compared with other market areas, the Northeast makes the most extensive use of LNG (Table 10). The peak-day deliverability from LNG in the region, 3.8 Bcf per day, is 32 percent as large as the total daily deliverability from underground storage facilities. This backup capability has been included in the overall design of the regional network and is necessary to meet the rapid increases in demand that can occur because of sudden temperature changes.

End-Use Consumption

Although the Northeast has the highest energy consumption of the regions, natural gas is a relatively low proportion of total energy consumed: 21 percent versus a national average of about 24 percent (Table 11). Yet, since 1990, the average

annual growth in natural gas demand in the region grew at a faster rate than the growth in overall energy use, 4.9 percent versus 1.2 percent (Table 11). This average annual growth in natural gas demand, as well as the spread between natural gas and overall energy use, was among the highest of the six regions examined.

Most of this growth can be attributed to the industrial sector, where natural gas consumption grew at an annual rate of 8.3 percent (Table 12) while per-customer usage grew at a 9.7 percent rate (Table 13). Reflected in these rates were large increases in industrial use in New York and New Jersey (Appendix C, Table C3). The increase in industrial gas use came despite a 1.5 percent per annum drop in the industrial customer base during the period.

Electric utilities in the region had a decrease in natural gas use, which declined at an average annual rate of 4.7 percent during the period. This occurred in spite of a growth in gas-powered generating capacity in the region. While the number of gas-fired electric generating units in the Northeast (excluding industrial cogeneration capacity) increased by only 0.4 percent per annum, generating capacity grew at a 4.4 percent annual rate (Table 13). Currently, about 14 percent of the generating capacity in the region is gas-fired and, coincidentally, gas-fired generating capacity in the region also represents 14 percent of total U.S. gas-fired generating capacity.⁸²

Although industrial use of natural gas continues to grow, residential customers in the region still remain the primary users of natural gas. They accounted for 35 percent of the gas consumed in the region in 1996, in contrast to the national average of 24 percent. Although the population of the region is estimated to have increased by only 0.7 percent per annum (Table 11) between 1990 and 1996, total gas consumption in the region increased at a 4.9 percent rate. Space-heating gas demand in the region is driven by the growing, highly populated urban corridor that stretches from Boston, Massachusetts, to Richmond, Virginia.

Recent and Proposed Expansions

In 1997, 12 expansion projects were completed in the Northeast, increasing overall deliverability within the region by more than 772 million cubic feet per day (Appendix B, Table B1). Only one project brought additional gas into the region; the rest were implemented to improve local deliverability to expanding markets within the region. Numerous other projects have been proposed for the Northeast market that could increase capacity by more than

⁷⁹Federal Energy Regulatory Commission, FERC Form 2 and 2A, "Annual Report of Natural Gas Companies," 1996.

⁸⁰Energy Information Administration, Form EIA-191, "Underground Gas Storage Report."

⁸¹Energy Information Administration, "U.S. Underground Storage of Natural Gas in 1997: Existing and Proposed," *Natural Gas Monthly*, DOE/EIA-0130(97)/9 (Washington, DC, September 1997)

⁸²Derived from: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report" (1990-1996).

7 Bcf per day. Planned expansions into the region would total 4.0 Bcf per day, or 32 percent above the 1996 level. Increasing demand for natural gas service in the region and the readiness of Canadian producers to meet the need underlie the bulk of the expansions. Long dependent on fuel oil, the Northeast has seen a steady increase in the availability of natural gas in recent years.

While a large portion of the anticipated growth in natural gas demand is expected to come from increased usage by the industrial sector, the major growth market is expected to be the electric utility sector. Several nuclear generating stations in the region are slated for retirement during the next several years and will be replaced by nonnuclear plants. The natural gas pipeline industry believes that many of these replacement facilities, as well as a number of new conventional power plants, will be built during the next decade and will use high-efficiency natural-gas-turbine technology more widely. At the same time electricity demand in the region is expected to grow as the effects of electric industry deregulation widen competition in the market.

Southeast Regional Market

The Southeast Region is the least developed market for natural gas in terms of per-capita consumption. In fact, natural gas accounts for only a small percentage of the total energy consumed in the region (Table 11). However, because of its proximity to major producing areas in the Southwest, numerous interstate natural gas pipeline companies operate throughout the region (Appendix A, Figure A4), transporting significant volumes via the region to the Northeast and Midwest markets.

Although the region has only limited storage capacity, numerous high-deliverability storage sites exist in the southern part of the region, many of which have been developed since 1990. Four such sites were added in Mississippi, which has several major interstate pipelines traversing the State en route to Northeast markets. The availability of these sites has made the State a prime market for the type of storage services needed by shippers with high upstream demand swings and load balancing requirements.

Entering/Exiting Capacity

During peak periods, the interstate pipeline system has the capacity to move up to 21.4 Bcf into the Southeast Region, principally from the Southwest (Figure 17). This is the second-largest capacity level into any region. More than 70 percent of this capacity is redirected out of the region, with 9.8 Bcf per day into the Midwest and 5.1 Bcf per day into the Northeast Region.

Capacity into the Southeast Region grew by slightly more than 7 percent between 1990 and 1996 (Table 9). Most capacity additions occurred within the region. The major projects completed were the Florida Gas Transmission expansion, the Mobile Bay Pipeline, and the Transcontinental Gas Pipeline southern expansion. Noteworthy were the additional pipeline expansions serving the northern North Carolina market. Several pipelines from the Northeast Region (Columbia Gas Transmission and Transcontinental Gas Pipeline Company) extended their systems into the Southeast market in 1993.

More natural gas pipeline capacity (excluding offshore-to-onshore) enters and exits Mississippi than any other State in the Nation (Appendix A, Table A4). It is the hub State for capacity into the region, with 21.3 Bcf per day coming into the State and 20.5 Bcf per day leaving the State. While several routes flow southward toward Florida, most are directed to the Northeast and Midwest regions (Appendix A, Figure A4).

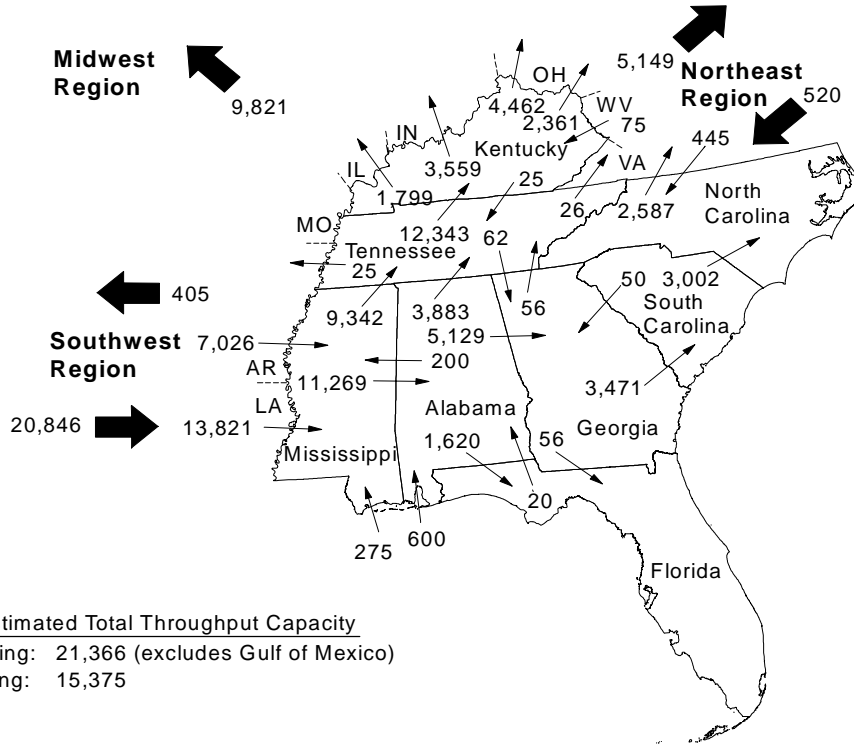
Fifteen interstate pipeline companies operate within the region, with all but four transporting gas from the Southwest. By capacity level, the largest transporters are Tennessee Gas Pipeline Company, Transcontinental Gas Pipe Line Corporation, Texas Eastern Transmission Corporation, and Texas Gas Transmission Corporation. These same four are also the largest exporters.

On its system peak day in 1995, Tennessee Gas Pipeline transported only about 30 percent of its volumes to delivery and interconnection points in the Southeast Region.⁸³ Likewise, Transcontinental Gas Pipe Line, which traverses the region via the Carolinas, delivered only 33 percent of its peak-day volumes in the Southeast. In 1996, average utilization rates on Transcontinental's lines en route to the weather-sensitive Northeast were 83 percent in Mississippi and 79 percent out of Virginia (Appendix A, Table A4). The average daily flow of natural gas into Mississippi in 1996 averaged 16.1 Bcf: 10.9 Bcf from Louisiana, at 79 percent of capacity, and 5.1 Bcf from Arkansas at 73 percent of capacity. The combined utilization on lines entering Mississippi in 1996 was 77 percent.

Major shippers on the major interstate pipeline systems serving the region have peak-day demands of approximately 9.4 Bcf per day. Within the region, demand requirements are the largest in Tennessee, primarily because of the interconnections and service provided among several interstate pipeline companies rather than service to LDCs.

⁸³Based on coincidental peak-day deliveries reported on the annual FERC System Flow Format 567 report.

Figure 17. Interstate Natural Gas Capacity Summary for the Southeast Region, 1996
(Volumes in Million Cubic Feet per Day)



Principal Interstate Natural Gas Pipeline Companies Operating in the Southeast Region

Principal Market Region / Pipeline Name	Regional Supply Source(s)	Primary/Secondary System Configuration ²	Regional Service Level			Systemwide Utilization Rates ¹ %		
			Percent of System Peak-day Deliveries ³	Number of Delivery Points	Number of Interconnects	12-Month Average ⁴	Peak Day ⁵	Summer Offpeak ⁶
Regional Pipelines								
Columbia Gulf Transmission Co	SW	Trunk	98	5	3	98	101	96
East Tennessee Natural Gas Co	SW	Grid/Trunk	92	122	2	84	88	37
Florida Gas Transmission Co	SW	Trunk	92	181	3	71	102	66
Midcoast Pipeline Co	SW	Trunk/Grid	100	NA	NA	NA	NA	NA
South Georgia Natural Gas Co	SW	Grid	100	68	1	NA	NA	NA
Southern Natural Gas Co	SW	Grid/Trunk	93	323	7	66	100	88
Texas Gas Transmission Co	SW	Trunk	55	215	2	79	111	58
Supplemental Pipeline Service								
ANR Pipeline Co	SW	Trunk/Grid	1	6	1	70	100	66
Columbia Gas Transmission Corp	SW, NE	Grid	11	50	2	73	98	26
Koch Gateway Pipeline Co	SW, SE	Grid/Trunk	25	365	4	57	100	59
Midwestern Gas Transmission Co	SW	Trunk	6	3	1	89	104	80
Tennessee Gas Pipeline Co	SW, Canada	Trunk	30	117	22	90	111	70
Texas Eastern Transmission Corp	SW	Trunk	4	37	3	84	109	49
Transcontinental Gas Pipeline Co ⁸	SW	Trunk	33	117	2	83	99	81
Trunkline Gas Co	SW	Trunk	12	24	3	74	90	66

¹ Usage rates are based upon capacity and transportation volumes for the whole system and do not represent regional service only.
² "Trunk" systems are long-distance trunklines that generally tie supply areas to market areas. "Grid" systems are usually a network of many interconnections and delivery points that operate in and serve major market areas. Some systems are a combination of the two.
³ Represents the percent of total pipeline system volume delivered within the region on the system peak-day occurring in the 1996-97 heating year.
⁴ Represents total system capacity divided by the total annual volumes (divided by 366 days) delivered in 1996 as reported in FERC Form 2.
⁵ Represents total system capacity divided by the single peak-day volumes delivered in the 1996-97 heating year as reported in FERC Form 2.
⁶ Represents a summer (nonheating season) usage level, using the sum of volumes delivered during the nonshoulder months of May through September (based on FERC Form 11 gas delivery data for 1995) divided by 153 days. April and October are considered to be months that "shoulder" the heating season of November-March.
 NA = Not available.
 Sources: **Capacity:** Federal Energy Regulatory Commission, FERC 567 Capacity Report, "System Flow Diagram" and Annual Capacity Report (18 CFR §284.12); Energy Information Administration, EIA GIS-NG Geographic Information System, Natural Gas Pipeline State Border Capacity, as of December 1997. **Delivery and Transport Volumes:** Federal Energy Regulatory Commission, FERC Form 11, "Natural Gas Pipeline Company Monthly Statement" and FERC Form 2, "Annual Report of Major Natural Gas Companies."

Deliverability Within the Region

Local gas service within the region, for the most part, is characterized by the presence of a large number of distributors per State, although in most States only one or two large companies predominate. For example, while Georgia has 90 LDCs, the largest one, Atlanta Gas Light Company, represents nearly three-quarters of the total commitments on interstate pipeline capacity in the State. Southern Natural Gas Company provides most of the gas sold by Atlanta Gas Light.

The States of North and South Carolina are exceptions to this regional pattern of having many different pipeline customers. Each of these States has fewer than 25 LDCs, most of which are quite small—representing less than 15 percent of peak-day deliveries on the interstate systems serving the respective States. The Carolinas were not served by any interstate natural gas pipeline until after World War II. Most of the interstate pipeline service (more than two-thirds) in North Carolina and South Carolina is from Transcontinental Gas Pipe Line Corporation. Southern Natural Gas Company also supplies customers in South Carolina.

The largest peak-day delivery volume in the region is 1.7 Bcf per day by Columbia Gulf Transmission Corporation to its affiliate, Columbia Gas Transmission Company, in Kentucky. Columbia Gas of Kentucky, an LDC, in turn receives about 0.2 Bcf per day of that total from Columbia Gas Transmission Corporation. Louisville Gas & Electric Company and Western Kentucky Gas Company are the largest LDCs in Kentucky. Their shipments with Texas Gas Transmission Corporation account for about three-quarters of the pipeline company's total deliverability within the State.

Storage Deliverability

Although the Southeast has the least underground storage capacity of the regions, it has the largest percentage of its daily deliverability (47 percent) from high-deliverability storage sites (Table 10), which are mainly located in Mississippi and Alabama. These facilities are used primarily by shippers on the interstate pipeline system to balance their loads on lines crossing into Alabama and points north and east and to accommodate the periodic swings in demand that are characteristic of some industrial and electric utility users. In Mississippi, interstate shippers and local consumers have access to a delivery (withdrawal) capability equivalent to 2.2 Bcf per day from salt dome storage sites (Appendix C, Table C1).

In the northwestern part of the region, in Kentucky, all of the storage sites are conventional depleted reservoirs, which are used primarily for seasonal supply and backup. About 32 percent of this underground storage capacity is owned by

LDCs that serve local markets in Louisville, Kentucky, and Evansville, Indiana. Nevertheless, while most of the remaining storage in Kentucky (representing about 67 percent of the daily peak-day withdrawal capability in the State) is owned by interstate operators, the bulk of its working gas capacity and deliverability service is reserved by LDCs in northern Kentucky, southern Ohio, Indiana, and Illinois.

Four-fifths of the storage capacity in Kentucky is owned by one interstate pipeline company, Texas Gas Transmission Corporation. The company's storage facilities have a total estimated peak-day delivery rate of about 1.2 Bcf per day, about 70 percent of the total within the State. This level is equivalent to about 80 percent of the total daily capacity of Texas Gas Transmission's lines moving north into Indiana. These storage facilities are also in close proximity to the ANR Pipeline Company system, which traverses the State to Indiana and Michigan. Combined, Texas Gas Transmission and ANR Pipeline have the capacity to move 2.9 Bcf per day north to Indiana (Appendix A, Table A2); Texas Gas Transmission's peak-day storage delivery level is the equivalent of about 42 percent of that figure.

End-Use Consumption

Economic growth in recent years has led to increased natural gas use in the Southeast marketplace. Natural gas increased its share of the energy market, outpacing the growth in total energy usage, 2.9 percent per year versus 2.2 percent (Table 11). Reflecting this growth, in 1995, natural gas use in the region stood at 15 percent of total energy used, 2 percent greater than in 1990. Still, the Southeast remains the smallest consumer of natural gas of all the regions.

Temperate weather, abundant regional coal reserves, and the long history of electricity use fostered by the Tennessee Valley Authority (TVA) have combined to keep residential use of natural gas relatively low. The residential share of natural gas in the region is less than half that of the industrial share, although the residential share has increased 2 percentage points since 1990 because of an increased number of customers during the period (Table 12). The States with the largest residential natural gas markets in the region are Georgia (33 percent) and Kentucky (30 percent) (Appendix C, Table C3).

While the industrial sector increased its consumption of natural gas at an annual rate of 3.2 percent between 1990 and 1996, its share within the natural gas market fell several percentage points (Appendix C, Table C3). Nevertheless, this sector currently represents 44 percent of the natural gas usage within the region, the highest share for the industrial sector in any region except the Southwest (Table 12). Average use by industrial customers increased at an average annual rate of

almost 1.4 percent in the early 1990s (Table 13) after declining throughout the latter part of the 1980s.

The electric utility sector share also grew during the early 1990s as more gas-fired units were installed at electric generating plants in the region. From 1990 through 1996, gas-fired generating capacity grew at an annual rate of 4.2 percent compared with a 1.2 percent growth rate in total generating capacity installed. In 1996, gas-fired generating capacity accounted for 10 percent of the total, compared with only 4 percent in 1990. Currently, this sector represents 16 percent of the natural gas market in the region, up 1 percentage point since 1990. Its share can be expected to increase during the next several years, even if the annual growth rate slows from the 8.3 percent pace during the period from 1990 through 1996.

Recent and Proposed Expansions

The continuing decline in deliverability from the western Gulf of Mexico and the increasing development of deep water production in the eastern part of the Gulf (see Chapter 2) is expected to result in greater capacity utilization on the major trunklines traversing the Southeast Region. New capacity could be needed in the near future, but, as of March 1998, no major expansions have been submitted to FERC for approval. Only Columbia Gulf Transmission Company (0.2 Bcf per day) and Tennessee Gas Pipeline Company (0.2 Bcf per day) have announced proposals that would address this issue (Appendix B).

Most of the expansion proposals into and within the region are targeted toward improving deliverability to regional customers and expanding into new market areas. In 1997, five projects were completed, accounting for only 0.4 Bcf per day of new capacity (Table ES1). This is equivalent to only about 0.5 percent of existing interstate pipeline capacity in the region (Appendix B).

More than 3.2 Bcf of new capacity has been proposed within the region for completion between 1998 and 2000 (Appendix B, Table B2). About 54 percent of this capacity is to bring in supplies from the Gulf of Mexico. While almost all of the onshore projects are regional, and for the most part support the area's expanding electric utility and industrial sectors, the offshore projects are designed to support the interstate pipeline network as well.

Demand for natural gas is still growing within the region. More natural gas is being used by all customer groups, including electric utilities (Table 12). In fact, natural gas demand in the region grew at an annual average rate of 3 percent between 1990 and 1995, with each customer category showing an increase. With pipeline utilization rates

within the region also showing an increase over the past several years (about 8 percentage points), increased expansion planning in the region can be expected.

Southwest Regional Market

Even though large volumes of natural gas leave the Southwest Region for other regional markets, significant volumes still remain in the region to fulfill a high level of industrial demand encouraged over the years by the proximity to production areas. In 1996, the Southwest Region consumed more natural gas than any other region, one-half more than the next largest consuming region, the Midwest. About one-third of the Nation's gas is consumed in the Southwest.

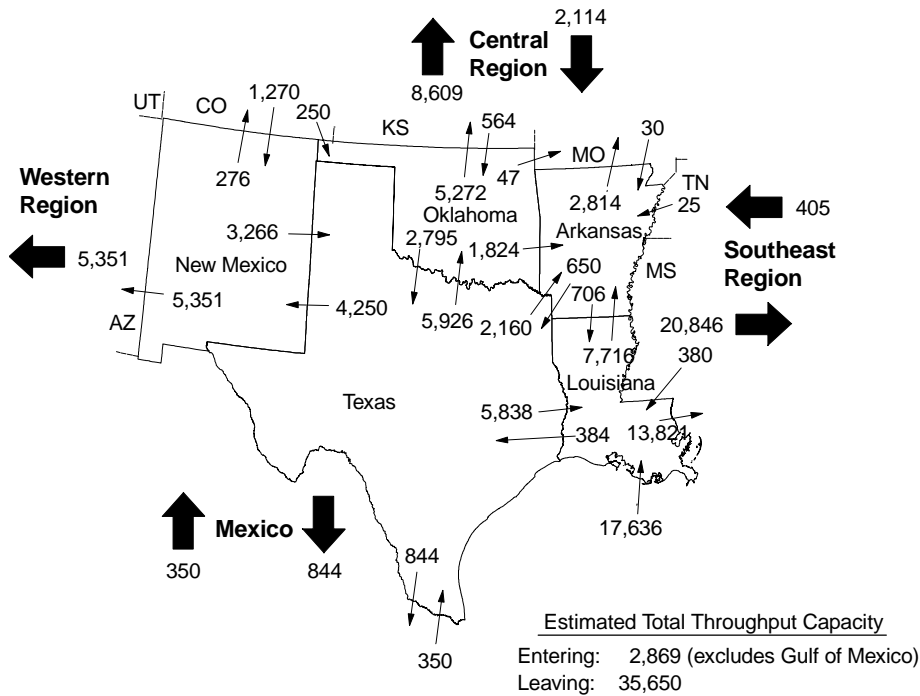
The region also has numerous underground storage reservoirs, most of which are used to store excess natural gas production during months of low consumption (Table 10). In recent years, however, more storage in the region is being devoted to supporting the needs of customers using natural gas market centers in the area. Total working gas storage capacity (983 Bcf) is the second highest of the regions. The region has temperate winters and long, hot summers. Louisiana and Texas are the second- and third-warmest States in the lower 48 States, which accounts for large electricity loads for air-conditioning services.

Entering/Exiting Capacity

Because the Southwest Region has many of the largest gas-producing areas in North America, a huge amount of natural gas pipeline capacity in the region represents export capability. More than 35.7 Bcf per day of capacity exits the region (Figure 18) on at least 20 interstate pipelines (Appendix A, Figure A5), directed toward markets in all other regions of the country, as well as Mexico. This represents an 8-percent increase since 1990 (Table 7, Chapter 3), most of which was evenly distributed on pipelines extending to the Western and Southeast regions (Appendix A, Table A5). From 1990 to 1996, average daily pipeline utilization rates increased along each of the exiting corridors except into the Western Region (and Mexico). The installation of excess interstate pipeline capacity, coupled with an economic downturn in that region, brought on a sizable drop in usage rates along the Western corridor.

Only about 2.9 Bcf per day of capacity enters the Southwest Region. Much of this capacity is on pipeline systems whose flows are directed toward interconnections with other interstate systems for transshipment to markets outside the Southwest Region. The remainder represents flows to local regional markets that are close to the borders of the region,

Figure 18. Interstate Natural Gas Capacity Summary for the Southwest Region, 1996
(Volumes in Million Cubic Feet per Day)



Principal Interstate Natural Gas Pipeline Companies Operating in the Southwest Region

Principal Market Region / Pipeline Name	Regional Supply Source(s)	Primary/Secondary System Configuration ²	Regional Service Level			Systemwide Utilization Rates ¹ %		
			Percent of System Peak-day Deliveries ³	Number of Delivery Points	Number of Interconnects	12-Month Average ⁴	Peak Day ⁵	Summer Offpeak ⁶
Regional Pipelines								
Koch Gateway Pipeline Co	SW	Trunk/Grid	75	907	13	57	100	59
Noram Gas Transmission Co	SW	Trunk/Grid	99	751	32	56	86	61
Mid-Louisiana Gas Co	SW	Trunk	100	7	3	NA	NA	NA
Ozark Gas Transmission Co	SW	Trunk	100	NA	NA	NA	NA	NA
Valero Interstate Transmission Co	SW	Trunk/Grid	100	NA	NA	NA	NA	NA
Supplemental Pipeline Service								
ANR Pipeline Co	SW	Trunk/Grid	17	21	22	70	100	66
Colorado Interstate Gas Co	SW, CE	Trunk/Grid	5	11	7	82	104	76
Columbia Gulf Transmission Co	SW	Trunk	2	10	11	98	101	96
El Paso Natural Gas Co	SW	Trunk	3	288	6	71	78	73
Florida Gas Transmission Co	SW	Trunk	8	25	1	71	102	66
Mississippi River Transmission Co	SW	Trunk	41	32	8	85	92	59
Natural Gas Pipeline of America	SW, CE	Trunk	7	83	25	84	96	80
Northern Natural Gas Co	SW	Trunk/Grid	4	45	8	92	107	80
Panhandle Eastern Transmission Co	SW	Trunk	1	9	0	78	98	58
Southern Natural Gas Co	SW	Grid/Trunk	2	18	10	66	100	88
Tennessee Gas Pipeline Co	SW, Canada	Trunk	11	141	29	90	111	70
Texas Eastern Transmission Corp	SW	Trunk	7	12	29	84	109	49
Texas Gas Transmission Corp	SW	Trunk	17	58	21	79	111	58
Transcontinental Gas Pipeline Co	SW	Trunk	1	5	4	83	99	81
Trunkline Gas Co	SW, CE	Trunk	1	30	16	74	90	66
Transwestern Gas Pipeline Co	SW, CE	Trunk	67	34	8	60	62	61
Williams Natural Gas Co	SW, CE	Grid/Trunk	4	86	1	75	82	42

¹ Usage rates are based upon capacity and transportation volumes for the whole system and do not represent regional service only.

² "Trunk" systems are long-distance trunklines that generally tie supply areas to market areas. "Grid" systems are usually a network of many interconnections and delivery points that operate in and serve major market areas. Some systems are a combination of the two.

³ Represents the percent of total pipeline system volume delivered within the region on the system peak-day occurring in the 1996-97 heating year.

⁴ Represents total system capacity divided by the total annual volumes (divided by 366 days) delivered in 1996 as reported in FERC Form 2.

⁵ Represents total system capacity divided by the single peak-day volumes delivered in the 1996-97 heating year as reported in FERC Form 2.

⁶ Represents a summer (nonheating season) usage level, using the sum of volumes delivered during the nonshoulder months of May through September (based on FERC Form 11 gas delivery data for 1995) divided by 153 days. April and October are considered to be months that "shoulder" the heating season of November-March.

NA = Not available.

Sources: **Capacity:** Federal Energy Regulatory Commission, FERC 567 Capacity Report, "System Flow Diagram" and Annual Capacity Report (18 CFR §284.12); Energy Information Administration, EIAGIS-NG Geographic Information System, Natural Gas Pipeline State Border Capacity, as of December 1997. **Delivery and Transport Volumes:** Federal Energy Regulatory Commission, FERC Form 11, "Natural Gas Pipeline Company Monthly Statement" and FERC Form 2, "Annual Report of Major Natural Gas Companies."

for example, Associated Natural Gas Company's 30 MMcf per day from Missouri into Arkansas.

About 45 percent (1.3 Bcf per day) of the total entering capacity represents pipeline capacity from Colorado (Central Region) to New Mexico on three pipelines (Appendix A, Table A5). Part of this capacity (about 60 percent) is redirected toward traditional Western Region markets, although in recent years a greater portion of this capacity is being directed to interstate interconnections and market centers that serve the Midwest marketplace. The average daily utilization rates on these three pipelines ranged from 55 to 88 percent in 1996, the lowest being on the Transwestern Pipeline system, which was affected by unusual maintenance needs and construction during off-peak periods.

Deliverability Within the Region

Several of the 22 or more interstate pipeline companies operating within the Southwest Region primarily serve customers in the region (Figure 18). Three of the larger ones, Noram Gas Transmission Company, Ozark Gas Transmission Company, and Valero Interstate Pipeline Company, have commitments within the region of close to 100 percent of their total transportation service levels. In addition, several of the major trunklines exiting the region also maintain sizeable deliverability levels within the region itself. For instance, in 1995, El Paso Natural Gas, Koch Gateway Pipeline, and Transwestern Pipeline companies delivered 54, 63, and 53 percent, respectively, of total throughput to points within the region on their system peak day.⁸⁴ Several of the other major exporting pipeline system delivered 25 to 30 percent of their peak-day volumes within the region.

In 1996, the average daily utilization rates on the interstate pipelines within the region ranged from 42 to 98 percent. In general, the average rate within the region was higher in 1996 than in 1990, 57 versus 49 percent. This rate is lower than the 66-percent average utilization for lines exiting the region (Appendix A, Table A5), but reflects some of the

⁸⁴Energy Information Administration, EIAGIS-NG Geographic Information System, Natural Gas Pipeline Deliverability Database, as of December 1995.

gathering and intermediate storage operations within the region performed in conjunction with production—features that affect trunkline operations to a lesser degree. Also, trunkline usage rates often are more a reflection of the downstream demands of other regional markets rather than of demands within the Southwest.

The regional interstate pipeline companies, that is, those with the majority of their deliveries within the region, together account for about one-quarter of the regional deliveries. Most of the regional consumption is supplied by local intrastate pipeline companies for which data are unavailable. As the largest consuming region in the United States, the Southwest has many large intrastate pipeline companies and LDCs supplying natural gas to consumers. For example, Lone Star Gas Company is the eighth largest LDC in the United States (in terms of total deliveries), with more than 1.2 million customers in Texas. The only States in which LDCs are among the largest customers of the interstate pipeline companies are Louisiana, where Koch Gateway Pipeline Company supplies New Orleans Public Service Inc., and New Mexico, where El Paso Natural Gas Company supplies three LDCs.

Storage Deliverability

Underground natural gas storage plays a vital role in the efficient export and transmission of natural gas from the Southwest to other regions, as well as in supplementing regional needs. These underground storage facilities represent over 982 Bcf of working gas capacity (Table 10) and an estimated daily deliverability level of over 20.5 million cubic feet. A large portion of this storage is near production fields and is used to balance production flows and fluctuating market demand.

About 38 percent of the region's daily deliverability from storage is owned by interstate pipeline companies, 29 percent by independent operators, and 33 percent by LDCs or intrastate pipeline companies. All of the interstate pipeline-owned storage, and most of the independently owned, is open access, that is, working gas storage capacity can be available to shipper/customers on a first-come, first-served basis at nondiscriminatory rates. This means that only a limited amount of the pipeline storage is for system or pipeline use

(for load-balancing operations). Most shippers are now responsible for making their own arrangements with storage operators to ensure that they comply with the receipt/delivery balancing requirements of the system on which they are shipping.

As a result, a growing amount of regional storage is also linked to the many natural gas market centers in the region that have become operational during the past 5 years.⁸⁵ These centers, often themselves owners of independent storage, assist shippers in making short-term arrangements to store excess load or to borrow gas when receipt volumes do not match delivery requirements or vice-versa, a situation that can result in imbalance penalties being levied by the transporting pipeline.

The overall peak-day withdrawal capability from storage into the interstate system is approximately 13.7 Bcf per day (Table 10), the equivalent of about 39 percent of the total capacity exiting the region. In Louisiana, almost all of the underground storage service is available to the interstate system, whereas in Oklahoma, 56 percent is operated as part of the interstate system (Appendix C, Table C1).⁸⁶ Industrial and electric utility customers in the region, with variable load demands and high swing requirements, are major users of high-deliverability, salt cavern storage, most of which is operated by interstate pipeline companies or independents.

Only about a third of the region's storage capacity is owned by LDCs and used exclusively for local service (Table 10), but regional distributors also have access to and use interstate and independent storage facilities. Most of the LDC-owned storage is near major industrial and population centers and has little impact upon the interstate pipeline network in the area. In Texas and Oklahoma, approximately 40 percent of underground storage capacity is at facilities operated by LDCs or intrastate pipeline companies, whereas in Arkansas all of the storage capacity is controlled by local operators (Appendix C, Table C1).

End-Use Consumption

The Southwest is the only regional marketplace where natural gas use grew at a slower rate than total energy demand (Table 11). Since 1990, natural gas consumption in the region grew at an annual rate of 0.2 percent, while total energy grew at a 1.3 percent rate. In fact, the use of natural gas as a percentage of total energy consumed dropped from 40 percent in 1990 to 39 percent in 1995. Part of this drop can be

⁸⁵See, Energy Information Administration, *Natural Gas 1996: Issues and Trends*, DOE/EIA-0560(96) (Washington, DC, December 1996), Table 8, Chapter 3.

⁸⁶Includes supply to the interstate system.

attributed to an annual growth rate of only 1.9 percent in residential consumption and 3.2 percent in the industrial sector (Table 12).

Although electric utility use of natural gas showed a slight annual decrease (0.1 percent) during the period (Table 12), gas-fired generating capability increased at a 1.4 percent rate. Gas-fired generating capacity grew to 57 percent of total electric generating capacity in the region by 1996, the highest rate among regions. Louisiana had the highest percentage, 71 percent, with Texas second at 61 percent.⁸⁷ Total electricity generating capacity in the region increased by only 2 percent from 1990 through 1996, at about the same level as installed gas-fired units (Table 13). On the other hand, nonutility generating capability, although accounting for only about 1 percent of electric power generated in the region in 1996, grew by 14 percent during the same period.

In 1990, natural gas provided 40 percent of the total energy input to electric utilities in the region.⁸⁸ By 1996, this proportion had fallen to 36 percent. In addition, the total volume of gas consumed within the region by electric utilities declined by 7 percent during the same period.⁸⁹ In spite of this regional decline, natural gas use by electric utilities in Texas increased slightly and in 1996 still accounted for 40 percent of all gas purchases by utilities in the Nation.

Despite a slight loss in energy share, regional consumption of natural gas is the highest in the Nation. Louisiana, Oklahoma, New Mexico, and then Texas, respectively, use natural gas as an energy source to a greater degree than any other States in the Nation (Appendix C, Table C2). This high level is due to the availability of gas in the region, where the overall ratio of natural gas production to consumption is 2.25 (Table 11), and the use of natural gas by industries and electric utilities in the region is still the highest compared with use in the rest of the Nation (Table 12).

The industrial sector dominates the regional market, consuming 53 percent of the natural gas delivered within the Southwest Region. The industrial share of natural gas consumption is highest in Louisiana (63 percent) because of its large petrochemical industry. From 1990 to 1996, industrial customers in all States in the region increased average natural gas use at an annual rate of 11 percent, with New Mexico (where industrial sector represents the smallest

⁸⁷Derived from: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report" (1990-1996).

⁸⁸During the 1980s, the proportion of natural gas consumed by electric utilities in the region dropped from 66 percent in 1980 to 41 percent in 1989 primarily because of high gas prices that developed in the early part of the decade.

⁸⁹Energy Information Administration, *Natural Gas Annual 1996*, DOE/EIA-0131 (Washington, DC, September 1997) and previous editions.

market share) and Texas showing the largest increases (Appendix C, Table C4). While natural gas lost in terms of overall industrial gas users, its share of the regional natural gas market still grew by 6 percentage points between 1990 and 1996 (Table 12).

The residential and commercial use of natural gas remains relatively low in the region, representing only about 11 percent of natural gas consumption in the region, virtually unchanged from the 1990 level. The Southwest is only fourth of the six regions in the proportion of the total population that uses natural gas, and also fourth in terms of average gas use per residential customer.⁹⁰ Since 1990, the number of residential and commercial gas customers increased somewhat, 1.2 and 2.2 percent per year, respectively, but not enough to affect their respective markets (Table 13).

Recent and Proposed Expansions

The principal arena for pipeline capacity expansions in the Southwest Region during the next several years will be in the intrastate market, mostly to expand access to new production areas and improve deliverability to local markets and links with the interstate system. In particular, producers in southern Texas and the Cotton Valley Trend area of eastern Texas will be seeking greater access to the interstate transmission network. In the interstate market, the primary effort will be to forge greater access to deep water developments in the Gulf of Mexico and to improve service at the several market centers in the region.

In 1997, 10 expansion projects were completed within the region, adding more than 3.7 Bcf to regional pipeline capacity. Six of these projects were designed to bring additional supplies onshore from the Gulf of Mexico: three major gathering systems (1.1 Bcf per day) and three pipelines (2.1 Bcf per day) coming onshore to Louisiana (Appendix B). The remaining projects were designed principally to expand interstate access to production in West Texas and New Mexico. Fourteen additional projects are scheduled for completion in 1998 and two in 1999, which would add 3.7 Bcf to regional capacity. Currently, no projects have been announced that would go beyond 1999.

Western Regional Market

The Western Region has some of the strongest environmental initiatives in the Nation, many of which call specifically for greater use of natural gas. For instance, regulatory agencies in

California have mandated reductions in consumption of residual fuel oil as a boiler fuel, resulting in increased use of natural gas in this area. Even before passage of the Clean Air Act Amendments of 1990, the South Coast Air Quality Management District issued rules that prohibit price-induced burning of fuel in dual-fired utility boilers. The Southern California Edison Company and the Los Angeles Department of Water and Power also adopted plans that would eliminate the use of fuel oil at all their power plants in order to reduce emissions.

This projected preference for gas because of environmental concerns was a primary force behind the 42-percent increase in pipeline capacity into the Western Region between 1990 and 1996. However, the expected growth in the natural gas market did not materialize as an economic slowdown resulted in underutilization of this new capacity.

California dominates the regional natural gas market because of its large population, the highest in the Nation, and because of its relatively high gas use. California customers account for about 59 percent of the energy consumed in the region and 74 percent of the natural gas use (Appendix C, Table C2). One utility, Pacific Gas and Electric, distributed almost 5 percent of the natural gas delivered to end-use customers in the United States in 1996. Another, Southern California Gas Company, is the largest gas distributor in the United States and perhaps in the world.

Entering/Exiting Capacity

Eight interstate pipeline companies provide service to and within the Western Region, the fewest number serving any region (Figure 19). Capacity entering the region is also the lowest of all gas-importing regions, approximately 10.1 Bcf per day. Slightly more than half of this capacity is on pipeline systems that carry gas from the Rocky Mountains area and the Permian and San Juan Basins (Appendix A, Figure A5). These systems enter the region at the New Mexico-Arizona and Nevada-Utah State lines. The rest arrive on pipeline systems that access Canadian supplies at the British Columbia-Idaho and Washington State border crossings.

Capacity into the Western Region increased overall by 42 percent, or 3.0 Bcf per day, between 1990 and 1996 (Table 9). The majority of this increase occurred on routes transporting gas from Canada, where 48 percent more capacity was implemented. PG&E Transmission-Northwest (formerly Pacific Gas Transmission Company) and Northwest Pipeline Company accounted for all of these capacity additions. In spite of a general economic downturn in the region during the early 1990s, particularly in California, average capacity usage rates on these routes recovered in

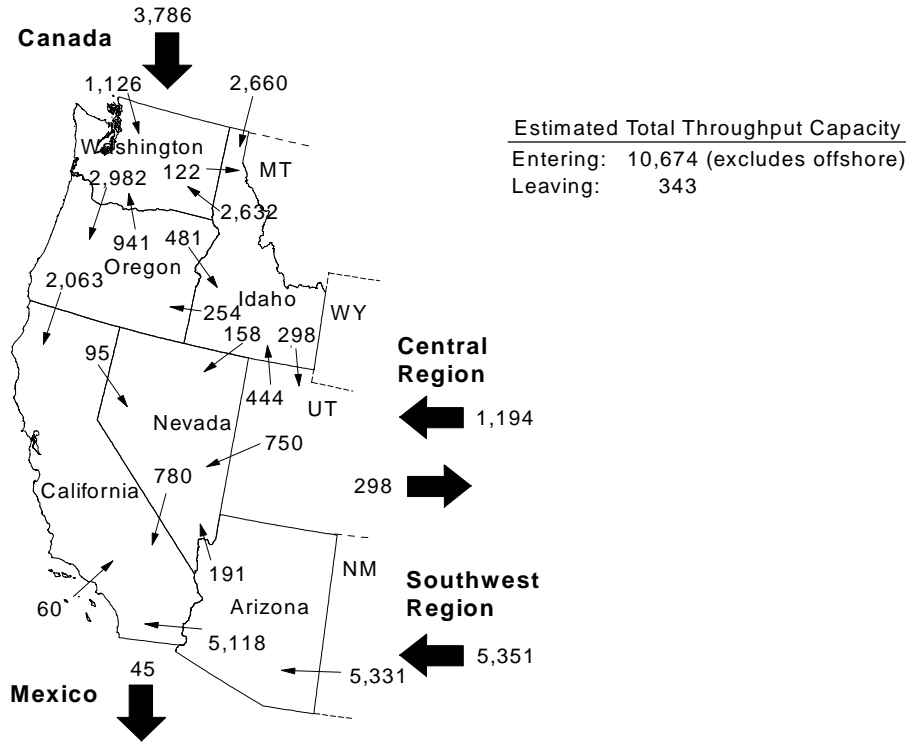
⁹⁰See, Energy Information Administration, *Natural Gas Annual 1996*, and previous editions.

1996 (after falling between 1993 and 1995) to reach or exceed their 1990 average rates.

Three new interstate natural gas pipeline systems were placed in service between 1991 and 1995 in the region and four existing systems underwent major expansions. While they were being built, however, the regional marketplace, especially in California, saw an overall decrease in economic activity and a slowdown in the growth of natural gas demand. A casualty of the slowdown has been the repeated postponement of the Altamont Pipeline project (737 MMcf per day), which was slated to serve the California market with gas transported from western Canada.⁹¹ Currently, the project is being marketed as a potential route for transporting Canadian supplies eastward via the expanding Trailblazer system (which transports gas to Midwestern markets).

⁹¹The Altamont system, as originally proposed, would flow southward from Alberta, Canada, through Montana and feed into the Kern River pipeline system at Opal, Wyoming.

Figure 19. Interstate Natural Gas Capacity Summary for the Western Region, 1996
(Volumes in Million Cubic Feet per Day)



Principal Interstate Natural Gas Pipeline Companies Operating in the Western Region

Principal Market Region / Pipeline Name	Regional Supply Source(s)	Primary/ Secondary System Configuration ²	Regional Service Level			Systemwide Utilization Rates ¹ %		
			Percent of System Peak-day Deliveries ³	Number of Delivery Points	Number of Interconnects	12-Month Average ⁴	Peak Day ⁵	Summer Offpeak ⁶
Regional Pipelines								
El Paso Natural Gas Co.	SW	None	76	330	2	71	78	73
Kern River Transmission Co	CE	Trunk	99	30	0	98	109	96
Mojave Pipeline Co	SW	Trunk	100	17	2	97	119	95
Northwest Pipeline Co	Canada	Trunk/Grid	64	282	1	90	94	54
Pacific Gas Transmission Co	Canada	Trunk	109	190	3	86	96	85
TransColorado Pipeline Co	CE	Trunk	100	NA	NA	NA	NA	NA
Transwestern Gas Pipeline Co	SW	Trunk	31	6	1	60	62	61
Tuscarora Gas Transmission Co	Canada	Trunk	109	4	1	NA	NA	NA

¹ Usage rates are based upon capacity and transportation volumes for the whole system and do not represent regional service only.
² "Trunk" systems are long-distance trunklines that generally tie supply areas to market areas. "Grid" systems are usually a network of many interconnections and delivery points that operate in and serve major market areas. Some systems are a combination of the two.
³ Represents the percent of total pipeline system volume delivered within the region on the system peak-day occurring in the 1996-97 heating year.
⁴ Represents total system capacity divided by the total annual volumes (divided by 366 days) delivered in 1996 as reported in FERC Form 2.
⁵ Represents total system capacity divided by the single peak-day volumes delivered in the 1996-97 heating year as reported in FERC Form 2.
⁶ Represents a summer (nonheating season) usage level, using the sum of volumes delivered during the nonshoulder months of May through September (based on FERC Form 11 gas delivery data for 1995) divided by 153 days. April and October are considered to be months that "shoulder" the heating season of November-March.
 NA = Not available.
 Sources: **Capacity:** Federal Energy Regulatory Commission, FERC 567 Capacity Report, "System Flow Diagram" and Annual Capacity Report (18 CFR §284.12); Energy Information Administration, EIA GIS-NG Geographic Information System, Natural Gas Pipeline State Border Capacity, as of December 1997. **Delivery and Transport Volumes:** Federal Energy Regulatory Commission, FERC Form 11, "Natural Gas Pipeline Company Monthly Statement" and FERC Form 2, "Annual Report of Major Natural Gas Companies."

The new pipeline systems constructed during the period include: (1) the Kern River Pipeline (750 MMcf per day) from Opal, Wyoming, to Kern County, California, currently operating at about 100 percent utilization during peak periods and 93 percent during baseload periods; (2) Mojave Pipeline (450 MMcf per day) from the Arizona/California border to Kern County, merging with the Kern River system, currently operating at about full capacity during peak periods but as low as 40 percent during other periods; and (3) Tuscarora Pipeline (110 MMcf per day) from the northern California Border to Reno, Nevada, which began operations in 1995 (load factors are unavailable).

PG&E Transmission-Northwest had the largest expansion during the period, adding more than 870 MMcf per day to its system from the Canada/Idaho border to the northern California border, a 55-percent increase. While the system currently operates at about 90 to 95 percent capacity during peak periods (compared with 100 percent in 1990), the range between high and low is only about 8 percentage points. Northwest Pipeline Company (NWPL), which also brings Canadian supplies into the region, increased its capacity by more than 240 MMcf per day, adding greater bidirectional flexibility and redirecting some of its flows to growing markets within its operational territory. NWPL's overall utilization level is higher than it was in 1990. The system operates at about full capacity during peak periods, although rates fell as low as 54 percent during off-peak periods.

Expansions of the El Paso Natural Gas Company and Transwestern Pipeline Company systems during 1992 and 1993 provided greater access to San Juan Basin production. The El Paso system experienced an increase of 371 MMcf per day, or 17 percent, while Transwestern's system increased by 680 MMcf per day.⁹²

Deliverability Within the Region

The States within the Western Region are almost totally dependent upon the interstate pipeline network for their gas supplies (Table 11). California is the only one that produces any substantial quantity, about 15 percent of its annual consumption level (Appendix C, Table C2). Another important characteristic of the region is that local gas distribution services are dominated by a few large companies. Other than some small municipal gas distributors, Idaho, Washington, and Nevada have only three LDCs, Oregon and

⁹²Transwestern completed its San Juan expansion project in 1996 and increased capacity further in the area in 1997. Its completion expanded capacity on the New Mexico side of the basin, thus relieving a production constraint situation that has hindered the flow of production out of the area for several years. The Transwestern system expansion prior to 1996 coincided with the construction of the Mojave Pipeline system, the two interconnecting at the Arizona/California border.

Arizona two, and California five. In addition, a company such as Washington Water Power operates in more than one State, providing service in Oregon, Washington, and California.

Until the early 1990s no interstate pipeline companies operated within California; all supplies were received from the interstate companies at the State border. That changed with the completion of the Kern River and Mojave Pipeline system into southern California in 1993 and the Tuscarora Pipeline system into northern California in 1995. However, even today, most service within California is provided by Pacific Gas and Electric Company and Southern California Gas Company, the two largest LDCs in the Nation. The two companies play dual roles as LDCs for their core customers and open-access transporters for major shippers, such as industrial users and electric utilities, within their respective service territories. They also serve as intrastate pipelines with interconnections to the other LDCs serving the State. Southern California Gas Company provides distribution service in southern California. Pacific Gas and Electric claims northern California as its service territory but also serves as a vehicle to move some Canadian gas supplies to southern California.

All of the pipelines entering the region, with the exception of Northwest Pipeline Company, terminate there as well. Each also has major commitments in the region. For instance, of the 645 delivery and interconnection points on the El Paso Natural Gas system, 341 are within the region and represented 76 percent of the peak-day volumes delivered off its system in 1995 (Figure 19). All of Pacific Gas Transmission's 192 delivery points are within the region, with the system transporting 2.7 Bcf on its peak day in 1996 (Table 1).

The interstate pipeline companies within the region operated at an average utilization rate of about 66 percent in 1996.⁹³ That was down from an 84-percent level in 1990. The difference reflects, to a large degree, the drop in capacity utilization on those pipelines bringing Southwest Region gas into California: Transwestern Pipeline Company and El Paso Natural Gas Company. However, even during the summer months, these systems operate within a narrow range of capacity utilization.

Storage Deliverability

Most of the underground storage facilities in the Western Region, especially in California which has 91 percent of the region's working gas capacity, are used as market area supply reservoirs to store Canadian gas supplies, which flow and are

⁹³Energy Information Administration, EIAGIS-NG Geographic Information System, Natural Gas Pipeline State Border Capacity Database, as of December 1997.

received at a rather constant rate (Appendix C, Table C1). The California storage fields are more like production (area) storage located at the market end of the supply corridor. The availability of this storage is one of the reasons why the pipelines entering the region operate at such high and sustained utilization rates. This storage allows the California operators to address the varying needs of their local customers and shippers while maintaining a steady flow on their systems.

All the underground storage sites in the region are conventional reservoir storage, owned and operated by LDCs (Table 10). Most of the storage is owned by the two largest California intrastate systems, PG&E and SoCal Gas. The rest is located in Washington State and Oregon and is used for seasonal storage and as peaking facilities.

Despite the region's relatively temperate climate, LNG storage is also used by LDCs in the market, especially in the northern States of Washington and Oregon (Appendix C, Table C1). LNG as a peaking fuel is very compatible with the need for occasional supplemental supply support, especially because the geologic makeup of the region precludes much further development of underground storage facilities. Installation of LNG facilities under these conditions also lessens the need for additional and expensive pipeline capacity when incremental supplies are needed only for the short term.

End-Use Consumption

Natural gas consumption in the Western Region increased at an average annual rate of about 4 percent between 1990 and 1996, whereas overall energy output increased at only a 0.3 percent rate (Table 11). The slowdown in the regional economy during the early 1990s was the main factor in the decreased energy growth. The higher growth in natural gas consumption can be attributed to its use as a substitute for hydropower when water levels were low and to its increased use for enhanced-oil-recovery operations in California. Environmental dictates also brought about increased substitution of natural gas for less clean-burning fuels.⁹⁴

Consumption by California customers accounts for 59 percent of the energy consumed in the region and 74 percent of the natural gas. In 1995, 26 percent of the total energy consumed in California was natural gas (Appendix C, Table C2). The industrial sector dominates the California gas market

(38 percent in 1996), particularly because of the enhanced oil recovery (EOR) industry in southern California. The EOR market, which uses natural gas to generate steam for injection onto heavy-oil fields, accounts for about 200 Bcf of the natural gas entering the State during the year. The EOR market is the primary reason for the 3.6 percent annual growth in the industrial sector in California since 1993, when the Kern River and Mojave pipelines first entered this market. Another factor in the growth in the industrial sector is the large number of cogeneration sites (more than 450) in the State. Natural gas accounted for more than 57 percent of the power generated from these facilities in 1996 and constituted about 12 percent of all electric power generated in the State.

Residential customers have a 26-percent share of the California natural gas market, electric utilities 18 percent, and commercial customers only 13 percent (Appendix C, Table C3). Hydropower electric generation is the major competitor of natural gas in the State. In past years, for instance, when severe drought conditions developed that restricted hydro-power generation, natural gas saw a major gain in its use for electric generation. As water levels improved, however, natural gas lost its market advantage and, as a result, the use of natural gas for this purpose dropped by 7.4 percent per year in the State from 1990 through 1996.

Nonetheless, the electric utility industry remains a significant user of natural gas. In three of the six States in the region (Arizona, Nevada, and California), the electric utility industry accounts for 16 to 38 percent of total natural gas deliveries to consumers (Appendix C, Table C3). From 1990 through 1996, gas-fired electric generation capacity in the region grew at an annual rate of only 0.3 percent, 5.6 percent in Oregon and 3 percent in Nevada.

In the northern States of the region—Idaho, Oregon, and Washington—the industrial segment is the predominant user of natural gas, accounting for more than 48 percent of the natural gas market in each State. Average annual industrial consumption of gas in these States increased by about 6.9 percent between 1990 and 1996, while the commercial and electric utility sectors saw a decrease in natural gas market share. These three States also showed some of the largest gains in overall energy consumption throughout the period. The low usage of natural gas in these States for electricity generation is primarily because of their extensive hydroelectric capacity.

Recent and Proposed Expansions

In 1997, two projects were completed in the region—a 25-MMcf-per-day export crossing with Mexico and a 12-MMcf-per-day pipeline expansion from Nevada to California. No new capacity has been built into the region since 1993.

⁹⁴Coincidentally, Federal and State environmental regulations are encouraging more natural gas use, particularly in applications where petroleum products and coal dominate the market. In some parts of the region, regulations to limit atmospheric emissions may make natural gas the only fossil fuel that can be used for electric power and steam generation.

However, the growing economies of the northern States in the region—Idaho, Oregon, and Washington—may increase capacity needs. The two major interstate pipeline companies serving these States, Pacific Gas Transmission and Northwest Pipeline, have announced plans to add additional deliverability during the next several years, although the final levels have yet to be determined.

Outlook

It appears that most, if not all, natural gas consumer markets in the United States have adequate service to meet their unique needs. Interstate pipeline capacity into each of the six regional markets has increased since 1990 at a pace consistent with the growth in demand. Furthermore, proposals for expanding the network are in line with current projections for regional natural gas demand growth during the next several years.⁹⁵

Open-season exercises conducted by the initiators of the current inventory of expansion proposals have resulted in bids for future capacity sometimes in excess of what had been initially offered as a project expansion estimate. This would seem to indicate that bidders/planners within local markets also believe that demand will grow substantially during the next several years. Planners at the local level usually possess better knowledge of the customer profiles within their own areas and, therefore, their bids for future pipeline capacity can be viewed as relatively firm support for the expansions.

In some cases, however, these bids for capacity are being made by marketers and other parties who are not that intimately involved in the local market but want to ensure their access to new capacity in the future. This new capacity would provide them with alternative routes to meet their customers' desires for access to least cost supplies rather than to address demand growth.

⁹⁵Nevertheless, close scrutiny and detailed economic analyses by regulatory authorities will result in some projects being deemed unnecessary and thus not approved. The analyses are done in an effort to avoid, as much as possible, the burden of costs to future ratepayers that are associated with underutilized or uncompleted projects.

If all the projects currently proposed were built—and that is highly unlikely since several have targeted the same markets—interregional capacity would increase by as much as 14.7 Bcf per day, or about 17 percent, from the 1996 level. Additional projects that are limited to providing service within a specific region comprise another 15.3 Bcf per day of capacity.

Underground storage operations, which facilitate both market center services and efficient pipeline operations, will also be expanding significantly over the next several years, many in support of market center or pipeline expansion.⁹⁶ For instance, the implementation of the proposed Vector pipeline, from Chicago to Dawn, Ontario, via the U.S. Midwest, will require the expansion of several storage facilities in Ontario and in Michigan to serve its shippers. Likewise, in the southern States of Texas, Louisiana, and Mississippi, where a number of market centers are located, including the Henry Hub, a number of high-deliverability salt cavern storage facilities are being built or expanded to handle growing production out of the Gulf of Mexico and increasing business between regional hubs such as those located in the Midwest (Chicago) and the Northeast (Pennsylvania and New York). In these States alone, proposed (through 2001) increases in daily deliverability from storage sites that directly or indirectly support market or trading centers amount to 2.2 Bcf per day, or 5 percent more than current levels.

The services and flexibility offered at natural gas market centers can be expected to be expanded and improved. The Chicago market center, for example, should grow as Canadian import and Southwest supplies (via the Henry Hub) expand into the area and much of this gas is redirected to the Northeast Region. The Leidy hub in Pennsylvania is the transaction and transfer point for several market centers serving the Northeast and can be expected to become key to moving gas from the Midwest to New England markets and other parts of the Northeast.

⁹⁶Energy Information Administration, "U.S. Underground Storage of Natural Gas in 1997: Existing and Proposed," *Natural Gas Monthly*, DOE/EIA-0130(97/09) (Washington, DC, September 1997).