Natural Gas Transportation - Infrastructure Issues and Operational Trends

by James Tobin

This report examines how well the current national natural gas pipeline network has been able to handle today's market demand for natural gas. In addition, it identifies those areas of the country where pipeline utilization is continuing to grow rapidly and where new pipeline capacity is needed or is planned over the next several years. As part of this analysis, the parallel, and oftentimes complementary, changes that have taken place in the corporate and business makeup of the industry are also studied, as are their potential impacts upon the operational future of the natural gas pipeline infrastructure.

The U.S. natural gas pipeline network has grown extensively over the past decade to meet the increasing demand for natural gas as a fuel and for transportation of the commodity. In addition to physically expanding the network, the companies engaged in natural gas pipeline transportation have also transformed the ways in which they transact business, while being consolidated into a smaller number of corporate entities through mergers and acquisitions.

These changes have improved the overall capability of the network to move natural gas to growing end-use markets. During the past decade, for example, while U.S. natural gas consumption increased 17 percent from 19.0 trillion cubic feet (Tcf) in 1991 to 22.3 Tcf in 2000, interregional pipeline capacity increased by 19.8 billion cubic feet per day or 27 percent (Table 1). Helping to make this possible has been the growth of natural gas market centers and hubs, and the expansion and integration of underground natural gas storage facilities into the operations of these centers.[1]

Natural gas demand is expected to grow even more rapidly over the next 20 years,[2] which will mean that more new pipelines and expansions of existing lines than ever will need to be installed. In addition, the natural gas pipeline industry will need to improve its ancillary facilities, such as storage, and develop new methods of conducting business to facilitate the flow of natural gas from supply locations to market areas and from one market to another. How effectively this may occur will depend in large measure upon the effects of the restructuring in the natural gas pipeline transportation sector to date.

Network Overview

The existing U.S. interstate natural gas pipeline grid consists of more than 206,000 miles of mainline transmission lines with an estimated daily deliverability capacity of approximately 119 billion cubic feet (Bcf).[3] Between 80 and 90 pipeline systems make up the interstate network––about 50-55 are categorized as major by the Federal Energy Regulatory Commission (FERC).[4] Another 60+ pipelines operate strictly within the borders of individual States in the intrastate market. The intrastate portion of the grid (excluding gathering lines and local gas distribution systems) accounts for at least another 73,000 miles of pipelines.

Changes in the national natural gas (pipeline) network in the past 10 years have been significant. Regulatory reform has reshaped the industry and increased competition (see box, "Regulatory Oversight," p. 3). Meanwhile, gas supply sources have diversified and end-use markets have expanded. Concurrently, new entities, such as natural gas market centers, have expanded their throughput volumes, and Internet online trading has developed, bringing additional players into the market. In many parts of

[1]Energy Information Administration, *Natural Gas 1996: Issues and Trends*, DOE/EIA-0560(96) (Washington, DC, December 1996), Chapter 3.

[2]Energy Information Administration, *Annual Energy Outlook 2001*, DOE/EIA-0383(01) (Washington, DC, December 2000).

[3]This level is equivalent to twice the daily average consumption rate in the United States during 2000.

[4]The number of "major" interstate pipelines varies slightly by year because FERC classifies respondent pipelines according to total gas volume transported during a calendar year. An interstate pipeline company selling and/or transporting more than 50 Bcf in each of the previous 3 years is classified as major.

Table 1. Interregional Pipeline Capacity and Average Daily Flows, 1990 and 2000

Regions		Capacity (MMcf per day) 1990	Capacity 2000	Capacity Percent Change	Average Flow (MMcf per day) 1990	Average Flow 2000	Average Flow Percent Change
To Market Areas							
Receiving	**Sending**						
Midwest	Canada	2,161	3,267	51	1,733	2,676	54
	Central	8,888	12,867	45	5,754	8,270	44
	Northeast	2,054	2,090	2	729	643	-12
	Southeast	9,645	9,821	2	6,134	5,846	-5
Total to Midwest		**22,748**	**28,240**	**24**	**14,350**	**17,435**	**22**
Northeast	Canada	467	2,956	532	309	2,636	753
	Midwest	4,584	4,887	7	3,474	3,644	5
	Southeast	4,971	5,480	10	4,091	3,893	-5
Total to Northeast		**10,022**	**13,323**	**33**	**7,875**	**10,174**	**22**
Southeast	Northeast	100	532	432	63	14	-77
	Southwest	19,801	21,311	8	14,613	14,112	-4
Total to Southeast		**19,901**	**21,844**	**10**	**14,676**	**14,126**	**-4**
Western	Canada	2,631	4,412	68	1,874	3,240	73
	Central	365	1,219	233	196	775	295
	Southwest	4,340	5,487	26	3,910	3,465	-11
Total to Western		**7,336**	**11,118**	**52**	**5,784**	**7,480**	**29**
Total to Central		**12,093**	**15,904**	**32**	**6,248**	**8,559**	**37**
Total to Southwest		**2,058**	**3,574**	**74**	**651**	**1,316**	**102**
U.S. Interregional Total		**74,158**	**94,003**	**27**	**49,584**	**59,090**	**19**
From Export Regions							
Sending	**Receiving**						
Canada	Central	1,185	3,673	209	944	2,362	150
	Midwest	2,161	3,269	51	1,733	2,676	54
	Northeast	467	2,956	532	309	2,637	753
	Western	2,631	4,412	68	1,874	3,240	73
Total from Canada		**6,444**	**14,308**	**123**	**4,860**	**10,914**	**125**
Central	Canada	66	66	0	44	4	-91
	Midwest	8,888	12,867	45	5,754	8,270	44
	Southwest	1,303	2,604	100	575	1,298	126
	Western	365	1,219	234	196	775	295
Total from Central		**10,622**	**16,756**	**58**	**6,569**	**10,347**	**63**
Southwest	Central	8,824	8,878	1	4,137	4,070	-2
	Mexico	354	1,305	269	74	259	284
	Southeast	19,801	21,311	8	14,613	14,112	-3
	Western	4,340	5,487	26	3,910	3,465	-11
Total from Southwest		**33,319**	**36,988**	**11**	**22,734**	**21,932**	**-4**

MMcf = Million cubic feet.

Sources: Energy Information Administration (EIA). **Pipeline Capacity:** EIAGIS-NG Geographic Information System, Natural Gas Pipeline State Border Capacity Database, as of December 2000. **Average Flow:** Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition."

the country, daily capacity usage rates on a number of major pipelines have increased sharply as regional demand has grown significantly (e.g., California).

Some of the major trends that have developed in the natural gas industry and that might be expected to have an impact on the transportation sector over the next several years are:

Regulatory Oversight

While the U.S. natural gas pipeline industry has undergone a major restructuring during the past decade, it has not been fully deregulated. Although natural gas pipelines are now relegated to being transporters only and can no longer buy and sell gas, many aspects of their operations and business practices are still subject to regulatory oversight. For instance, the **Federal Energy Regulatory Commission (FERC)** still determines a company's rate-setting methods, sets rules on business practices, and has approval authority on the building of new pipelines and the expansion of existing ones. Those pipelines not governed by the FERC are regulated by State authorities.

The **U.S. Environmental Protection Agency** assists the FERC and/or State authorities in determining if the environmental aspects of a pipeline development project meet acceptable guidelines.

Governing the safety standards, procedures, and actual development/expansion of any pipeline system in the United States is the job of the **U.S. Department of Transportation's Office of Pipeline Safety (OPS)**. A pipeline may not begin operations until a line, or line segment, has been certified safe by the OPS. The OPS retains safety jurisdiction over the lifetime of the pipeline.

With the growing demand for natural gas, and some high-profile instances of perceived natural gas pipeline capacity shortages, e.g., at the California State border in 2001, regulatory delays are often cited as reasons why new pipelines or additional capacity are not available to resolve the situation. Oftentimes, however, the situation develops as the result of a temporary market anomaly, which may resolve itself in the time it takes to complete a pipeline construction project. Nevertheless, whenever such situations do arise, regulatory bodies have the authority, in most instances, to suspend some rules and regulations under specific circumstances, which can place some projects on a regulatory fast track. Indeed, in February 2001, the FERC published a number of initiatives it proposed as a way, in part, to speed up the process of directing new natural gas pipeline gas to the Western States.

- **Regional shifts in domestic natural gas production, such as in the Southwest,[5] have tended to lessen pipeline utilization on some existing lines.** This trend has helped spur construction of new pipelines from Canada and greater use of existing lines from Canada. In addition, production has expanded in the Rocky Mountains area of the United States, as well as in western Canada and offshore eastern Canada. Meanwhile, production in Kansas, Oklahoma, and the panhandle of Texas has dropped off markedly.

- **A major increase in natural gas demand in the past 2 years (1999 and 2000) has brought about a surge in proposals to expand existing pipeline systems in several major markets.** In particular, several new pipeline laterals have been proposed to connect to planned new gas-fired electric power plants. In turn, where excess capacity does not exist on the interconnecting mainlines, expansions of their upstream facilities have also been proposed.

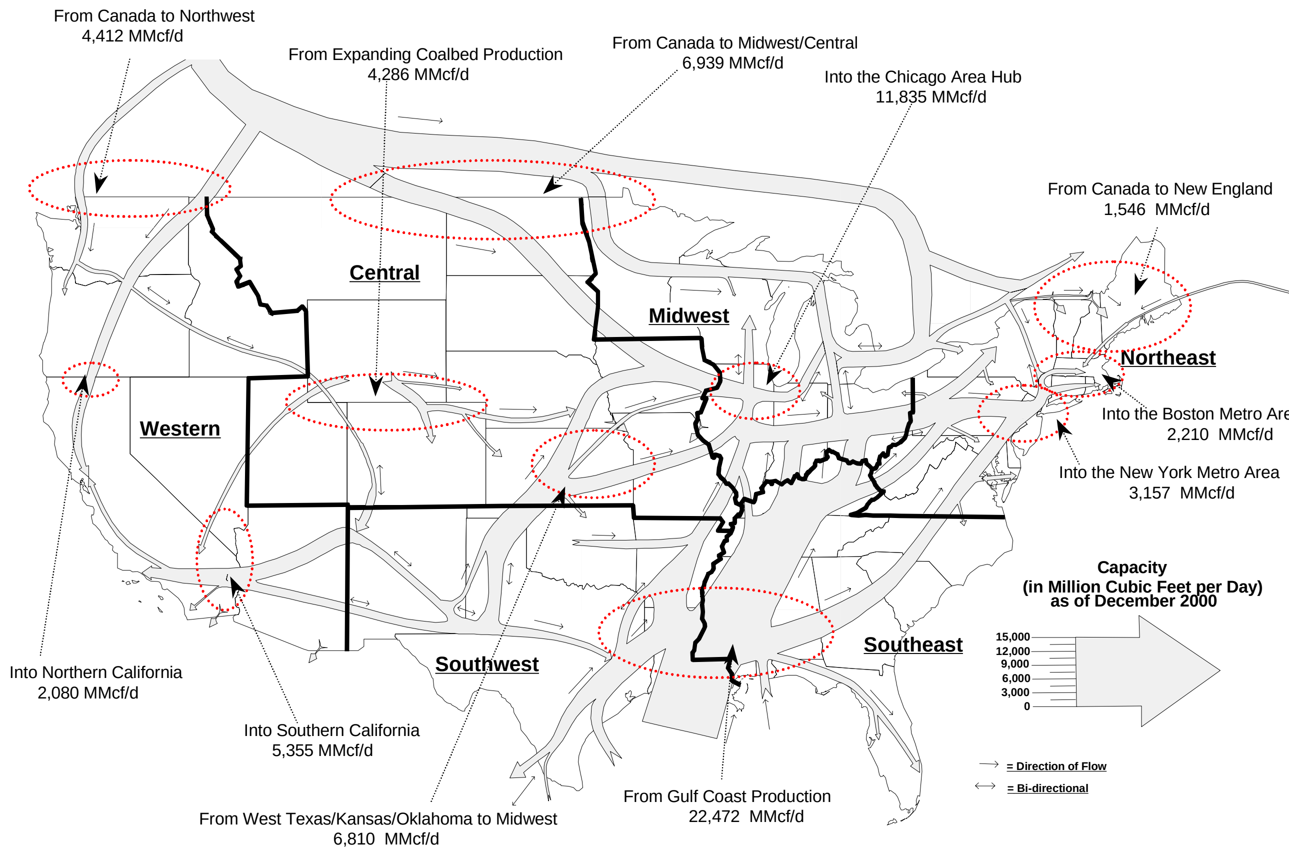
- **Shippers and pipeline operators have increased their need for underground storage services**, particularly those that provide rapid injection/withdrawal capabilities such as those found at high-deliverability storage facilities. Expanding gas demand increases the demand for storage capacity to handle variation in consumption. Additionally, a greater number of pipeline operators are offering storage park-and-loan services, which help facilitate gas trading at market centers and hubs and other strategic points.

Meeting Market Demand Growth

The expanding economy of the 1990's and the increasing demand for natural gas as a relatively clean-burning fuel helped bring about a 17-percent growth in its consumption between 1991 and 2000. During that time, enough additional natural gas pipeline capacity was installed in the United States to satisfy demand as it grew. Few instances

[5]Energy Information Administration, *Natural Gas Annual 2000*, DOE/EIA-0131 (Washington, DC, Draft copy October 2001), and previous issues.

Figure 1. Major Natural Gas Pipeline Transportation Routes and Capacity Levels at Selected Key Locations, 2000



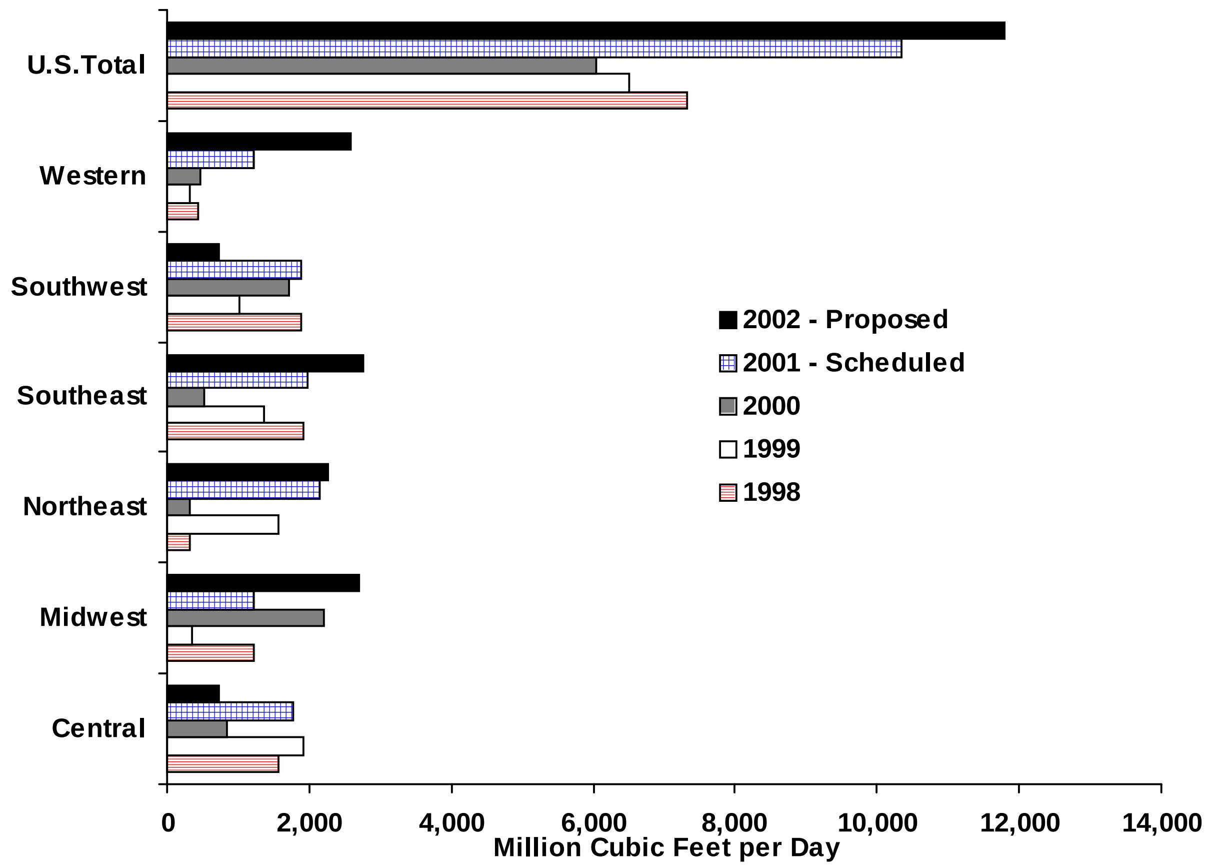
Source: Energy Information Administration, EIAGIS-NG Geographic Information System, Natural Gas Pipeline State Border Capacity Database, as of December 2000.

of capacity constraints or bottlenecks were observed with little or no disruptions in service. However, in the past year, the demand for natural gas pipeline capacity appears to have approached its limit in some fast-growing market areas such as California and New York. In most cases, though, the conditions that have contributed to these situations appear to be short term in nature and readily resolved.

For instance, during the past 2 years, natural gas markets in the Western Region were substantially affected by a drop in the water levels in the Northwest and consequently a drop in electric power generation from hydropower. As a result, greater demand was placed on the gas-fired electric power plants in the region, especially within California. Increased demand for natural gas to power these plants brought about a corresponding demand for natural gas and pipeline capacity into and within the State. The imbalance has been reflected in the large swings in gas prices at California border receipt points during the past year. With the higher prices and greater demand has come a call for additional pipeline capacity into and within the State. Since July 2001, however, natural gas prices into California have dropped to less than $2.00 per million Btu (October 4, 2001) after being as high as $58.50 in December 2000. The drop in price resulted from reduced demand owing to conservation and more favorable weather.

Pipeline capacity is also reaching throughput limits at several strategic points on the pipeline network in the Northeast, particularly in the vicinity of New York City and Boston, Massachusetts (Figure 1). Adding to the increasing demand for pipeline capacity is the scheduled construction of a number of gas-fired electric power generation plants in the Northeast Region in the next few years.

Figure 2. Annual Additions to Natural Gas Pipeline Capacity by Geographic Region



Note: Project capacity is included in the total for the region in which the project terminates.
Source: Energy Information Administration, EIAGIS-NG Geographic Information System, Natural Gas Proposed Pipeline Construction Database, as of September 2001.

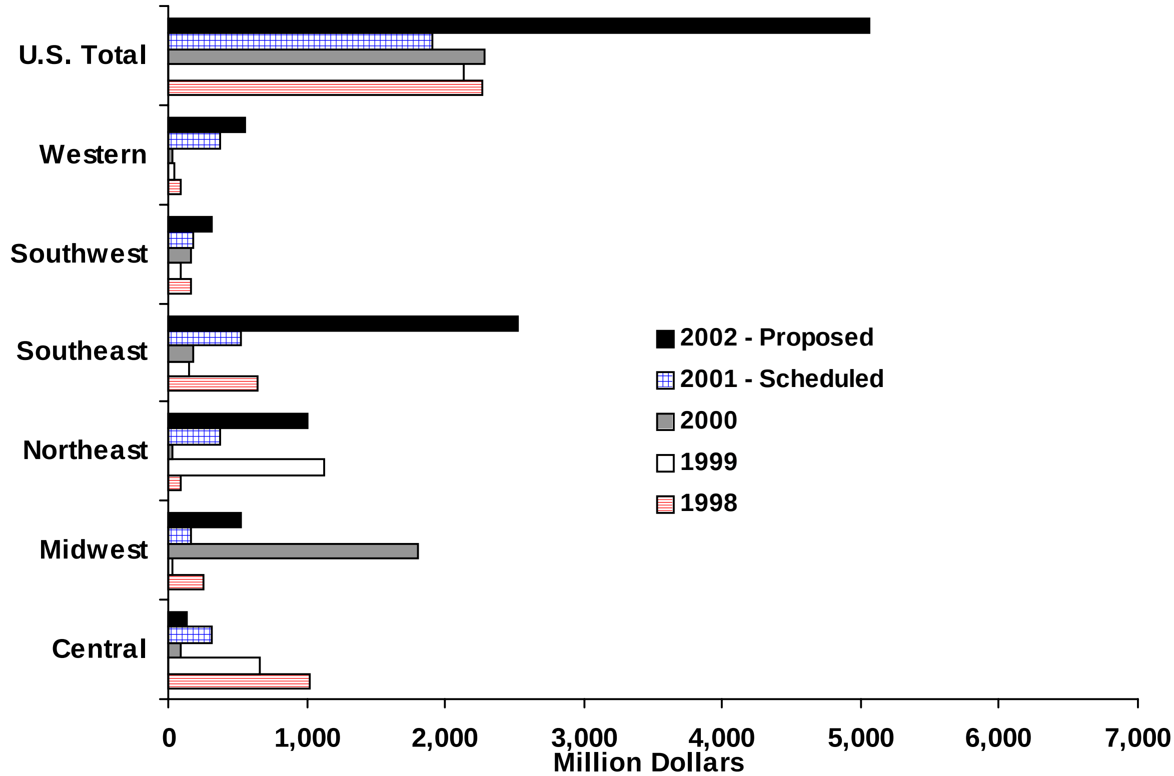
For the most part, however, no major or immediate pipeline capacity limitations have surfaced in other parts of the country. Nonetheless, recent proposals to develop new pipeline capacity reflect a recognition that a steady growth in natural gas demand is occurring. Florida, North Carolina, and South Carolina, for instance, have experienced a significant growth in natural gas demand over the past decade, although a sufficient amount of additional pipeline capacity was installed to match the increase in demand.

Increasing Regional Pipeline Capacity

Over the past 2 years, at least 65 natural gas pipeline construction projects were completed and placed in service in the United States: 35 in 1999 and 30 in 2000. These projects accounted for more than 12.3 billion cubic feet per day (Bcf/d) of new pipeline capacity, an increase of 15 percent over the level completed in 1998. From 1997 through 2000, natural gas pipeline capacity grew in excess of 5 Bcf/d per year, totaling almost 20 Bcf/d (Figure 2),[6] while annual expenditures on pipeline development exceeded $2.0 billion (Figure 3) during that time. Of that, expenditures on new pipeline development and major new extensions and laterals from existing systems accounted for more than 70 percent of total expenditures, while

[6]Total added capacity as measured on an individual project basis.

Figure 3. Annual Natural Gas Pipeline Construction Expenditures by Geographic Region



Note: Estimated project costs are included in the total for the region in which the project terminates.
Source: Energy Information Administration, EIAGIS-NG Geographic Information System, Natural Gas Proposed Pipeline Construction Database, as of September 2001.

expansions to existing systems accounted for the rest. In 1999, the largest level of expenditures was for projects terminating in the Northeast Region, $1.1 billion, while in 2000, projects terminating in the Midwest Region accounted for the largest share of expenditures, $1.8 billion.

Through 2003, another 32 Bcf/d of pipeline capacity has been proposed (Table 2), with most of the new pipelines directed to growing markets in the West and Northeast (Figure 4). The addition of new pipeline capacity, however, is rarely an easy and quick matter (see box, "Natural Gas Pipeline Project Development Process," p. 8). Regulatory delays and local opposition can delay a project up to 4-5 years.[7] In addition, some projects could be canceled if regional demand projections fail to materialize.

Regional markets in the United States have different demographics, different weather patterns, and distinct natural gas customer profiles. In the colder, seasonal markets, regional transportation and distribution systems are designed to meet space-heating demands by residential and commercial customers and are interlaced with backup 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 short-term demand fluctuations and system balancing.

[7]For instance, the proposed Independence Pipeline and Millennium Pipeline projects, when first proposed in 1996, sought completion in 2000. Although both have since been approved, in whole or in part by the FERC, neither is likely to be completed until late 2002 at the earliest.

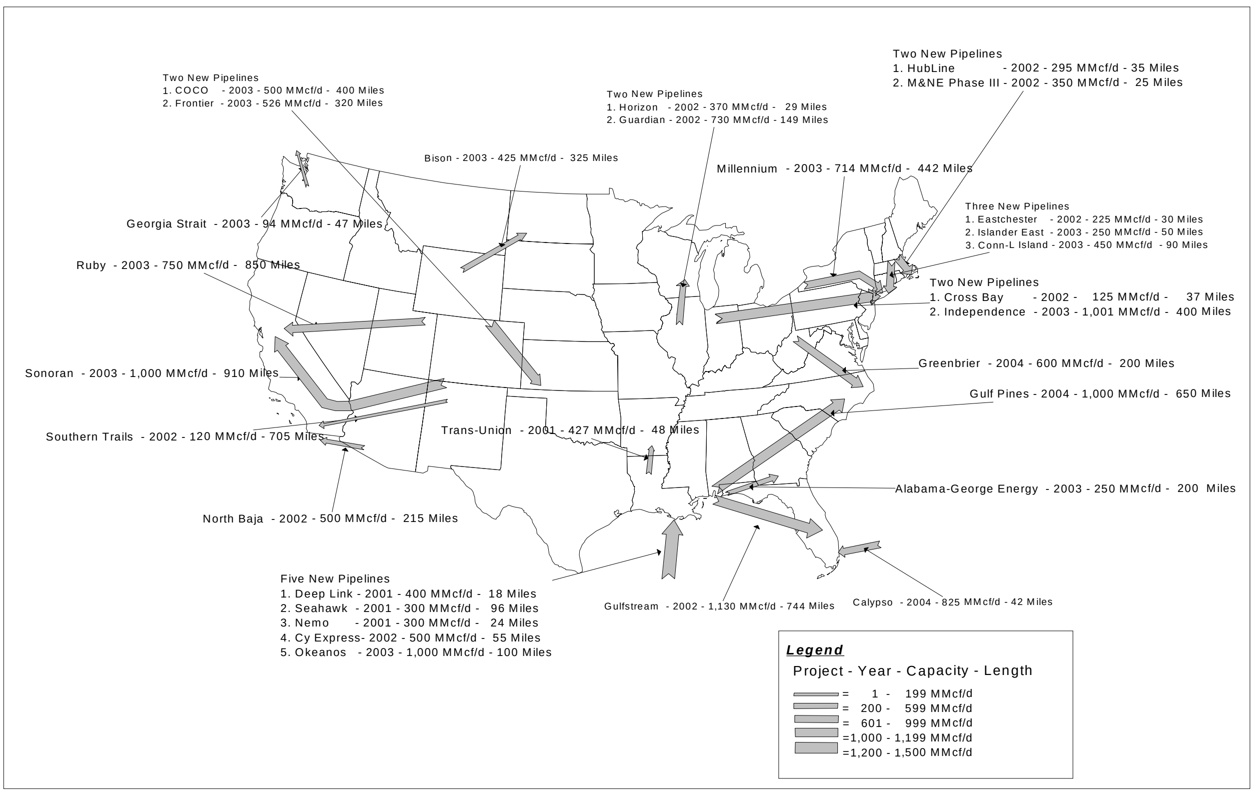
Table 2. Recent and Proposed Regional Natural Gas Pipeline Additions to Capacity

Region	Capacity Additions (Million cubic feet per day)									
	Completed 1999		Completed 2000		Scheduled for 2001		Proposed for 2002		Proposed for 2003	
	New Pipelines	Expansions	New Pipelines	Expansions	New Pipelines	Expansions	New Pipelines	Expansions	New Pipelines	Expansions
Central	1,897	25	380	473	1,386	400	340	0	145	0
Midwest	0	339	2,045	153	335	883	1,100	1,615	210	73
Northeast	1,314	257	117	193	1,156	1,003	1,782	483	3,040	1,152
Southeast	663	692	0	510	785	1,183	1,452	1,318	1,250	589
Southwest	745	264	745	925	1,427	470	500	231	300	0
Western	78	241	300	156	802	517	1,919	664	2,900	1,176
U.S. Total	4,697	1,818	3,587	2,410	5,891	4,456	6,703	4,311	7,845	2,990

Note: Excludes projects on hold as of October 2001. Sixteen pipeline projects, representing about 6.25 Bcf/d of additional capacity and originally planned for completion in 2001–2003, have been placed on hold for various reasons. In the table, a project that crosses interregional boundaries is included in the region in which it terminates. Offshore projects are included in the Southwest Region. Export projects that terminate at the Mexico or Canada border are included in the region in which the border crossing occurred.

Source: Energy Information Administration: EIAGIS-NG Geographic Information System, Natural Gas Pipeline Construction Database through September 2001.

Figure 4. Potential New Interstate Natural Gas Pipelines, 2001–2004



Note: MMcf/d = million cubic feet per day.

Source: Energy Information Administration, EIAGIS-NG Geographic Information System, Natural Gas Pipeline Projects Database, as of September 2001.

Natural Gas Pipeline Project Development Process

On average, an interstate construction/expansion project may take about 3 years from the time it is first announced until it is placed in service, even longer if it encounters major environmental obstacles, or public opposition. The life-cycle for a natural gas pipeline project involves several milestones. After first detecting market indications that enough potential need may exist in a particular supply or market area to support construction of new capacity, the sponsors of the project, be it a new pipeline or an expansion of an existing one, publicly announce their belief that a project of particular magnitude and location could be built if there is enough interest. To gauge the level of market interest, an **open-season** is held (1 to 2 months), giving potential customers an opportunity to enter into a nonbinding commitment to sign-up for a portion of the capacity rights available on the pipeline project. If enough interest is shown during the open-season, the sponsors will arrive at a preliminary project design and move forward.

The need for new or additional pipeline capacity to meet the growing demand for natural gas can be implemented in several ways. Pipeline designers have various options open to them, each with particular physical and/or financial advantages and disadvantages. Some of the alternatives available for installing new capacity include building an entirely new pipeline, conversion of an oil or product pipeline, or expansion or extension of an existing pipeline system. The least expensive option, often the quickest and easiest, and usually the one with the least impact environmentally, is to upgrade facilities on an existing route. But that may not be feasible, especially if the market to be served is not currently accessible to the pipeline company.

The **development of the final project design** and obtaining firm financial commitments from customers, may take from 2 to 3 months, after which the project specifications are filed with the appropriate regulatory agency. While there are no data available on the average length of time a project may require to receive a final determination from a State agency, generally a FERC review takes from 5 to 18 months, with the average time being about 15 months. Usually, **approval by the regulating authority** is conditional, but most often the conditions are minor. Regardless, it is then up to the project sponsor to accept or reject the conditions or refile with an alternative plan.

Construction typically is completed within 18 months following final regulatory approval, and sometimes in as little as 6 months. Sometimes construction of an approved project is delayed because of the extended time required to acquire local permits from the sometimes numerous towns and land use agencies located along the proposed construction route. In 2000, two major pipeline expansion projects were postponed till the summer of 2001 because they were unable to acquire all of the local approvals in time to construct and complete the project before the beginning of winter.

Commissioning and testing of the completed pipeline project usually takes about 1 to 3 weeks and involves subjecting the completed segments of the projects to hydrostatic and other required testing of the line in place. Line packing, or filling the line with the initial baseload gas volumes, is usually needed only on new pipelines or larger expansion projects.

In this analysis, the United States is divided into six regions (Figure 1). Four of the regions—the Midwest, Northeast, Western, and Southeast regions—have limited natural gas resources and depend upon major longhaul pipeline systems to provide their link between suppliers and the regional pipeline networks. Only 7 of the 33 States within these importing regions produce enough natural gas and/or have sufficient storage withdrawal capability to meet peak-month internal consumption so that excess production is available for export to downstream nonproducing States (Table 3).

The other two regions—the Southwest and Central regions—account for most of the natural gas produced in the United States and export supplies to the other regions. The Southwest Region[8] includes the largest natural gas producing States, Texas and Louisiana, and also consumes more natural gas than any other region. However, production has slowed somewhat in areas of the Southwest, which has reduced utilization on some of the lines extending from the region. Meanwhile, production has expanded in the Rocky Mountain area and in western Canada and offshore eastern Canada. Many of the recent

[8]Texas is also the major consuming State in the United States. while Louisiana is number three (behind California).

Table 3. Interstate Natural Gas Pipeline Capacity and Estimated State Natural Gas Requirements

Region / State	Interstate Pipeline Capacity (MMcf/d)			Average Day During Peak Month Consumption versus Supply [a]				Peak Month Usage Rate for Net Interstate Pipeline Capacity (percent) (G / C) -H-
	Entering the State -A-	Exiting the State -B-	Net (a - b) -C-	End-Use Consumption[b] (MMcf/d) -D-	Marketed Production (MMcf/d) -E-	Net Withdrawals From Storage (MMcf/d) -F-	Net Interstate Capacity Needed (MMcf/d) (D - (E + F) -G-	
Central								
Colorado	3,882	4,847	-965	1,439	2,152	156	-869	90
Iowa	7,425	6,689	736	1,129	0	727	402	55
Kansas	6,283	7,761	-1,478	1,002	1,444	821	-1,263	86
Missouri	7,097	4,611	2,486	1,391	0	36	1,355	55
Montana	2,874	3,009	-135	257	211	167	-121	90
Nebraska	5,882	5,127	755	509	--	54	455	60
North Dakota	3,995	3,967	27	165	144	0	21	77
South Dakota	3,897	3,680	217	178	--	0	178	86
Utah	2,101	2,737	-636	611	800	353	-542	85
Wyoming	2,347	5,461	-3,114	226	2,982	117	-2,873	92
Midwest								
Illinois	13,173	8,142	5,030	5,448	--	1,609	3,839	75
Indiana	10,808	8,168	2,639	2,632	--	228	2,404	91
Michigan	7,219	5,597	1,622	4,064	496	2,020	1,548	95
Minnesota	8,316	6,610	1,706	1,726	0	20	1,706	100
Ohio	11,528	7,146	4,382	3,943	--	1,960	1,983	45
Wisconsin	5,513	2,967	2,546	2,036	0	0	2,036	80
Northeast								
Connecticut	1,731	1,125	606	526	0	0	526	87
Delaware	360	157	203	188	0	0	188	93
Maine	623	588	35	34	0	0	34	97
Maryland/DC	4,225	3,326	898	979	--	169	810	90
Massachusetts	2,432	505	1,927	1,693	0	0	1,693	88
New Hampshire	872	766	106	103	0	0	103	98
New Jersey	6,148	3,199	2,949	2,826	0	0	2,826	96
New York	8,431	3,288	5,143	4,225	49[c]	560	3,615	70
Pennsylvania	9,985	11,374	-1,389	2,949	550[c]	3,091	-692	50
Rhode Island	1,078	705	373	367	0	0	367	99
Vermont	52	0	52	37	0	0	37	70
Virginia	5,577	3,857	1,720	1,197	197[c]	22	978	57
West Virginia	6,677	8,575	-1,898	458	460[c]	1,862	-1,864	98
Southeast								
Alabama	11,490	11,723	-233	1,002	1,040	30	-68	29
Florida	1,721	0	1,721	1,582	16	0	1,566	99
Georgia	5,488	3,803	1,685	1,616	0	0	1,616	96
Kentucky	12,922	12,484	438	1,047	--	713	334	98
Mississippi	21,857	21,542	315	908	266	367	275	76
North Carolina	3,603	2,587	1,016	1,036	0	0	1,036	101
South Carolina	3,661	3,147	514	500	0	0	500	97
Tennessee	14,244	12,980	1,264	1,191	--	6	1,185	94
Southwest								
Arkansas	11,440	11,176	224	683	470[c]	16	197	88
Louisiana	6,928	22,146	-15,717	4,661	14,879	-416	10,634	68
New Mexico	5,510	9,068	-3,558	462	3,859	13	-3,410	95
Oklahoma	7,009	10,213	-3,204	2,743	4,401	1,363	-3,021	94
Texas	7,403	19,122	-11,719	11,892	17,413	-805	-4,716	40
Western								
Arizona	6,037	5,172	865	679	--	0	679	78
California	7,435	433	7,002	6,848	1,055	624	5,169	74
Idaho	3,783	3,418	365	278	0	0	278	76
Nevada	1,335	592	742	650	--	0	650	88
Oregon	3,997	3,269	728	747	--	48	699	96
Washington	5,092	3,916	1,176	1,018	0	126	892	76

[a] In most instances the peak month volumes used in columns D, E, and F represent reported levels for December 2000. Exceptions include: FL - May 2000; CA, LA, and TX - August 2000: and AL, AR, DE, GA, ID, KS, MS, NH, TN, VT, WV, and WA - January 2000.

[b] Does not include gas consumed in gathering, gas plant, and pipeline operations.

[c] Peak month value unavailable. Estimate based on annual (2000) production volume divided by 365.

MMcf/d = Million cubic feet per day. -- = Less than 5 MMcf/d.

Note: Column G represents the estimated average day volume of natural gas that would have been required to have been supplied to the State by the interstate natural gas pipeline system during the selected peak month, while Column C represents the estimated net daily interstate capacity that would have been available to meet that requirement. The average load factor (Column H) is a percentage that expresses the level at which the interstate pipelines serving the State met that need during the peak consumption month. For those Sates with high net underground storage withdrawal levels, e.g., Pennsylvania, much of these volumes actually are shipped to other States. However, because the actual amount exiting the State(s) cannot be determined, the full amount has still been retained as a supply source within the State for calculating net capacity needs (Column G). As a result, the load factor (H) will tend to be lower.

Source: Energy Information Administration: **Capacity**: EIAGIS-NG Geographic Information System, State Border Capacity Database; **Consumption/Production/Withdrawal:** *Natural Gas Monthly* (September 2001), Tables 7, 13, and 19; and *Natural Gas Annual* (November 2001).

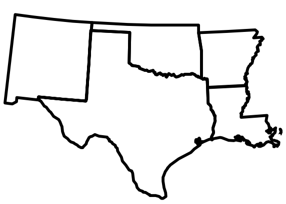
expansion projects were designed to transport this increased production to gas-consuming markets.

Growth in Access to Supply Areas

Much of the growth in market area consumption of natural gas during the past decade has been accommodated by (totally) new pipelines or extensions from new supply areas rather than expansions of pipeline capacity in existing production areas.[9] For instance, the amount of new pipeline capacity from Canada increased by 123 percent between 1990 and 2000 (Table 1).[10] During the same period, the amount of new capacity exiting the Southwest production area increased by only 11 percent. Overall, the exit capacity from the Southwest increased only 3.7 Bcf/d, while Canadian natural gas export capacity to the United States increased 7.9 Bcf/d. Exit capacity from the Central Region increased 6.1 Bcf/d between 1990 and 2000 as several expansions were completed to improve deliverability to the Midwest from capacity-constrained production areas in Wyoming and Montana.

Southwest Region

The downward trend in capacity growth exiting the Southwest Region reflects the maturity and the large amount of pipeline capacity already in place that is directed out of the Southwest. It also reflects the increasing resources devoted to the region's own needs as rising consumer demand in the Southwest Region itself competes for available natural gas supplies. Nonetheless, the natural gas pipeline systems exiting these producing states, for the most part, still maintain high utilization rates (Table 3) and the region itself still remains the principal supplier of natural gas to the rest of the nation.



Among the few areas of the Southwest Region where natural gas production is growing is in the Gulf of Mexico, specifically in the central portion of the Gulf. Extensive development of deepwater leases in particular has increased natural gas production offshore of Louisiana, Mississippi, and Alabama by 10 percent since 1995.[11] Much of this increased production has come from new platforms that have had to be serviced by new gathering pipeline and/or large capacity pipelines designed to transport this production onshore. Between 1997 and 2000, for instance, 22 natural gas pipeline projects were completed that added a total of 8.2 Bcf/d of new pipeline capacity in the Gulf. The surge in oil and natural gas prices in 2000 and early 2001 likely will result in increased natural gas production. If new development in the central Gulf continues to increase, at least in the short term, it will mean a greater utilization of existing pipeline capacity in the Gulf and the construction of new gathering pipelines.

Indeed, in 2001 and 2002, almost all (98 percent) of the 1.7 Bcf/d of new natural gas pipeline capacity scheduled to be developed and placed in service in the Gulf consists of new gathering pipelines (Figure 4). The largest of these, in capacity, will be the 55-mile, 500 MMcf/d Canyon Express system which will be constructed in the deepwaters, 120 miles southeast of New Orleans. Beyond 2002, so far no new offshore-to-onshore pipeline has been proposed although deepwater development is expected to expand. To date, the only major project announced for the Gulf has been the multi-phased 1 Bcf/d, 74-mile, Okeanos Project designed to transport gas from new platforms in the developing NaKika deepwater field to an interconnection with the Destin Pipeline system. Given the size of the Okeanos Project, however, it is probable that the Destin system will also be expanded in the near future.

Elsewhere in the Southwest Region, the level of proposed pipeline capacity expansion is minimal. While five of the seven remaining pipeline projects scheduled for 2001-2002 address the needs of shippers and producers to gain additional access to the few onshore areas in the region that are experiencing production expansion, the level of potential added capacity of these projects is less than 0.5 Bcf/d. Furthermore, the region's largest onshore pipeline project scheduled in the next 2 years represents only 427 MMcf/d of capacity to transport natural gas from Louisiana to supply a 2,700 megawatt power plant located in southern Arkansas.[12] Overall, the potential additional capacity currently slated for the Southwest Region in 2001

[9]Except for the San Juan Basin area of Colorado/New Mexico where increasing coalbed methane discoveries have led to the installation of one new pipeline system (TransColorado Gas Transmission Company) and the expansion of several existing ones in the area over the past 4 years.

[10]Both the largest percentage increase and largest volumetric increases occurred on routes into the Northeastern United States from Canada.

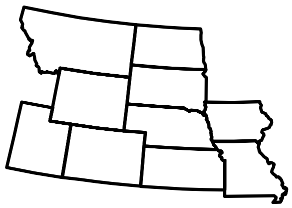
[11]Energy Information Administration, *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves Annual Report 1999,* DOE/EIA-0216(99) (Washington, DC, December 2000).

[12]The new line is the 42-mile, 30-inch diameter, Trans-Union Interstate pipeline which will transport natural gas from Clairborne Parish, Louisiana to Union County, Arkansas.

and 2002 totals only about 3.0 Bcf/d. This is the smallest amount of planned capacity additions of the six regions.

Central Region

In the Central Region, particularly in the Rocky Mountains area of Wyoming/Montana, expanding coalbed methane production (up 44 percent since 1990) has increased the need for long-haul capacity to carry the gas to end-use markets.[13] Since 1990, proved natural gas reserves in Wyoming/Montana area have increased by 37 percent from 10.8 trillion cubic feet (Tcf) to 14.4 Tcf in 1999. The area's reserves represented only 6 percent of U.S. proved natural gas reserves in 1990 but almost 10 percent in 1999.[14] To accommodate this growth, a number of new gathering and header systems have been built. Four projects were completed in 1999 and 2000 to move the gas from the production field to transmission lines, but not enough matching interstate pipeline capacity has been installed so far.



It has only been in the past year that proposals have been made for a significant expansion of the area's interstate takeaway capacity. Such proposals include the building of several new longhaul pipelines to transport natural gas from the Cheyenne Hub in northern Colorado to interconnections with major interstate pipelines located in Kansas (Figure 4). These interconnections would provide shippers with transportation services to Midwest markets. However, these projects, which include the Colorado Interstate Pipeline Company's COCO Pipeline project (500 MMcf/d) and The Williams Companies' Western Frontier Pipeline (526 MMcf/d), will not be completed until 2003 at the earliest. The Wyoming Interstate Medicine Bow Lateral (675 MMcf/d) and Trailblazer System expansions (324 MMcf/d), on the other hand, will make additional capacity available in 2002.

Meanwhile, producers in the region continue to build new pipeline laterals to move gas from expanding coalbed methane production areas. In 1999, natural gas production in Wyoming alone increased by 45 percent from 836 Bcf to 1,213 Bcf. Currently, 1.3 Bcf/d of new gathering capacity and 1.0 Bcf/d of new interstate capacity is slated to be placed in service in 2001-2002. During the interim, producers are looking at gaining access to markets in the Western Region through expansion of the Kern River Transmission system (135 MMcf/d) to California and Nevada. The Kern River project would also improve access within the region itself, such as to markets in Denver, Colorado, and Salt Lake City, Utah areas.

Canadian Sources

The major growth area in new pipelines and added capacity in recent years has been the import market for Canadian natural gas. Since 1998, there has been a 58-percent increase in natural gas import capacity directed into the Midwest Region[15] and a 23-percent increase into the Northeast Region.[16] The installation of the Maritimes and Northeast Pipeline and the Portland Natural Gas Pipeline into the Northeast Region in 1999 alone contributed 578 MMcf/d of new import capacity, or about 15 percent of the overall increase in natural gas import capacity from Canada that year. The completion of the Alliance Pipeline System (1.3 Bcf/d) into the Midwest in 2000 represented another 10-percent increase in overall Canadian gas import capacity and a 23-percent increase into the Midwest alone.[17]

Several additional projects are scheduled for completion in 2001 and 2002. In total, if all expected proposals were approved and placed in service, about 0.7 Bcf/d of new import capacity would be built by 2002, a 3-percent increase. Most of this new capacity will be directed into the Northeast Region with the remainder into the Western Region. The rest of the proposed capacity additions will be expansions of existing import pipelines.

Even greater amounts of Canadian import capacity are scheduled to be integrated into the national grid within the next 5 years. However, only two projects—Millennium and Northwinds—will be completely new pipelines. Columbia Gas Transmission Company's Millennium Project (714 MMcf/d), which will reach from Lake Erie to the New

[13]Expansion of the region's existing interstate pipelines could reach markets located in the Midwest and Western regions as well as in the eastern portion of the Central Region itself.

[14]Energy Information Administration, *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves, 1999 Annual Report* (Washington, DC, December 2000), and previous issues.

[15]Much of it via the Central Region.

[16]Energy Information Administration, "Status of Natural Gas Pipeline System Capacity Entering the 2000-2001 Heating Season," *Natural Gas Monthly*, DOE/EIA-0130(10/00) (Washington DC, October 2000).

[17]In fact, the Alliance Pipeline is designed to handle up to 1.6 Bcf/D (1,325 MMcf/d firm, and 275 interruptible). During the winter of 2000-2001 the pipeline carried the maximum on a number of occasions.

York City area, is scheduled for operation in 2003.[18] The recently proposed Northwinds project (500 MMcf/d), which is a partnership between National Fuel Gas Supply Corporation and TransCanada Pipeline, would transport Canadian gas to the U.S. Northeast in mid 2003.

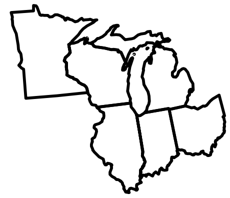
In addition, several importing pipelines have indicated their intention to increase capacity into the United States by more than 800 MMcf/d by 2005. Maritimes and Northeast has announced that it expects to double its current capacity (400 MMcf/d) by the close of 2004, while the Alliance Pipeline sponsors anticipate a need for a major expansion sometime within the next 5 years.[19] And, with the growing demand for greater gas supplies in the Northwest and California markets, it is very likely that PG&E Gas Transmission - NW will further increase its capacity out of Canada, beyond the relatively small 207 MMcf/d expansion scheduled by the end of 2001. The Westcoast Energy and BC Gas companies, who supply Alberta and British Columbia natural gas to U.S. pipelines at the Canada border, have already announced plans to increase their respective system capacities significantly in 2003 and 2004. This increased capacity would serve growing Canadian domestic needs and also increase service to their interconnection points with Northwest Pipeline Company and PG&E Gas Transmission - NW.

Growth in Market Area Pipeline Capacity

During the past decade, natural gas pipeline capacity growth into the Midwest Region showed the largest volumetric increase, 5.5 Bcf/d (24 percent), while capacity into the Western Region grew by the largest percentage, 52 percent (3.0 Bcf/d). However, when growth in import capacity from Canada is examined, the Northeast Region experienced both the largest percentage increase (532 percent) and volumetric increase (2,489 MMcf/d) among the regions having access to Canadian supplies (Table 1).

Although capacity into the Midwest and Northeast markets grew by 24 and 33 percent, respectively, between 1990 and 2000, their largest growth occurred during the past 4 years, and more specifically during the past 2 years. Between 1996 and 2000, 62 percent or 3.5 Bcf/d of the decade's increase of 5.5 Bcf/d was installed. During the past 2 years alone (1999 and 2000), regional import capacity grew by 5 percent, primarily because of the completion of the Alliance Pipeline in 2000.

Midwest Region



Not only has the amount of new capacity into the Midwest Region grown rapidly, the utilization of the new capacity installed in late 2000 began high and has remained so. During the past heating season (2000-2001), pipeline capacity usage averaged 90 percent and above on those pipelines importing Canadian supplies (Alliance, Northern Border, Great Lakes, and Viking pipeline systems).[20]

Because of the colder-than- ususal weather in the Midwest Region, completion of the Alliance Pipeline in 2000 did not lead to the short-term excess capacity situation once expected. In fact, the Alliance Pipeline was operating at close to its full firm contracted capacity (1.3 Bcf/d) shortly after service was inaugurated in December and reached close to full utilization levels (1.6 Bcf/d) in July 2001.[21]

And, this may not be a short-term situation. Demand in the Midwest Region, including the southern Wisconsin area, is still growing.[22] Moreover, some of the large increase in new pipeline capacity into the region during the past 2 years was originally slated to supply major pipeline projects in Northeast markets that were to have been completed in 2000. Additional capacity will be needed to feed into these pipelines once they are finally built (expected in 2002).

Several pipeline projects have been approved or awaiting regulatory review that would provide substantial additional capacity within the region itself. These projects include the Horizon (370 MMcf/d), Guardian (730 MMcf/d), and ANR Wisconsin Loop (270 MMcf/d). At this time, it is uncertain how many of these proposals will actually be implemented. It is unlikely that all will be built. The cumulative capacity represented in these proposals total about 125 percent more gas supplies than will be available

[18]Although granted preliminary approval by the FERC, it is still not a certainty that the Millennium Pipeline will be completed by 2003.

[19]Discussions with company representative.

[20]Pipeline utilization information was obtained from company websites.

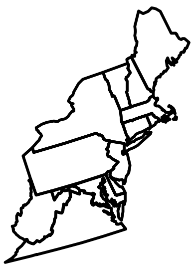
[21]Alliance Website: http://www.alliance-pipeline.com/shipper_services/0040_Operational_Reports.asp

[22]Proposals to build new and expanded natural gas pipelines within the region over the next several years suggest that as much as an additional 2.7 Bcf/d of capacity may need to be directed into the region to meet the demand.

on the new pipelines scheduled to bring additional supplies into the region.

Northeast Region

Natural gas pipeline capacity into the Northeast Region grew throughout the decade, mainly through construction of new lines from Canada. The level of import capacity into the region was very small in 1990 and most of the natural gas into the region came from the Southwest. But as natural gas was marketed heavily in New England, less expensive Canadian natural gas supplies were seen as a strong alternative to expanding the natural gas pipeline network into the region from the Southwest. And, as new gas fields were developed off the eastern coast of Canada in the late 1990's, the expansion of import capacity became an even stronger alternative. At the close of the decade, several major new U.S./Canadian pipeline projects increased import capacity by 23 percent (1999-2000) or 0.6 Bcf/d.



Much of the decade's growth in additional natural gas pipeline capacity into the Northeast Region has been in displacing residual fuel oil as the primary fuel used within the region and more recently as a source of supply for the new electric power generating plants being built in the region. The majority of the proposed new pipelines into the region and the expansions of existing systems within the region are predicated upon the development of new gas-fired plants and their expected demand for natural gas.

The region's interstate natural gas pipeline capacity is already being utilized at high load levels during peak months (Table 3). In New England in particular, only the State of Vermont shows a load factor of less than 80 percent and it has yet to develop a substantial market for natural gas.

At least four major pipeline expansion projects are scheduled to be completed to serve the New England market before the end of 2001, and two new local pipelines are proposed for implementation in 2002 (Figure 4). These six projects represent the possible installation of 1.3 Bcf/d of new capacity in the Boston area.

The two new pipelines scheduled for 2002 are interrelated. The Maritimes and Northeast Phase III project (350 MMcf/d) would provide shippers of Sable Island (Canada) gas the option of shipping their gas directly to the Boston area via the Algonquin Pipeline system or as they do now, through the Tennessee Gas Pipeline system. Algonquin Pipeline Company would build a 295 MMcf/d pipeline, the Hub Line, from an interconnection with the new Maritimes and Northeast extension, to the Boston area. For its part, the Maritimes and Northeast Pipeline Company believes that demand will continue to grow in the area. It has announced that it intends to double its system capacity in 2004 if current natural gas demand projections hold up.

Elsewhere within the Northeast Region, the New York City area is the destination and focal point of a number of major pipeline expansions and new lines. Currently, approximately 3.2 Bcf/d of natural gas pipeline capacity reaches the area (Figure 1). Increasing demand for natural gas to feed industrial growth and new and planned gas-fired electric power generators has placed a large burden on a local infrastructure that has already occasionally developed capacity constraint problems. Consequently, a slate of proposals to add new pipelines and expand pipeline capacity has arisen. For example:

- The Cross Bay Pipeline, a joint project between Duke Energy Corporation and The Williams Companies (Transcontinental Gas Pipeline Company), would increase natural gas pipeline capacity into New York City and Long Island by 125 MMcf/d by late 2002 where currently only about 650 MMcf/d is available.

- Several proposals that would extend Canadian shippers' access to Long Island by 2003 have been filed with FERC. These projects include the new Islander East Pipeline (250 MMcf/d),[23] the Tennessee Gas Pipeline new "Connecticut-Long Island" pipeline (450 MMcf/d),[24] and the Iroquois Eastern Long Island expansion (225 MMcf/d). The latter project would extend the current Iroquois system, which already serves western Long Island, to customers in the eastern part of the Island.

[23]A joint venture between Duke Energy and KeySpan Energy, the Islander East Pipeline would have access to Canadian supplies via the Algonquin Pipeline system, which in turn will have access to Canadian supplies with the completion of its HubLine and Maritimes & Northeast Pipeline Phase III pipeline (350 MMcf/d) scheduled for 2002. Algonquin also has a proposed upgrade project (280 MMcf/d) before the FERC, which would link the Islander East Pipeline to its system in 2003.

[24]The new pipeline would actually begin at Dracut, Massachusetts, and extend south to Suffolk County, Long Island, New York. At Dracut, the new pipeline would provide transportation capacity to shippers of Canadian supplies off of the Portland/Maritimes & Northeast system.

- Iroquois also would increase its service to the western New York City area in 2002 through a proposed extension of its system to Eastchester County, New York (160 MMcf/d).

- Transcontinental Gas Pipeline Company also plans on adding another 162 MMcf/d (in 2001) and 127 MMcf/d in 2003 as part of the long-delayed Market-Link project. The Market-Link project represents the final leg of the 1,000 MMcf/d Independence Pipeline system that would provide an alternative route to New York via the Leidy Hub (in north-central Pennsylvania) for Canadian and Southwestern gas supplies currently flowing into the Midwest Region.

A growing demand for gas trading and transport capacity at the Leidy Hub in Pennsylvania[25] has spurred interest in several projects to bring additional gas into and out of the area in the next few years. In addition to the Independence Pipeline and Transco Market-Link project, Tennessee Gas Pipeline and National Fuel Gas Supply companies have tentative plans to expand segments of their respective systems in the area. Tennessee Gas intends to increase its capability to move imported Canadian natural gas from Niagara, New York, to Leidy in 2003 (200 MMcf/d).

Tennessee Gas also plans on expanding its ability to transport storage supplies on a new lateral (490 MMcf/d) and interconnection with the Stagecoach high-deliverability storage facility being developed in southcentral New York. The project would also include a major upgrade of the Tennessee Gas Pipeline's mainline that transports supplies from the Leidy area to the New York-New Jersey area. Coincidently, the development of the Stagecoach storage facility has led to plans by several New York intrastate pipelines to expand their systems to deliver storage supplies to their customers in northeast New York State by 2002-2003.

New natural gas pipeline capacity into the Northeast could reach 0.5 Bcf/d in 2002, while expansions within the region could total 1.1 Bcf/d (Figure 2). All told, a total of more than 6.5 Bcf/d of new capacity (more than 30 projects) could be installed into and in the Northeast Region, although it remains to be seen if all of these projects will be able to garner the necessary shipper commitments to survive market and FERC scrutiny.

Southeast Region

Capacity into the Southeast Region grew by 10 percent between 1990 and 2000, with significant volumes flowing through the region to markets in the Northeast and Midwest. However, the nine natural gas pipeline expansions completed in the Southeast Region in the past 2 years were mainly to improve deliverability within the region, primarily in North and South Carolina, Georgia, and Alabama. About 1.9 Bcf/d of additional capacity was added in the region in 1999-2000, which included enhancement of the Columbia Gulf Transmission system (307 MMcf/d) and completion of several Transcontinental Gas Pipeline system projects that totaled 863 MMcf/d of added system capacity. The Transcontinental projects included completion of the Cardinal intrastate pipeline and Pine Needle LNG link in North Carolina, and the Southmost expansion of Transcontinental's mainline in Alabama and Georgia.

Use of available interstate pipeline capacity during peak demand periods is high in most states in the region (Table 3). Nevertheless, enough additional capacity is expected to be installed in the next few years to preclude any major capacity shortfall. The proposed pipeline projects within the region include expansion of pipeline access to underground storage sites that are also expanding, development of new capacity on intrastate pipelines to improve service to expanding end-use markets, and installation of new interstate capacity that will complement these intrastate expansions. For example, Southern Natural Gas, East Tennessee Gas, and Transcontinental Gas Pipeline companies will increase their existing system capacity in the region by up to 200 MMcf/d each within the next 2 years. Most of this capacity will either provide direct delivery to end users, such as new gas-fired power plants, or increase deliveries to expanding intrastate systems such as the Sandhills Pipeline (300 MMcf/d) built in North Carolina in 2001.

The increasing importance of access by shippers and other pipeline customers to the high-deliverability underground storage located in the region is exemplified by the several pipeline expansion projects that are predicated upon

[25]Major segments of the Columbia Gas Transmission Company, CNG Transmission Company, National Fuel Gas Supply Corporation, Tennessee Gas Pipeline Company, Texas Eastern Transmission Company, and Transcontinental Gas Pipeline Company systems traverse the Leidy, Pennsylvania area.

expected expansions of existing storage facilities currently interconnected to the pipelines.

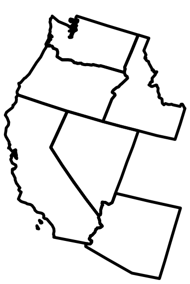
- In conjunction with the approved 2002 Petal Gas Storage site expansion, for example, its operator has proposed building a 59-mile, 36-inch, 680 MMcf/d capacity pipeline from that storage facility to new interconnections with Transcontinental Gas, Southern Natural Gas, and Destin Pipeline companies.

- Another storage facility that is expected to be expanded is the Bay Gas McIntosh facility in Alabama. Its operators will build an additional 18-mile pipeline from the site to provide shippers a new interconnection with Gulf South Pipeline Company.

The most significant pipeline development expected in the region during the next 2 years is construction of the 1,130 MMcf/d Gulfstream Pipeline, which will bring gas supplies from the Mobile Bay area of Alabama across the Gulf of Mexico to points in central Florida (Figure 4). Completion of the Gulfstream Pipeline will mean that Florida Gas Transmission Pipeline will no longer be the only source of gas available to the state's natural gas shippers and customers. Nevertheless, the Florida Gas Transmission Company still continues to expand its system. In 2001, it completed a 200-MMcf/d expansion and expects to add another 200 MMcf/d in 2002 with completion of its Phase V expansion.

Western Region

Natural gas pipeline capacity into the Western Region increased substantially over most of the past decade. However, in the past 2 years (1999-2000), capacity into the region grew by only 1 percent (0.14 Bcf/d). Since 1996, less than 1 Bcf/d of new natural gas pipeline capacity into the region has been installed. Although consumption of natural gas was growing within the region, supplies were still plentiful and spot prices were relatively low. Meanwhile, the needs of gas-fired electric power plants were easily accommodated from existing pipeline capacity, as the pending scarcity of hydropower electric power generation had yet to impact the region's overall electric power generation needs.



Between late 2000 and mid-2001, however, a rapid increase in natural gas demand, brought about by a need to increase electricity output from gas-fired power plants (to compensate for decreased availability of hydropower), also created a tight market for natural gas pipeline capacity, especially in California. As a result, since the beginning of 2001, eight more projects have been proposed to bring additional pipeline capacity into the state. Most of the current proposals, however, will not have any effect on the California capacity market until after 2002. Only two projects, the Kern River Transmission Company 2001 Expansion (135 MMcf/d) and the El Paso Line 2000 Project (230 MMcf/d), are slated for completion in 2001.

The first completely new natural gas pipelines to be built into California in over a decade have been proposed for 2003: the Kinder-Morgan Energy Company's 1,165 MMcf/d Sonoran Pipeline into southern California and Colorado Interstate Gas Pipeline Company's 750 MMcf/d Ruby Pipeline into north-central California. The Sonoran Pipeline will be a two-phase project. The first phase will consist of a 460-mile line from the San Juan Basin to the southern California border, while the second phase will extend the system 600 miles to just south of San Francisco. The Ruby Pipeline will extend from northeastern Utah, 850 miles west to Sacramento, California, providing a more direct route to northern California for Rocky Mountains gas supplies. Between these two pipelines alone, as much as an additional 2 Bcf/d of gas pipeline capacity could reach California, approximately 27 percent more than today.

Within the state itself, Southern California Gas Company (SoCal) is proceeding with plans to increase its system capacity in 2001 by more than 350 MMcf/d. Two projects, scheduled for completion by the end of 2001, would expand intrastate receipt capabilities at several points and at interconnections with the several interstate pipelines that will be expanding their own deliverability in the near future. Pacific Gas & Electric, on the other hand, has placed its announced plans to increase capacity along its two routes that bring Canadian and Southwest gas into California on hold because of its current uncertain financial condition. The proposed expansion plans would have increased PG&E overall intrastate system capacity by 1.2 Bcf/d by January 2003.

Although the California market has been the prime target of most of the recent proposals to expand natural gas pipeline capacity in the region, other portions of the Western Region have showed signs that available capacity probably is not sufficient to handle potential future demand. In Oregon and Washington, a series of proposals has been put forward to build a number of large laterals or new pipelines from the existing mainlines of Northwest

Pipeline Company and PG&E Gas Transmission-NW to serve growing natural gas markets within the northwest portion of the region. Completion of these projects would add approximately 500 MMcf/d of new capacity to the area by the end of 2002. An additional 700 MMcf/d could also be installed in 2003 if current demand growth indicators, especially concerning gas-fired power plant needs, continue to rise.

The need to supply new gas-fired power plants in Arizona and Nevada is also generating proposals to expand available natural gas pipeline capacity to these areas as well. In fact, several proposed interstate pipeline expansion projects slated to serve the California market may initially provide all, or part of their capacity, to these markets. For example, the Questar Southern Trails, which will terminate in Southern California, will, at least initially, provide most of its 90 MMcf/d of capacity to new gas-fired power plants located just east of the California/Arizona border.[26] The line is scheduled to be placed in service during the second quarter of 2002. And, although the Kern River Transmission Pipeline system was expanded by 135 MMcf/d in July 2001 to increase available capacity to California, 220 MMcf/d of the system's capacity will be drawn off in 2002 to serve a new gas-fired power plant located northeast of Las Vegas, Nevada. Kern River is expected to complete its system-wide expansion and double its current capacity to 1.6 Bcf/d in 2003. Until then, the pipeline will have difficulty meeting the needs of both markets.

The Western Region will also be the originating source for almost all of the new natural gas export capacity to Mexico that is slated for development in 2001 and 2002. The impetus for most of the increased export capacity will be primarily to support industrial and power generation customers located in the border area.[27] At the end of 2000, export capacity to Mexico reached 2.1 Bcf/d; by the end of 2002 it should reach 2.8 Bcf/d. The largest of the scheduled export projects, the North Baja Pipeline project, will increase export capacity by 500 MMcf/d. Still, more than 110 MMcf/d of the capacity of this pipeline, which will extend from Blythe, California, to Tijuana, Mexico, will be directed back into the United States to supply a 510-megawatt power plant being built just south of San Diego, California.

Over the next several years, as much as 2.7 Bcf/d of new pipeline capacity could be installed in the Western Region if all the 17 projects currently planned are actually completed. That would represent a major reversal from 1999-2000, when pipeline capacity within and into the Western Region grew by only 49 MMcf/d. It remains to be seen, however, if the market conditions shift during the interim and demand for new capacity drops. If that does happen, then it is possible that only a fraction of the currently proposed capacity will actually be installed.

Expansion Trends

Based on profiles of the announced (90) pipeline projects proposed for development in 2001 and 2002, U.S. natural gas pipeline companies could install up to an additional 22.1 Bcf/d of capacity within the national network (Figure 2). The largest number of these projects (19) would terminate in the Northeast Region, although the largest amount of new capacity (5 Bcf/d) would be added in the Midwest Region. Several of the projects terminating in the Northeast in 2002 represent projects that originally were proposed for 2000 but were delayed because of public opposition and/or failure on the part of the sponsors to meet initial regulatory filing requirements. In other parts of the country, a number of projects are planned for areas where new supply sources are being tapped, such as deepwater development in the Gulf of Mexico and expanding coalbed methane production in the Rocky Mountains area.

Indeed, the large amount of capacity and expenditures estimated for 2002 (Figures 2 and 3) partly reflect this situation. Moreover, the large incremental increase in capacity in 2002 also is accounted for by the number of large projects scheduled to be completed that year. In fact, 9 of the 37 projects planned for completion in 2002 have a capacity level of 500 MMcf/d or greater. Many, if not most, of these major projects have been premised upon the need to serve growing electric power generation markets in their respective market areas.

To date, the U.S. natural gas pipeline industry has been able to finance and install the additional infrastructure needed to accommodate the decade-long demand growth on the network and, barring any major disruption of financial markets, should be able to continue doing so. The quickest and least expensive way of installing additional

[26]In Arizona, the El Paso Natural Gas Company is also scheduled (2002) to build a 620-MMcf/d lateral off its southern system to serve two new gas-fired power plants located west of Phoenix.

[27]The domestic natural gas pipeline network in Mexico has yet to be fully developed in several locations along the US/Mexican border, especially in the northwestern areas below Arizona and California.

pipeline capacity is by increasing compression on the existing system, if feasible. Looping (integrating a parallel pipeline with all or a portion of the system), or a combination of looping and compression, would be the next least expensive alternative. Over the past several years, the number of proposals to develop new laterals and expand compression has increased significantly.

This trend, albeit perhaps short-term, is reflected in the increased number and incremental capacity represented by compression-only and looping/compression expansion projects proposed for 2001-2002. Compared with 1996 through 2000, when such projects added an average of 753 MMcf/d per year, the amount of new capacity to be added in 2001 and 2002 could be as much as 1.4 and 1.8 Bcf/d, respectively (Figure 5). The increased use of looping/compression expansion reflects the maturity of many of the systems that make up the national network. Using these methods, pipeline companies can add capacity relatively quickly, while minimizing the potential public opposition, especially in heavily populated areas.

The steep rise in the annual increase in natural gas pipeline mileage since 1999 reflects, for the most part, the completion of several long-distance natural gas pipelines in 2000 and several more scheduled for 2001-2002 (Figure 6). These new pipelines are needed to tap into new supply sources located in Canada and in the Rocky Mountains area and to provide natural gas transportation for customers located in markets in the Midwest, Northeast and Western regions of the United States.

Additionally, with the growth in new gas-fired electric power plants, the miles of lateral projects and the level of the average incremental capacity from these projects have also increased. While the average capacity of new laterals installed between 1996 and 2000 was 100 MMcf/d, the averages for 2001 and 2002 are 261 and 238 MMcf/d, respectively. Moreover, in 2001 and 2002, 120 and 189 miles, respectively, of new laterals have been proposed, compared with an average of 98 miles per year in the previous 5 years.

Consolidation Within the Pipeline Industry

Aside from the physical changes that have occurred to the natural gas pipeline infrastructure since 1993, the restructuring of the gas pipeline industry has brought about a major shift in pipeline ownership and in the business structure of many corporate parent companies. Indeed, there have been some very large consolidations of pipeline assets under single corporate umbrellas. The corporate strategies behind these moves have varied, but the outcomes have been profound. For instance, when gas pipeline companies were no longer permitted to engage in the sale of natural gas (FERC Order 636, 1993), many companies created affiliated natural gas marketing arms or subsidiaries and transferred the merchant functions to these new divisions. Today, many of these marketing entities also engage in the marketing of other types of energy as well, e.g., Reliant, and/or have major online (Internet) trading sites, e.g., Enron. In many instances, the annual revenues of these trading companies are now much greater than those of the pipeline divisions of which they were once a part.[28]

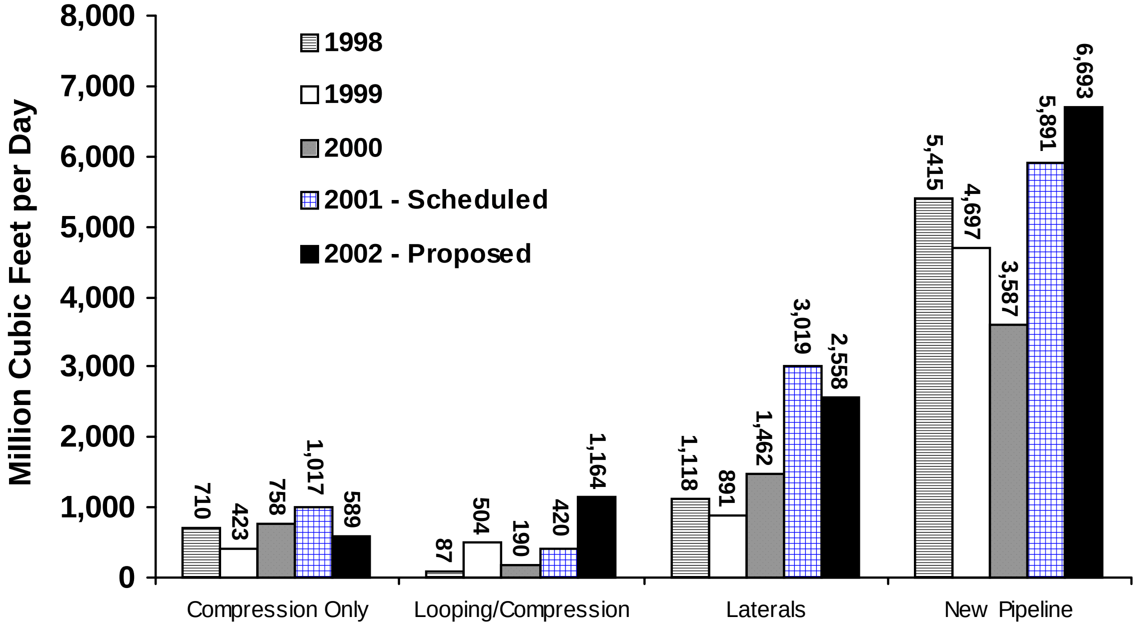
Corporate expansion strategies vary widely as can be seen in a few case studies. The largest instance of consolidation has been carried out by the El Paso Energy Corporation, once the owner of only one major interstate pipeline, the El Paso Natural Gas Pipeline Company. Since 1997, it has acquired eight other interstate pipeline systems (Table 4). As a result, El Paso Energy-owned interstate pipelines now provide customer access to markets across the Lower 48 States. The original gas sales and marketing arm of the El Paso Natural Gas Pipeline became El Paso Merchant Energy Company, one of the top 10 natural gas and energy marketing companies in the United States in 2000.

Similarly, the Williams Company also succeeded in creating a nationwide pipeline network through the acquisition of other pipeline companies. Its natural gas marketing and trading arm, Williams Energy Services Inc., ranked about 18th in the United States in 2000, based on contracted volume.

The Duke Energy Corporation, a regional (Southeast) electric power company at the start of the 1990's, began acquiring interstate pipeline companies in the mid-1990's. Its original objective appears to have been the development of a nationwide pipeline network of affiliates. But in 1997 the company changed course and sold those interstate pipeline company affiliates that did not serve its historic

[28]Marketing companies are playing a key role in the restructured gas market by offering the aggregation and bundling functions previously provided by pipeline companies. Consumers contract separately for gas purchases and transportation, receiving transportation from the pipeline company and the local distribution company. Customers can purchase supplies from any seller. Many customers use marketing companies to rebundle services. Marketing companies are not regulated.

Figure 5. Amount of New Natural Gas Pipeline Capacity Added by Type Of Project



Note: Many pipeline projects contain a mix of several types of expansion methods but for purposes of this graph each project has been included in the category that appears to reflect the bulk of the overall effort.

Source: Energy Information Administration, EIAGIS-NG Geographic Information System, Natural Gas Proposed Pipeline Construction Database, as of September 2001.

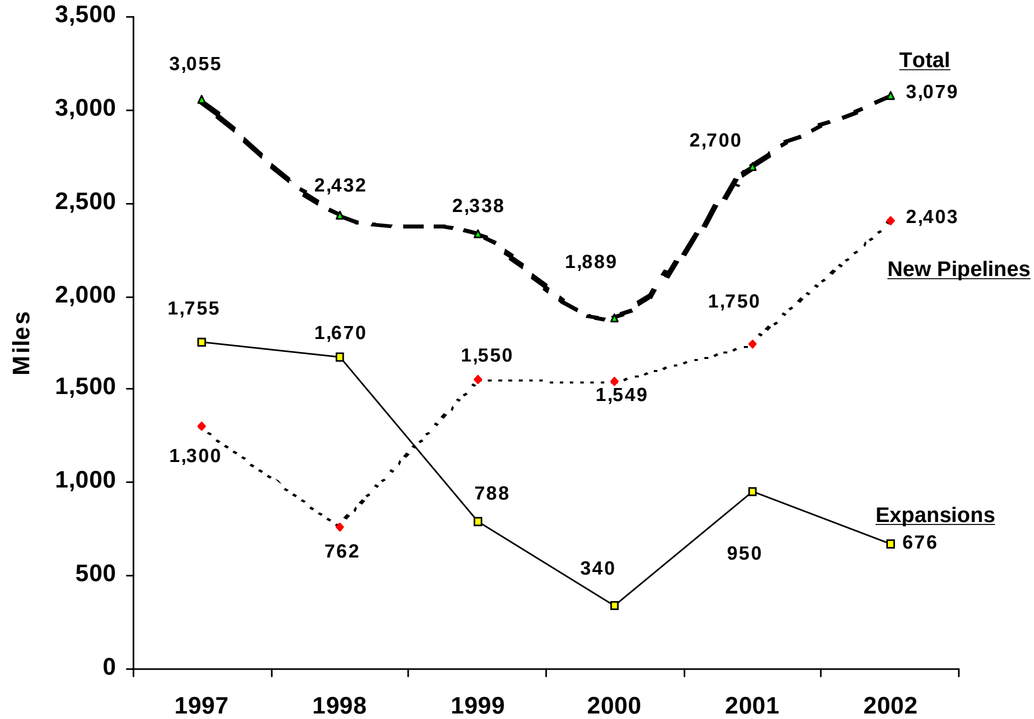
southeastern marketplace or the eastern United States. It retained the natural gas marketing expertise from its original acquisitions. Duke Energy Marketing has grown substantially and was the second-largest natural gas marketer (by volume) in the United States in 1999 and 2000.

Similar to Duke Energy Corporation, CMS Energy Corporation was a regional (Midwest) energy company that did not own any interstate pipeline companies before 1993. When it did enter the interstate pipeline market, it did so by buying the several pipelines that Duke Energy divested itself of in the Midwest. Today, CMS has integrated these interstate pipeline companies into its regional (Midwest-Southwest) energy marketing operations. Its CMS-MST (Marketing, Services and Trading) subsidiary ranked among the top 20 natural gas marketers in 2000.

Enron Corporation took a different approach to the restructured natural gas marketplace. It still owns the same interstate pipeline companies as it did in the early 1990's (Table 4), but its marketing arm has become the largest in the United States. The volume of natural gas traded by the company in 2000 was almost double the volume in 1999 and twice that of second-ranked Duke Energy Marketing. The principal reason for most of its recent growth has been the success of its online (Internet) energy trading operation, Enrononline.com.

Kinder-Morgan Corporation is a relative newcomer to the interstate pipeline community. In 1998 it acquired the Mid-Con Corporation and its two interstate pipelines. In 1999, it acquired the KN Energy Company with its one wholly owned system and one joint-venture pipeline (TransColorado Gas Transmission Co). Nevertheless, even with these acquisitions, it still remains focused on markets in the mid-continent region of the United States. While it has a natural gas marketing arm (KM Gas Services Division), its operations are primarily confined to services within its regional service area.

Figure 6. Miles of Additional Natural Gas Pipeline, Expansions Versus New Pipelines



Note: Mileage for expansion projects includes mostly added system looping and short laterals off existing systems.
Source: Energy Information Administration, EIAGIS-NG Geographic Information System, Natural Gas Proposed Pipeline Construction Database, as of September 2001.

Pipeline Changes in Business Operations

As the natural gas pipeline transportation sector has expanded over the past decade, it has done so in a more competitive market. Consequently its participants have had to find more efficient ways of transacting business, in order to maintain market share and reduce business costs. Although the large number of mergers within the industry has decreased overhead costs in many instances, the adoption of new business techniques and methods, particularly through Internet applications, has emerged as a key factor in remaining economically viable in today's marketplace. The integration of e-commerce into the daily operations of the pipeline industry has progressed rapidly and will continue to become more integral as new applications are developed to take advantage of the Internet medium.

Use of the Internet by the major natural gas pipeline companies takes several different forms: (1) to provide operational and tariff information to customers and to the general public, (2) to permit customers to engage the services of the pipeline such as bidding for released capacity, and (3) to gain access to online platforms of major energy trading firms in order to arrange for the transportation of gas traded and/or other services the pipeline might provide.

The expanded availability of general pipeline operational information on the Internet is the product of a FERC initiative that was formally developed under the guidance of the Gas Industry Standards Board (GISB). All natural gas pipeline companies are now required to have an Internet site (Figure 7) that provides information on its rates (tariffs), operational capabilities, and availability. For example, these company Internet sites provide information on daily availability of unused capacity and notices of situations on the pipeline system that might affect a customer's use of the system's facilities, such as the unscheduled loss of a compressor station that could affect deliveries at a specific receipt or delivery location.

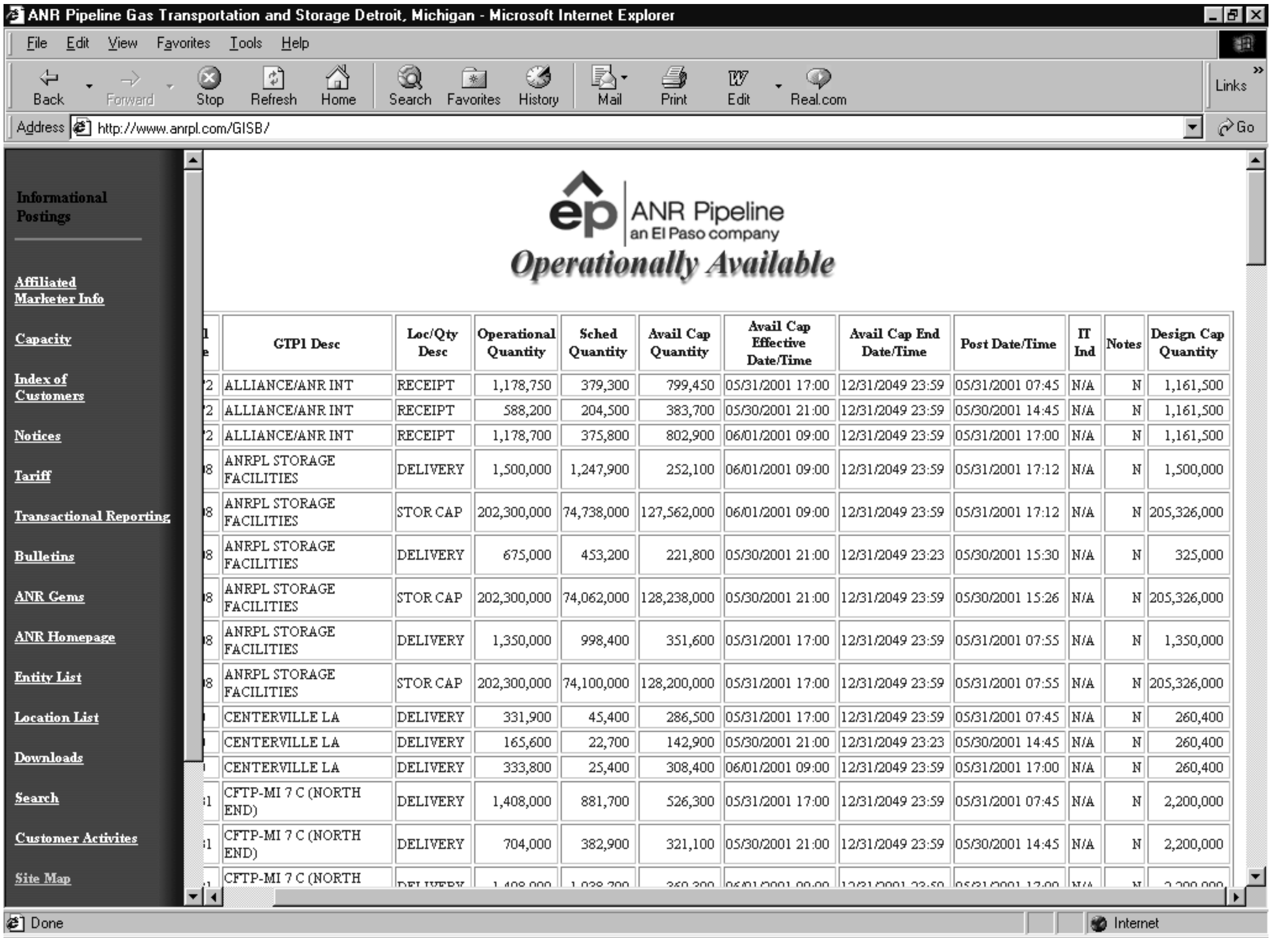
Table 4. Shifts in Ownership of Major Interstate Natural Gas Pipeline Companies Since 1990

Parent/ Pipeline Name	Marketer Affiliate/ Prior Ownership	Merger Year	Total Deliveries (Bcf) 1990	Total Deliveries (Bcf) 1999	Market Area Served	System Mileage	System Capacity (MMcf/d)
CMS Energy Corp	**CMS-MST**						
Panhandle Eastern Pipeline Co	Panhandle Eastern Corp	2000	1,166	630	Midwest	6,467	2,765
Sea Robin Pipeline Co	SONAT Corp	2000	243	224	Gulf Coast	470	1,241
Trunkline Gas Co	Panhandle Eastern Corp	2000	929	987	Midwest	4,134	1,884
Dominion Resources Corp							
Dominion Gas Transmission Co	Consolidated Natural Gas Co	2000	781	1,999	Northeast	9,950	6,257
Duke Energy Corp	**Duke Energy Trading Co**						
Algonquin Gas Transmission Co[a]	Panhandle Eastern Corp	1999	282	315	Northeast	1,092	1,586
East Tennessee Natural Gas Co	Tenneco Energy Corp	2000	87	120	Southeast	1,100	700
Maritimes & Northeast PL Co	Built in 1999	n/a	n/a	NA	Northeast	304	440
Texas Eastern Transmission Corp	Panhandle Eastern Corp	1999	1,842	1,475	Northeast	12,100	5,939
El Paso Corp	**El Paso Merchant Energy**						
ANR Pipeline Co	Coastal Corp	2000	2,388	5,060	Midwest	9,553	5,846
Colorado Interstate Gas Co	Coastal Corp	2000	635	791	Central/Denver	4,123	2,350
El Paso Natural Gas Co	El Paso Energy Co	n/a	3,999	1,438	Western/Southwest	10,009	5,344
Mojave Pipeline Co	Built in 1993	n/a	n/a	143	Western	362	550
Portland Gas Transmission Co	Built in 1998	n/a	n/a	23	Northeast	242	178
South Georgia Natural Gas Co	SONAT Corp	1999	NA	NA	Southeast	909	129
Southern Natural Gas Co	SONAT Corp	1999	1,164	927	Southeast	7,612	2,536
Tennessee Gas Pipeline Co	Tenneco Energy Corp	1999	3,079	2,414	Northeast	9,270	5,587
Wyoming Interstate Gas Co	Coastal Corp	2000	79	241	Central	425	1,175
Enron Corp	**ENRON Online Trading**						
Florida Gas Trans Co (50%)	No Change	n/a	378	590	Southeast	5,203	1,405
Northern Natural Gas Co	No Change	n/a	3,731	1,630	Midwest	15,637	3,800
Transwestern Gas Co	No Change	n/a	335	549	Western	2,532	2,700
Great Lakes Gas LP							
Great Lakes Gas Trans Co	No Change	n/a	664	983	Midwest/Canada	2,101	2,483
Iroquois Pipeline LP							
Iroquois Gas Transmission System	Built in 1991	n/a	n/a	371	Northeast	375	850
Kinder-Morgan Corp	**KM Gas Services Division**						
Kinder-Morgan Interstate PL Co	KN Energy Corp	1999	185	255	Central	6,081	1,075
Kinder-Morgan Texas PL Co	MidCon Corp	1999	NA	NA	Southwest (TX)	2,101	na
Natural Gas Pipeline Co of America	MidCon Corp	1998	4,060	1,859	Midwest	10,076	5,001
Trailblazer Pipeline Co	MidCon Corp	1998	76	214	Central/Midwest	436	605
Koch Corp	**Koch Energy Trading Co**						
Gulf South Pipeline Co	United Gas Corp	n/a	1,061	1,296	Southeast	7,252	3,476
Mobile Bay Pipeline Co	Built in 1993	1998	n/a	NA	Southeast	26	600
Leviathan Gas Pipeline Partners							
High Island Offshore System	KN Energy Corp	2000	443	290	Gulf Coast	247	1,800
UT Offshore System	KN Energy Corp	2000	304	148	Gulf Coast	30	1,040
NiSource Corp							
Columbia Gas Transmission Corp	Columbia Energy Corp	2000	2,774	3,562	Northeast	11,215	7,276
Columbia Gulf Transmission Co	Columbia Energy Corp	2000	2,490	4,237	Southwest/Northeast	4,200	2,317
Crossroads Pipeline Co	Built in 1995	n/a	n/a	39	Midwest	205	250
Granite States Gas Trans Co	Northern Utilities Inc	1999	NA	23	Northeast	na	na
Northern Border Partners							
Midwestern Gas Transmission Co	Tenneco Energy Corp	2001	151	87	Midwest	350	785
Northern Border Pipeline Co	No Change	n/a	400	878	Midwest	1,214	2,355
Questar Corp							
Overthrust Pipeline Co	No Change	n/a	48	52	Central (WY)	88	227
Questar Pipeline Co	No Change	n/a	408	333	Central	2,000	1,400
TransColorado Gas Trans Co	Built in 1998	n/a	n/a	86	Central/Western	295	300
Reliant Energy Corp	**Reliant Energy Wholesale Group**						
Mississippi River Trans Co	No Change	n/a	280	358	Midwest/Central	1,976	1,670
Reliant Energy Gas Trans Co	No Change	n/a	851	871	Southwest	6,228	2,797
Williams Companies, Inc	**Williams Energy Services**						
Cove Point LNG LP	Columbia Energy Group	2001	n/a	23	Northeast	87	585
Kern River Transmission Co	Built in 1992	n/a	n/a	306	Western	922	800
Northwest Pipeline Co	No Change	n/a	1,583	724	Western	3,932	2,900
Transcontinental Gas Pipeline Co	Transco Energy Corp	1997	3,047	5,038	Northeast	10,562	7,000
Williams Gas Pipeline - Central	No Change	n/a	618	359	Midwest	5,926	2,800
Williams Gas Pipeline - SouthCentral	Transco Energy Corp	1997	1,087	2,805	Central	5,573	2,000
Xcel Corp							
Viking Gas Transmission Co	Northern States Power Co	2000	129	173	Midwest	662	516

Notes: Table is not inclusive of all interstate pipelines operating in the United States in 1990 and 2000; Bcf = Billion cubic feet; MMcf/d = Million cubic feet per day; n/a denotes not applicable to category; and NA = Not available.

Sources: **Total Gas Deliveries:** Federal Energy Regulatory Commission Forms 2 & 2A, "Annual Report of Major/Minor Natural Gas Companies," 1999. **System Capacity & Mileage:** Federal Energy Regulatory Commission, FERC Annual Capacity Report (18 CFR ~284.12). **Ownership & Affiliations:** Compiled from various news sources and natural gas trade press periodicals.

Figure 7. Interstate Natural Gas Pipeline Company Internet Posting (Operationally Available Capacity)



GTP1 Desc	Loc/Qty Desc	Operational Quantity	Sched Quantity	Avail Cap Quantity	Avail Cap Effective Date/Time	Avail Cap End Date/Time	Post Date/Time	IT Ind	Notes	Design Cap Quantity
ALLIANCE/ANR INT	RECEIPT	1,178,750	379,300	799,450	05/31/2001 17:00	12/31/2049 23:59	05/31/2001 07:45	N/A	N	1,161,500
ALLIANCE/ANR INT	RECEIPT	588,200	204,500	383,700	05/30/2001 21:00	12/31/2049 23:59	05/30/2001 14:45	N/A	N	1,161,500
ALLIANCE/ANR INT	RECEIPT	1,178,700	375,800	802,900	06/01/2001 09:00	12/31/2049 23:59	05/31/2001 17:00	N/A	N	1,161,500
ANRPL STORAGE FACILITIES	DELIVERY	1,500,000	1,247,900	252,100	06/01/2001 09:00	12/31/2049 23:59	05/31/2001 17:12	N/A	N	1,500,000
ANRPL STORAGE FACILITIES	STOR CAP	202,300,000	74,738,000	127,562,000	06/01/2001 09:00	12/31/2049 23:59	05/31/2001 17:12	N/A	N	205,326,000
ANRPL STORAGE FACILITIES	DELIVERY	675,000	453,200	221,800	05/30/2001 21:00	12/31/2049 23:23	05/30/2001 15:30	N/A	N	325,000
ANRPL STORAGE FACILITIES	STOR CAP	202,300,000	74,062,000	128,238,000	05/30/2001 21:00	12/31/2049 23:59	05/30/2001 15:26	N/A	N	205,326,000
ANRPL STORAGE FACILITIES	DELIVERY	1,350,000	998,400	351,600	05/31/2001 17:00	12/31/2049 23:59	05/31/2001 07:55	N/A	N	1,350,000
ANRPL STORAGE FACILITIES	STOR CAP	202,300,000	74,100,000	128,200,000	05/31/2001 17:00	12/31/2049 23:59	05/31/2001 07:55	N/A	N	205,326,000
CENTERVILLE LA	DELIVERY	331,900	45,400	286,500	05/31/2001 17:00	12/31/2049 23:59	05/31/2001 07:45	N/A	N	260,400
CENTERVILLE LA	DELIVERY	165,600	22,700	142,900	05/30/2001 21:00	12/31/2049 23:23	05/30/2001 14:45	N/A	N	260,400
CENTERVILLE LA	DELIVERY	333,800	25,400	308,400	06/01/2001 09:00	12/31/2049 23:59	05/31/2001 17:00	N/A	N	260,400
CFTP-MI 7 C (NORTH END)	DELIVERY	1,408,000	881,700	526,300	05/31/2001 17:00	12/31/2049 23:59	05/31/2001 07:45	N/A	N	2,200,000
CFTP-MI 7 C (NORTH END)	DELIVERY	704,000	382,900	321,100	05/30/2001 21:00	12/31/2049 23:59	05/30/2001 14:45	N/A	N	2,200,000
CFTP-MI 7 C (NORTH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Source: http://www.anrpl.com/GISB/

Pipeline companies also often give customers access to online software packages for submitting nominations for daily or longer-term capacity needs, trading in unused pipeline capacity, arranging for the transportation of natural gas packets, and acquiring other services that the pipeline may offer.[29] For instance, a number of companies now offer parking and loaning[30] and market-balancing services that can help customers manage their shipping arrangements and avoid operational penalties.

In addition to direct Internet services, others in the industry have developed their own online platforms for the trading of natural gas and related energy products. Several companies, including Enron and Dynegy,[31] are now trading billions of dollars worth of natural gas annually via the Internet.[32] Enron, in fact, publicizes that 60 percent of its business transactions are now performed via its Enrononline.com operation.

[29]These portions of a pipeline's site may be accessible only to customers who sign on as a client for these services.

[30]Parking services provide for the temporary storage of a portion of a customer's gas shipment when the customer's receipts into the pipeline exceed the maximum contracted level during a specified period. Loaning services provide a customer with short-term access to additional gas supplies when its deliveries levels do not meet the minimum contracted flow requirements with the pipeline. In either case, when the contracted level is not met the pipeline company may impose penalties until the imbalance situation is rectified.

[31]Enron's online trading operations may be found at: http://www.enrononline.com/jsp/marketing/Markets/NaturalGas/US/index.jsp. Dynegy's may be found at: http:// www.dynegy.com/dynegy_com.nsf/pages/products+&+services

[32]Financial Times Energy, *Gas Daily* (February 9, 2001), p. 8.

The increasing use of Internet platforms has decreased the flow of the paperwork involved in facilitating the trading, transporting, and routing of natural gas flows. Without the Internet medium, the industry would find it difficult to handle the large number of transactions that are characteristic of today's high-volume natural gas marketplace.

Summary and Conclusions

The capacity and reach of the U.S. natural gas pipeline network has grown extensively over the past decade, driven by a significant (17 percent) increase in U.S. natural gas consumption. Major new pipelines have been built to bring additional gas imports from Canada and supplies from expanding U.S. production areas such as the coalbed-methane basins of the Rocky Mountains region. But, added pipeline capacity is not the only reason the network has been able to accommodate this growth in demand and maintain service in an efficient and reliable fashion.

The companies engaged in natural gas pipeline transportation have also transformed the way in which they transact business, such as through the Internet, and have consolidated operations through major mergers and acquisitions. Although merger activities have slackened over the past year, the need to expand into additional market areas, such as to accommodate shippers doing business with affiliated marketing firms, will probably result in more such actions during the coming years. It is suggested that these changes will put them in a better position to handle the large growth in natural gas demand expected over the next two decades.

Forecasts by the Energy Information Administration, as well as other forecasts, predict even greater growth in natural gas demand over the next several decades,[33] signaling that more new pipelines/expansions than ever will be needed. To support this expected expansion, the number and operational capability of auxiliary facilities, such as market centers/hubs and high-deliverability underground storage sites, will also grow correspondingly.

[33]See Energy Information Administration, *Annual Energy Outlook 2001*, DOE/EIA-0383(01) (Washington, DC, December 2000).

The major factor in the anticipated heavy increase in natural gas demand in the next 20 years is the continuing growth in gas-fired electric power generation plants. To provide natural gas to these plants, often a lateral has to be built from the mainline transmission line to each plant and the mainline pipeline itself has to be expanded, or a new pipeline built, perhaps as far back as the original source of supply. It is estimated that each new 100 megawatts (MW) of gas-turbine power generation requires between 8.8 and 11.2 MMcf/d of natural gas to operate.[34]

In 2002, it is estimated that 50,000 MW of new gas-fired capacity will be installed in the United States. That figure translates into 4.4 to 5.6 Bcf/d of new mainline pipeline capacity likely to be needed for these plants. In Michigan, alone, an estimated 3,800 MW of gas-fired power generation plants could come on line in 2002,[35] representing an estimated need for 300–425 MMcf/d in new gas pipeline capacity within the state for this service alone. While the national natural gas pipeline network has expanded sufficiently to meet demand growth during the past several decades, the large incremental needs of power plants over the next several decades can be expected to place unusual demands upon the natural gas pipeline industry.

Nevertheless, the methodical process by which a pipeline or expansion is developed, from concept to installation, has worked exceedingly well in the past and should be able to handle even the major growth expected over the next 20 years. However, delays in acquiring approval for some of these projects, for whatever reason, could result in short-term local deficiencies in pipeline capacity and affect expected service to new customers.

[34]The range for gas requirements reflects the following assumptions. Half of all new capacity is for base-load, with the other half for peaking service. Base-load and peaking units have heat rates of 7,500 and 9,500 Btu per kilowatt-hour, respectively. The average annual utilization rate for base-load plants is from 75 to 90 percent, while peaking units operate at 20 to 30 percent.

[35]Michigan Public Service Commission web site, http://www.cis.state.mi.us/mpsc/.