

Appendix D

Data Sources

The data presented in the body of this report came from many sources and often required some adjustment to provide information on a comparable basis for use in the analysis. This appendix provides detailed information on the methodology and source material used to develop estimates of interstate pipeline capacity at State borders and the changes in energy usage patterns from 1990 through 1995.

The following is a list of the data sources discussed in this appendix.

- Annual pipeline company reports filed with the Federal Energy Regulatory Commission (FERC) under 18 CFR §284.12, “Peak-Day Capacity Report,” and §260.8, Format FERC 567, “System Flow Diagrams.”
- FERC Form 2, “Annual Report of Major Natural Gas Companies”
- FERC Form 11, “Natural Gas Pipeline Monthly Statement,” 1995 and earlier years. (The survey became a quarterly report in 1996.)
- FERC Index of Customers
- Energy Information Administration (EIA), Form EIA-176, “Annual Report of Natural and Supplemental Gas Supply and Disposition”
- Energy Information Administration, Form EIA-191, “Underground Natural Gas Storage Report”
- *Natural Gas Annual*, DOE/EIA-0130, various issues.

Pipeline Capacity

The measure of pipeline capacity that was estimated and addressed in this report is the daily capacity of the interstate natural gas pipeline network at regional and State boundaries. Specifically, it is an estimate of the maximum volume of gas that can be transported under normal operating conditions for a sustained period of time. While pipeline systems have considerable operational flexibility to increase deliveries of natural gas above design capacity levels to certain areas for short periods of time, this often means that deliveries are reduced elsewhere or that line packing occurs. Neither

measure is likely to be sustainable for more than a short period of time.

Information on capacity levels for the interstate pipeline systems is generally available from filings at the Federal Energy Regulatory Commission (FERC). However, this information is typically associated with compressor stations and not State border capacity. Thus, to estimate the State-to-State capacities on the pipelines, an approach was required. Further, while there is a regulatory requirement for the submission of design information, the terminology provided in the submissions sometimes is unclear as to whether the data provided by a company are in fact the information requested.

The original compilation of pipeline capacity estimates was done by the Energy Information Administration during 1991 and 1992, using 1990 as the base year. The initial approach taken to derive the State-to-State capacity information was the following:

- Develop initial capacity estimates by using compressor station data from FERC Format 567, “System Flow Diagrams.”
- Adjust initial estimates by using delivery requirements of customers located between the State line and the station and for any contracted receipts from other pipelines.
- When compressor station data were unavailable on Format 567, derive a statistical estimate by using a regression equation based upon the diameter(s) of the pipeline segment in question.
- Impute remaining missing values by using proxies for capacity. Data used for this purpose include contract demand (CD) data for pipeline sales customers, which were available for the years 1988 and 1989. (CD data were no longer available once FERC Order 636 was implemented in November 1993.)
- Cross check the State border capacities for reasonableness by using contract demand levels (if not used as a proxy for capacity); flow data from Form EIA-176, “Annual Report of Natural and Supplemental Gas Supply and Disposition”; and consultations with FERC staff and company officials.

The initial (1990) estimates of capacity on a pipeline segment at a State border were based on reported compressor station throughput, the daily output of whichever compressor station appeared to be closest to the State border. The working assumption was that throughput capability, even if only an estimated flow under current operating conditions, of any compressor station is a reasonably good estimate of peak-period throughput at that point on the line. (Note: Compressor station output may be a “constraint” on throughput when downstream pipeline diameter and other characteristics of the segment may allow the physical pipeline to handle greater loads than required under current customer peak-day commitments. Conversely, the designed compressor output may be greater than can be sent through existing pipeline configurations.)

When no delivery or receipt points were between the selected compressor station and the State line, the capacity at the State border was assumed to equal the station capability, even though some friction losses would occur because of the distance between the line and compressor. When data were available for both receipt and CD deliveries between the compressor station and the State line, then the initial capacity estimates were adjusted to account for these volumes.

In some cases, peak-day information rather than design capacity was reported on the Format 567. These estimates were considered a reasonable proxy for capacity.

Under certain conditions, contract demand data were used to estimate capacity levels at a State border. CD data were assumed to be a reasonable reflection of current peak-day demands on the pipeline system and, therefore, a close approximation of the capability or capacity of the pipeline to supply those customers. A pipeline's CD commitment levels within a State were used as a surrogate for a measure of that pipelines' capacity into the State when the pipeline system, or a branch, terminated in the State. Even in this instance, however, the pipeline company could meet a portion of its commitments from sources within the State borders.

In some cases, compressor station data and contract demand data were inadequate to develop an initial capacity estimate, and other methods were pursued to make the initial capacity estimate. For instance, regression equations to estimate capacity were developed by use of a universe of 814 compressor stations with known pipeline diameters, capacities, and pressures, extracted from the Format 567 filings. The results indicated that diameter alone was a good predictor of capacity in these equations.

Subsequently, updated annual capacity estimates were developed for years 1991 through 1996 by using the 1990 levels as starting points. First, the contents of the most recent

annual FERC Format 567 “System Flow Diagram” for each pipeline system were compared with the previous year’s submission. The primary items examined were the throughput capabilities of the pipeline’s compressor stations and whether they had increased, had changed, or had new stations added. In addition, comparisons of receipt and delivery point volumes were also performed to determine changes in peak-day deliverabilities and as a replacement for contract demand data which were no longer current. Available data on pipeline construction projects completed during the interim were also factored into any estimate adjustments. These comparisons were done, to the extent possible, through comparative analyses of updated databases. Initial estimates of revised capacity levels were produced and displayed on annotated pipeline maps.

These estimates were then presented to the pipeline company or FERC staff for evaluation. These inputs were used to settle upon a final estimate.

Average Daily Pipeline Flow

The data source for actual average daily pipeline volume flows across State borders was Form EIA-176, “Annual Report of Natural and Supplemental Gas Supply and Disposition.” In addition, these data are the basis for State-level supply, consumption, and transportation volumes presented in this report.

The respondent universe of the Form EIA-176 includes interstate and intrastate pipeline companies; investor and municipally owned natural gas distributors; underground natural gas storage operators; synthetic natural gas plant operators; and field, well, or processing plant operators that deliver natural gas directly to consumers and/or transport gas to, across, or from a State border through field or gathering lines.

The average daily flow volumes presented in the “Region-to-Region Capacity” tables in the report are based upon preliminary 1996 data from Form EIA-176. They are the sum of data that can be identified as volumes brought across a border: on-system purchases received at a State border, plus transportation and/or exchange receipts received at a State line, plus transported into the report State. The data on Form EIA-176 are annual; average daily levels were computed on a 366-day basis (1996 was a leap year).

Greater detail concerning Form EIA-176, its background, and EIA processing methodology, may be found in the EIA publication *Natural Gas Annual 1996*, DOE/EIA-0131, Appendix A.

System Flow Rate Data

The pipeline systemwide flow rate data discussed in this report (detailed in Appendix A) and used for utilization analyses are based on monthly throughput volume data reported on FERC Form 11, "Natural Gas Pipeline Monthly Statement." These data for the period January 1980 through December 1995 are maintained and available on computer tape.

Transportation, sales, and intercompany transfer throughput volumes are reported, but for the total pipeline system only. As a result, these data cannot be used to compute regional or State-level utilization levels. However, the historical data were used to identify and quantify the largest monthly throughput level occurring on the individual pipeline systems over the period 1980 through 1995. Average monthly throughput rates for 1989 and 1995 were then divided by the largest monthly throughput (which was used as an approximation of a 100-percent load factor or a surrogate measure for full capacity utilization) to estimate the overall relative flow rate (throughput) on the various pipeline systems in 1995.

This report also uses data from the FERC Form 2, "Annual Report of Major Natural Gas Companies," for discussions pertaining to system peak-day deliverability rates and utilization levels on those days. These data, which are reported on page 518, "Transmission System Peak Deliveries" of FERC Form 2, provide peak delivery volumes at several levels. Those periods are: highest day, 2nd highest, and 3rd highest days deliveries, highest 3 consecutive days, and highest month deliveries. These data are to be reported for the period "during the twelve months embracing the heating season overlapping the year's end for which this report is submitted." The latest such period available for this report was the 1995-96 heating year (April 1995 through March 1996).

The peak-day (highest one day) deliveries reported on FERC Form 2 were used in relation to system capacity levels reported on the annual pipeline company reports filed with the FERC under 18 CFR §260.8. The comparison of the two items provides some insight into the systemwide level of pipeline usage during periods of highest user need and some indication of how well the system is able to meet its obligations to its customers under current capacity limitations.

Transportation System Access

The analysis of transportation system access (Chapter 5) employed a sample of 46 major interstate natural gas pipeline

companies. The sample was selected to ensure that adequate and uniform peak-day and monthly transportation information was available for each pipeline company. All pipeline companies in the sample were required to have at least three of the four peak-delivery data necessary to determine maximum capability. The data used in the derivation of maximum capability are from the pipeline company reports filed with the Federal Energy Regulatory Commission (FERC). These data include: the estimated peak-day capacity of the pipeline company's system from the 1996 Peak-Day Capacity Report (18 CFR §284.12); the quarterly contracted firm transportation capacity from the quarterly Index of Customers filings for the period April 1, 1996, through April 1, 1997; the coincident peak-day delivery from the 1995 FERC Format 567 "System Flow Diagrams"; and the transmission system peak deliveries from the 1996 filing of FERC Form 2, "Annual Report of Major Natural Gas Companies." In addition to having sufficient information to estimate maximum capability, the analysis required that each pipeline company in the sample had filed FERC Form 11, "Natural Gas Pipeline Company Quarterly Statement of Monthly Data," for the period April 1996 through March 1997. The transportation volumes from FERC Form 11 were used to assess the utilization of the reserved capacity.

These data requirements resulted in a sample size that was 17 pipeline companies smaller than the sample selected for the analysis of firm capacity contracts, also in Chapter 5. Although the accessibility analysis used 32 percent fewer pipeline companies than the sample for the contract analysis, it excluded only 1 percent, or 1.4 quadrillion Btu per day, of the firm contracted capacity (based on the April 1, 1997, FERC Index of Customer filing) included in the firm contract analysis.

Firm Capacity Contracts

The FERC Index of Customers filing was the principal source of information for the analysis of firm capacity contracts in Chapter 5. The guiding principal for the analysis was to assemble the most recent, reliable information available. Therefore, the quarterly FERC Index of Customers filings for April 1, 1996, through April 1, 1997, were used for the analysis. Several pipeline companies were excluded from the filed Index of Customers because their data were inconsistent or missing. The resulting sample consists of 63 interstate pipeline companies. Since the analysis was not concerned with consistency across several sources of information, it employed a much larger sample of pipeline companies than the accessibility analysis.

Firm transportation capacity was examined by type of shipper. Pipeline companies are required to disclose the amount of capacity reserved by each firm customer in the

quarterly Index of Customers filing to the Federal Energy Regulatory Commission. The Index of Customers provides the name of each company that contracted for firm transportation, but it does not provide any other information to identify what type of company each shipper was. Thus, EIA staff compared shipper names with lists of companies from other sources to classify each shipper. Four sources were used for comparison: (1) Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition"; (2) Benjamin Schlesinger and Associates, Inc., *Directory of Natural Gas Marketing Service Companies*, Eleventh Edition (May 1997) (a proprietary source); (3) Energy Planning, Inc., *Directory of Natural Gas Consumers*, 5th Edition (1996) (a proprietary source); and (4) Form EIA-860, "Annual Electric Generator Report."

The list of electric utilities from Form EIA-860 included combination electric and gas utilities. Shippers that appeared in this list and that used natural gas as either the primary or alternative source of fuel for electricity generation were classified as electric utilities, even the combination companies. Combination companies that did not use natural gas as the primary or alternative source of fuel for electricity generation were classified as local distribution companies. For example, Baltimore Gas and Electric Company was classified as an electric utility while Atlanta Gas Light Company was classified as a local distribution company.

The final set of shipper categories is as follows:

- Electric utilities (including combination electric and natural gas utilities for which natural gas is the primary or alternative source of fuel for generating electricity)
- Industrial companies (including independent power producers, cogenerators, and commercial firms)
- Local distribution companies (including intrastate pipeline companies and combination electric and natural gas utilities for which natural gas is not the primary or alternative source of fuel for generating electricity)
- Marketers
- Interstate pipeline companies
- Other companies (including producers and gatherers and companies that could not otherwise be classified).

Underground Natural Gas Storage Data

Each month, on the Energy Information Administration's Form EIA-191, "Underground Natural Gas Storage Report," U.S. storage operators are required to report their current estimates of injections and withdrawals occurring in the previous month at each site they operate. In addition, on an annual basis, each operator is expected to report any change to total, base, or working gas capacity, as well as daily deliverability (see Glossary) that may have occurred at the site during the previous calendar year.

These data have been compiled in a database with each site identified by such criteria as ownership type (interstate pipeline, local distribution company, or independent operator), type of facility (depleted reservoir, salt cavern, aquifer, or mine), and interconnecting pipeline. The combination of this information, in association with the capability (capacity level) of connecting pipeline systems, with an approximate location, permitted an analysis and a way of estimating the impact of storage availability and operational capability on service to producers and shippers and pipeline utilization.

Maps and Mapped Data

The geographic displays in this report were produced, in whole or in part, using the EIAGIS-NG Geographic Information System. The system consists of a series of site-specific databases and digitized pipeline maps residing in a personal computer (PC) environment. The pipeline map files were developed from publicly available sources, although in some cases, more detailed maps were provided by the individual pipeline companies. Currently, the EIAGIS-NG contains map data for 61 interstate and 71 intrastate pipeline companies located in the United States, and 18 interstate pipeline companies located in Canada.

Many of the interstate pipeline map files also contain profile (attribute) data for each pipeline segment, such as pipe diameter, maximum allowable pressure, looping, etc. These data were compiled from the pipeline system schematic contained in the Form FERC-576, "System Flow Diagram." The individual databases supporting the system include the following pipeline-related data:

- Compressor stations
- Delivery points
- Receipt points
- Major interconnections
- State border crossings and capacity levels.

Nonpipeline-related databases include:

- Underground storage sites
- Planned underground storage projects
- Proposed construction projects
- Local distribution company service areas
- Export and imports
- Market centers/hubs
- Electric power plants, etc.

The principal geographic data used in this report to compile capacity estimates were the pipeline maps and their receipt, delivery, interconnection, and compression station points. Planned and existing underground storage site data were used to develop estimates of supplemental peak-day deliverability to the pipeline network.

U.S. Regional Definitions

The six U.S. regions used in this report were based in whole or in part upon the 10 Federal regions originally defined by the Bureau of Labor Statistics. The groupings are as follows:

Northeast Region – *Federal Region 1*: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. *Federal Region 2*: New Jersey, and New York. *Federal Region 3*: Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia.

Southeast Region – *Federal Region 4*: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee.

Midwest Region – *Federal Region 5*: Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin.

Southwest Region – *Federal Region 6*: Arkansas, Louisiana, New Mexico, Oklahoma, and Texas.

Central Region – *Federal Region 7*: Iowa, Kansas, Missouri and Nebraska. *Federal Region 8*: Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming.

Western Region – *Federal Region 9*: Arizona, California, and Nevada. *Federal Region 10*: Idaho, Oregon, and Washington.