

Impact of Interruptible Natural Gas Service on Northeast Heating Oil Demand

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Preface

Impact of Interruptible Natural Gas Service on Northeast Heating Oil Demand was undertaken at the request of U.S. Secretary of Energy Bill Richardson to assess the extent of interruptible natural gas contracts and their effect on heating oil demand in the Northeast. An earlier report with policy recommendations was issued by the Department of Energy's Office of Policy in November 2000 that examined the effect of interruptible contracts in New England. The current report expands the geographic scope of the analysis by including New Jersey, New York, and Pennsylvania and presents a more comprehensive assessment of gas service interruptions, the responses of different types of customers, and the effects on the distillate fuel oil market.

The report is based on the results of two surveys developed by the Energy Information Administration (EIA): Form EIA-903, "Natural Gas Service Interruptions in the Northeast During December 1999, and January and February 2000," and Form EIA-904, "Customer Survey of Natural Gas Service Interruptions in the Northeast During January and February 2000." The respondents to Form EIA-903 were 34 natural gas companies who provided 94 percent of natural gas deliveries to interruptible gas customers in the Northeast in 1998, while respondents to Form EIA-904 were 97 end users in New England who were identified by their suppliers as experiencing natural gas interruptions in the winter of 1999-2000.

The report has five chapters and four appendices. Chapter 1 gives an overview of the Northeast heating oil and natural gas markets during the winter of 1999-2000. Chapter 2 provides background information on natural gas markets in the Northeast and the role of interruptible contracts in the region's energy market. Chapter 3 examines the main factors that affect heating oil and natural gas prices by comparing market events during

other periods of sharp price increases in recent years. Chapter 4 provides an analysis of the information derived from the EIA surveys of gas suppliers and customers, and Chapter 5 summarizes the market implications.

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Executive Summary

The Natural Gas and Heating Oil Market in January-February 2000

Natural gas and distillate fuel oil¹ prices can rise rapidly during winter peak-demand months especially when stocks are low and demand increases quickly. Such was the case in the Northeast in mid-January 2000 when a sudden surge of cold weather blanketed the area, substantially increasing demand. During the week ended January 22, 2000, temperatures in the Northeast shifted from being up to 17 percent warmer than normal to 24 percent colder than normal. This large temperature shift drastically increased heating requirements at a time that the market was experiencing supply constraints. Distillate fuel oil stocks were low, and the colder weather led to distillate delivery problems as well as natural gas capacity constraints in some areas. The low temperatures and high gas demand also triggered service interruptions to natural gas customers without guaranteed (firm) service contracts, which led to purchases of other fuels, especially petroleum products. These elements came together to create rapid and extremely large price increases in the distillate fuel oil and natural gas markets.

- ! From January 11 to January 20, 2000, spot prices (market prices for immediate delivery) for natural gas in the New York City market rose from \$2.65 to \$15.34 per million Btu (MMBtu), an increase of nearly 500 percent. Natural gas prices at the Algonquin Pipeline citygate, which serves the Boston area, peaked at \$12.54 per MMBtu on January 20, 2000.
- ! Between January 14 and February 4, 2000, New York Harbor spot prices for home heating oil rose by 133 percent while residential prices for home heating oil in New England increased by 66 percent.

The high prices and supply constraints in both markets caused great concern. Public meetings were held in February 2000 to discuss what may have caused the extreme market conditions in the Northeast and how to avoid such problems in the future. Some meeting

participants pointed to interruptible gas service contracts as a major contributor to the fuel oil price spikes because of the increased demand for backup fuel when gas deliveries were suspended. Under interruptible contracts, a customer agrees to gas service without a guarantee of supplies in return for discounted rates. Roughly 10 to 15 percent of all natural gas deliveries by interstate pipeline companies (excluding transportation for other pipelines) in 1997 were on an interruptible basis.

In February 2000, Senator Joseph Lieberman asked the Department of Energy (DOE) to study how service interruptions by natural gas suppliers affected the distillate fuel oil market this past winter. To meet his request and to evaluate other factors affecting oil and gas markets, the Energy Information Administration (EIA) surveyed major gas suppliers and customers in New England and the Middle Atlantic States (New Jersey, New York, and Pennsylvania) on the extent of natural gas service interruptions during the 1999-2000 heating season and the types of fuels burned as alternatives to natural gas. Two surveys were conducted: Form EIA-903, "Natural Gas Service Interruptions in the Northeast During December 1999, and January and February 2000," and Form EIA-904, "Customer Survey of Natural Gas Service Interruptions in the Northeast During January and February 2000." The respondents to Form EIA-903 were 34 natural gas companies who accounted for nearly all of the volumes delivered to end users under interruptible contracts in the Northeast in 1998, while respondents to Form EIA-904 were 97 end users in New England who received natural gas under interruptible service contracts (see Appendix B for details on the data collection methodology).

This report examines the data collected from these companies in the context of the overall energy market in the Northeast. The main purpose of the report is to provide insight into the level and duration of interruptions of natural gas service and the extent of fuel switching between natural gas and other energy markets. An earlier EIA report *The Northeast Heating Fuel Market: Assessment and Options* that addressed the ability of Northeast natural gas customers to switch to distillate fuel oil was released in May 2000. In addition, a report with policy recommendations was issued by DOE's Office of Policy in November 2000 that addressed the role of interruptible gas contracts in the New England heating oil market.

¹Distillate fuel oil is a general classification for one of the fractions produced from crude oil. It is used primarily for space heating and on- and off-highway diesel engine fuel as well as power generation. It includes products known as No. 1, No. 2, and No. 4 fuel oils and No. 1, No. 2, and No. 4 diesel fuels.

Reductions in Natural Gas Service

An interruption of natural gas service is said to occur if gas service was discontinued to comply with a specific order by the local distribution company (LDC) or pipeline company and the service disruption was not tied to a previously determined schedule as to occurrence or duration. Thus the end user could not predict precisely when or even if a service disruption would occur. For example, customers holding interruptible service contracts would expect that service likely will be suspended sometime during the winter but the date and duration of the interruption(s) would be completely unknown.

Some energy customers contract for natural gas services for only a short period or on a seasonal basis. Service suspensions specified in seasonal or short-term contracts are not considered an interruption as long as the terms of the arrangement are not disrupted during the period of performance for the contract. Interruptions can be triggered by system operating conditions and/or temperatures. The supplier LDC or pipeline company has the right to suspend service at any time that it deems necessary to maintain system integrity or in order not to compromise service to its firm service customers. In some contracts with temperature-controlled provisions, service is suspended automatically when the outside temperature falls below a certain threshold and is not resumed until temperatures are above the threshold for a sustained period determined by the LDC.

Natural gas service may also be suspended voluntarily by customers with switchable or dual-fuel capability, even when delivery capacity is available. Some demand shifted from natural gas to distillate fuel oil during January and February 2000 because of the relative fuel prices. However, this behavior was motivated by market conditions under competition and would not be considered a service interruption.

The interruption data cited in this report are based on the volumes reported by gas suppliers on Form EIA-903. As subsequently discovered, these volumes included reductions in gas consumption because of economic switching and termination of seasonal service in addition to interrupted volumes. Although these *reported interruptions* exceed shifts from gas service due to unexpected interruptions alone, they are informative as an upper limit on volumes of fuel switching owing to gas service interruptions.

Highlights

During the peak week (ended January 22), reported gas service interruptions in the Northeast represented 49 percent of the LDCs' and pipeline companies' planned service levels to interruptible customers for that week. Overall, however, interruptions were limited and no firm service customer was interrupted. Approximately 12.4 trillion Btu or 13 percent of the total planned level of natural gas service to interruptible customers was interrupted in the Northeast during January and February 2000.

The reported gas service interruptions for customers in the Northeast with distillate fuel oil as their backup were the equivalent of between approximately 78 and 84 thousand barrels of distillate per day during the peak week. This corresponds to about 11 percent of the average daily distillate consumption in the Northeast in January 2000 and a smaller but immeasurable share of distillate consumption in the peak week. The greatest level of interruptions was focused on the third week of January, when interruptions were much greater than for any other week in January or February. Most (76 percent) of the interruptions during January and February 2000 occurred in the third and fourth weeks of January.

The estimated range of 78 to 84 thousand barrels per day of potential incremental distillate consumption is consistent with previously published estimates,² which ranged up to 100 thousand barrels per day for distillate fuel oil for both interruptions and economic switching combined. In fact, if the larger estimates are reliable, the 78 to 84 thousand-barrel-per-day range shows that more than 15 percent of the fuel shifting from gas to distillate is due to factors other than gas service interruptions. These distinctions have important implications for further analysis or policy formulation. Understanding motivations behind customer behavior is essential to understanding gas and fuel oil markets at critical times of the year.

Actual *purchases* of distillate fuel oil resulting from the interruptions, however, likely were less than the calculated equivalent volumes, because some customers drew down inventories slightly while others simply reduced operations or temporarily shut down. Data from a limited sample of interrupted customers in New England

²Energy Information Administration, *The Northeast Heating Fuel Market: Assessment and Options*, SR/OIAF/2000-03 (Washington, DC, May 2000), p. 44. Petroleum Industry Research Foundation, Inc., *What Happened to Heating Oil?* (March 2000), p. 6.

who responded to Form EIA-904 indicate that less than half the volume of gas interrupted during January and February was replaced with distillate purchases.³ Scaled-back operations in the Middle Atlantic, as indicated by anecdotal evidence, would have further reduced the demand for distillate fuel oil.

Additional highlights include the following:

- ! **Interruptions represented a larger share of planned service levels in New England than in the Middle Atlantic.** During the peak week ended January 22, reported interruptions in New England were roughly equal to planned service levels, meaning that virtually no gas was delivered under interruptible service contracts. In contrast, interruptions in the Middle Atlantic during that week were only 39 percent of planned service levels. This relative pattern is present during the full 2 months, although at lower levels. Interruptions totaled 3,786 billion Btu in New England and 8,578 billion Btu in the Middle Atlantic, representing 28 percent and 11 percent, respectively, of planned service levels to interruptible customers in the region.
- ! **Both large-volume and small-volume customers who responded to the EIA-904 maintained a fairly constant level of distillate inventories.** Throughout the 8-week period, the large customers, which included power producers, maintained their inventories within a narrow range: 90 percent full at its maximum on the week after the largest interruptions and 79 percent full in late February. On average the smaller customers maintained weekly inventories at 68 percent of their distillate capacity with 79 percent as the high and 63 percent as the low during the period.
- ! **The large-volume and small-volume customers have contrasting distillate inventories and inventory capacities.** Based on maximum potential

interruption levels, the small customers had 14.3 days of distillate storage capacity available and 9.8 days of distillate inventories on hand. In contrast, large customers had only 3.7 days of storage capacity and 3.1 days of inventory.

- ! **Customers in the education, health, and housing/lodging industries accounted for 30 percent of the interruptions known by industry type⁴ in the Northeast during January and February 2000.** Customers in these categories relied less heavily on distillate as a backup fuel and had more inventories on hand than the average interrupted customer. Like other customers interrupted, though, they made purchases to replace fuels burned during the interruption in natural gas service in order to maintain onsite stocks.

This study provides better information than previously available on the magnitude of fuel switching from natural gas to alternative fuels. It also contains information on customer behavior during the winter heating season, including times of intense demand when some portion of gas service is not available. This information highlights the complex interactions between interruptible gas service and other fuel markets. Customer reactions to gas service interruptions reflect varying operational objectives and economic circumstances.

The additional demand in the distillate market from interrupted gas customers may not have been as large as previously thought. However, if supplies are tight, additional purchases may have a disproportionate price response, so even small volumes of additional purchases may be difficult to accommodate. Further, although interruptible contracts may have had a limited role in recent fuel oil price spikes, that influence may increase over time as gas markets are expected to expand relative to the distillate fuel oil markets, especially heating oil, in the Northeast.

³The findings from the EIA-904 customer survey are provided as illustrative, but they are not statistically valid for the overall regional market.

⁴About 50 percent of the volumes reported by respondents to Form EIA-903 could be categorized by primary business of the customer.

1. The Northeast Natural Gas and Heating Oil Markets in the Winter of 1999-2000

This report was undertaken at the request of U.S. Secretary of Energy Bill Richardson to assess the impact of interruptible natural gas contracts on heating oil demand in the Northeast. An earlier report with policy recommendations was issued by the Department of Energy's Office of Policy in November 2000 that examined the effect of interruptible contracts in New England. The current report expands the geographic scope of the analysis by including New Jersey, New York, and Pennsylvania and presents a more comprehensive assessment of gas service interruptions, the responses of different types of customers, and the effects on the distillate fuel oil market.

Overview

Price spikes and petroleum product shortages dominated the energy market in the Northeast for several weeks in the winter of 1999-2000 as a sudden drop in temperatures led to a sharp increase in demand for heating fuels. Despite generally warmer-than-normal temperatures during much of last winter, the Northeast had a period of cold weather from mid-January to early February 2000 during which daytime temperatures ranged between 10 and 20 degrees Fahrenheit for over a week in many areas (Figure 1).

The colder weather increased demand for energy in all end-use markets. Residential and commercial consumers increased their use of distillate fuel oil¹ to heat their homes and businesses and power companies increased their use to meet electricity demand. Demand for distillate fuel oil was expanded further as power companies and industrial customers with dual-fired facilities increased their use of distillate fuel oil by switching from natural gas, either as required by their gas supply contracts or to avoid the higher price of natural gas.

The unexpected rapid increases in demand for distillate fuel oil coincided with serious delivery problems. Icebound rivers and high winds along the New York, Connecticut, and Massachusetts coastlines hindered the arrival of new distillate fuel oil into New York and Boston harbors. In part, because of weather-related delays in docking and unloading tanker and barge deliveries, the new supply that did arrive commanded higher prices.

Also, supply deliveries within the region were impeded by icy roads that slowed truck deliveries.

The colder weather also strained the capacity of the natural gas pipeline system in the Northeast. The increase in heating demand caused natural gas deliveries to expand to the peak-day sendout capacity of a number of natural gas systems.² This forced natural gas companies to suspend deliveries to a number of interruptible customers as per the service contract (see box, "Defining an Interruption," p. 2), so that suppliers could meet the demand of their firm service customers and maintain system capability. In addition, several pipeline companies issued operational flow orders (see box, "Operational Flow Orders," p. 3) at locations serving the Northeast, putting further pressure on spot market prices.³

Natural Gas Spot Prices at Northeast Markets Reached High Levels in January 2000

Natural gas spot prices spiked sharply in the Northeast as cold weather blanketed much of the area. Daily spot prices show the extent by which weather was a factor in creating these rapid price spikes. Natural gas spot prices at the Boston citygate⁴ opened for the month of January at \$2.77 per million Btu (MMBtu) and remained less than \$3.00 until January 13 (Figure 2). Then prices surged, peaking on January 20, during the height of the severe weather, at a high of \$12.54 per MMBtu, and stayed above \$9.00 for the following 3 days.

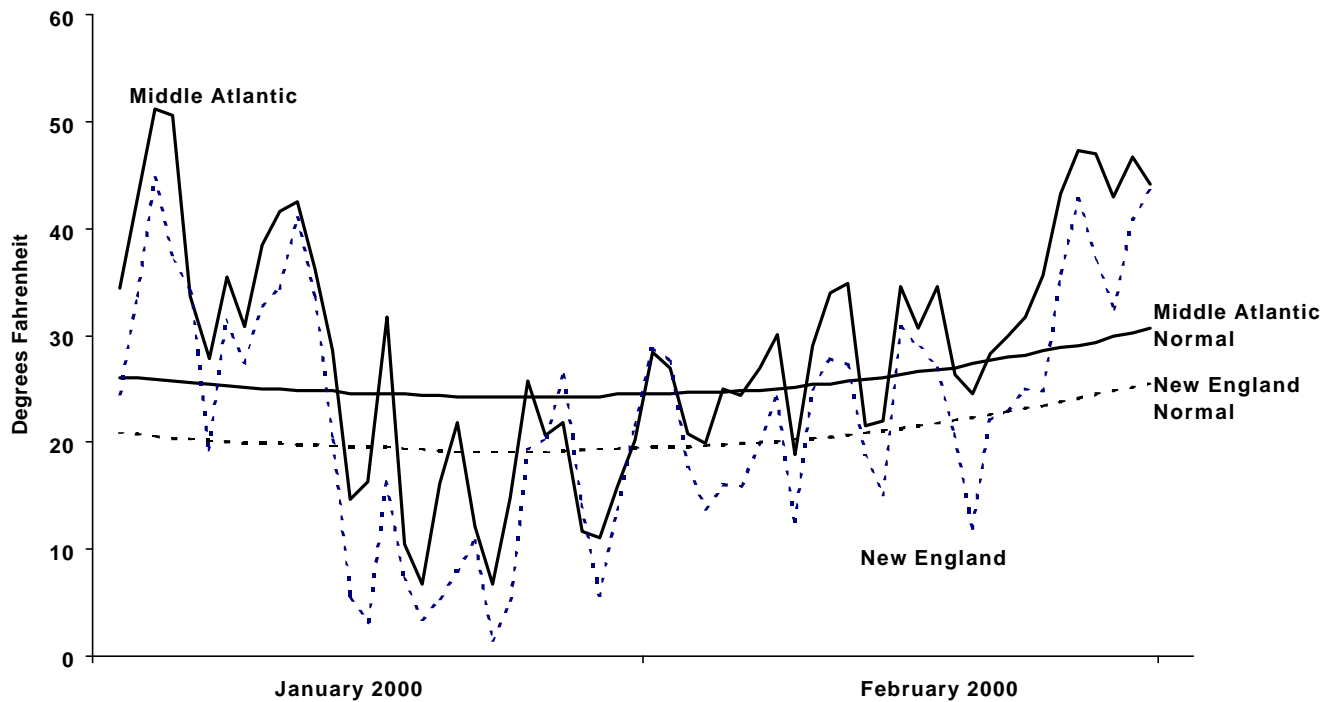
¹The "distillate fuel oil" designation comprises Nos. 1, 2, and 4 heating oils and diesel fuels. Generally, home heating oil is a high-sulfur No. 2 fuel oil. No. 1 distillate oil and No. 2 low-sulfur diesel fuel can also be used for home heating if necessary and available. Price usually precludes their normal use for these purposes.

²For example, regional deliveries in New England hit an unprecedented sendout of 3.4 billion cubic feet per day.

³Spot market prices, also known as "cash prices," are the market prices for immediate deliveries of the product.

⁴The Algonquin citygate spot price (as reported by Financial Times in the *Gas Daily*) is used as the approximate measure for the Boston citygate.

Figure 1. Daily and Normal Temperatures in New England and the Middle Atlantic States, January and February 2000



Note: Daily temperatures were computed from daily observations available from the National Climate Data Center website and weighted by housing units within a region. Normal is the 30-year average temperature.

Source: Energy Information Administration, Office of Oil and Gas, derived from National Climate Data Center data (<http://www.ncdc.noaa.gov/ol/climate/climatedata.html>).

Defining an Interruption

In this analysis, an interruption of natural gas service is said to occur if the end user discontinued gas consumption to comply with a specific order by the local distribution company (LDC) or pipeline company and the service disruption was not tied to a previously determined schedule as to occurrence or duration. Thus the end user could not predict precisely when or even if a service disruption would occur. For example, customers holding interruptible service contracts would expect that service would likely be suspended sometime during the winter but the date and duration of the interruption(s) would not be known beforehand.

Some interruptible customers contract for natural gas services for only a short period or on a seasonal basis. Service suspensions specified in seasonal or short-term contracts generally should not be considered an interruption as long as the service under the arrangement is not disrupted during the period of performance for the contract. Natural gas service also may be suspended voluntarily by customers with switchable or dual-fuel capability, even when delivery capacity is available, because of the relative fuel prices. Survey data presented in this report are *reported interruptions*, based on Form EIA-903, which included reductions in gas consumption because of economic switching and termination of seasonal service in addition to interrupted volumes. The additional distillate fuel oil demand from customers who voluntarily choose to switch from natural gas despite the availability of gas service could be significant and would have the same impact on petroleum markets as equivalent demand owing to interruptions. Although some of this activity was reported by respondents to Form EIA-904, data are not available to quantify reliably the extent of seasonal or voluntary fuel switching in this analysis.

Operational Flow Orders

When FERC Order 636 was instituted in 1993 and open access became the norm, the Federal Energy Regulatory Commission (FERC) recognized that pipeline operators needed a mechanism that would allow them to maintain the operational integrity of their system during periods of potential flux and when the system is under stress. Conditions such as extreme weather, unscheduled downtime on critical parts of the system, and extreme imbalance situations are some of the reasons pipeline companies cite as the need for such short-term control.

Operational flow orders (OFOs) (also called system emergency orders or critical period measures) are the mechanisms put in place to permit this control. In effect, these orders permit the pipeline operator during emergency situations to restrain shipper activities and to curtail services that could result in imbalances and service interruptions. For instance, OFOs allow the operator to reduce or eliminate flow tolerances and require shippers to maintain a strict daily balance between receipt and delivery volumes. The OFO also may restrict or eliminate such services as intraday nominations, the use of secondary receipt and delivery points, firm storage withdrawals, and interruptible storage services. As an enforcement measure, pipeline companies can exact penalties for violations. Under an OFO, pipeline companies generally perform to the level of their contract obligations, but the strict operational inflexibility does tend to restrict the flow volume in practice.

Despite their utility, OFOs are controversial. Some have suggested that the direct consequence of measures taken under OFOs during the past few years was to lessen short-term trading and shipping flexibility on the part of customers. Also many critics maintained that pipeline operators were given too much discretion regarding what constitutes an OFO situation and that operators had incentives for maintaining the OFO for longer than is needed.

In an effort to minimize the use of OFOs, FERC issued new rules that require each pipeline company to take system-wide measures to ensure that OFOs are used for only the most serious circumstances. In FERC Order 637, issued in February 2000, pipeline companies were directed to change their tariffs to incorporate these new requirements, or to explain and describe how current tariff and operating procedures are consistent with the new requirements. Each pipeline company tariff must now include:

- c Clear, pipeline-specific standards, based on objective operational conditions, for when OFOs begin and end
- c A stated obligation to provide information about the status of conditions during an OFO as soon as possible
- c What steps or remedies will be taken before issuing an OFO so as to provide as much advance warning as possible
- c Standards for different levels or degrees of severity for OFOs so that penalties correspond to degree of emergency
- c Specific reporting methods for providing later information on why an OFO was issued and lifted.

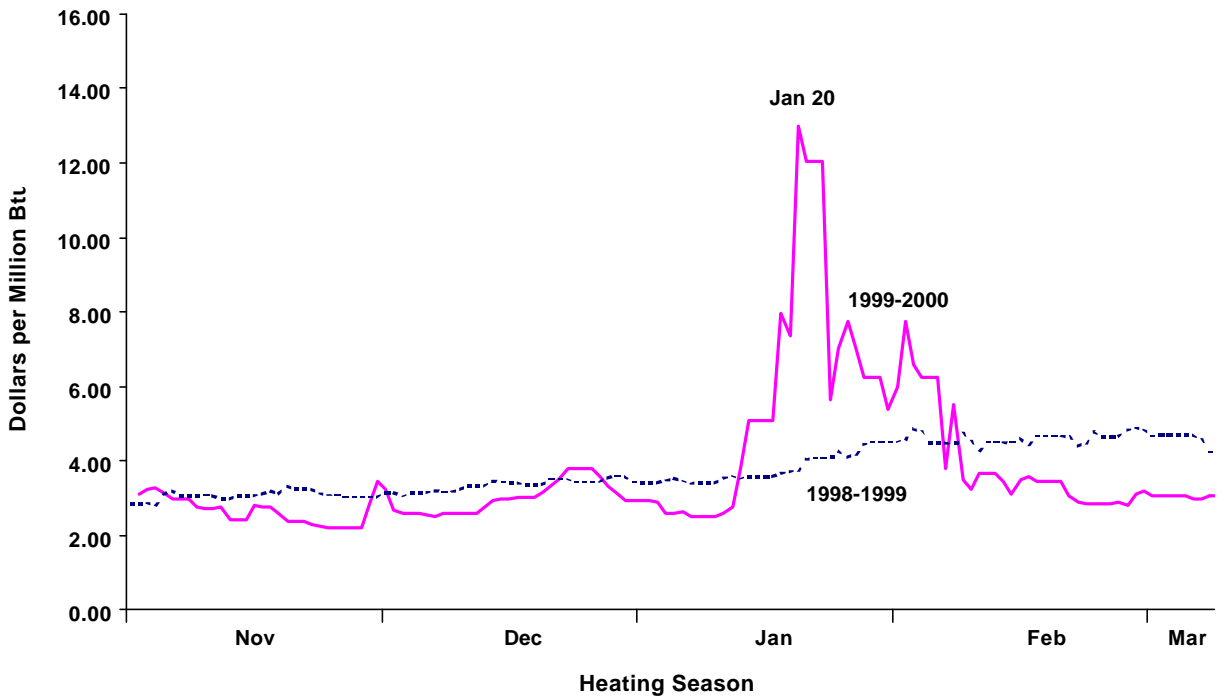
Pipeline companies can implement these changes into their tariffs on an individual basis: there are no general requirements in regards to specific language that must be used. FERC also ruled that pipeline companies must credit all revenues from penalties (net of cost), including OFO penalties, to shippers.

The same rapid increase and decrease in natural gas spot prices occurred in the New York City market (Figure 3).⁵ Prices at the New York citygate peaked at more than \$15.00 per MMBtu on January 20, 2000, and traded between \$8.00 and \$10.00 for several days during the period. The average spot price in January 2000 was \$5.98 per MMBtu, which is 57 percent higher than the

4-year average for the month of January and more than double the average price in January 1998. In contrast to the previous three winters (beginning in 1997), during which spot prices declined in the latter part of the season, spot prices remained relatively high in the last 2 months of the 1999-2000 heating season.

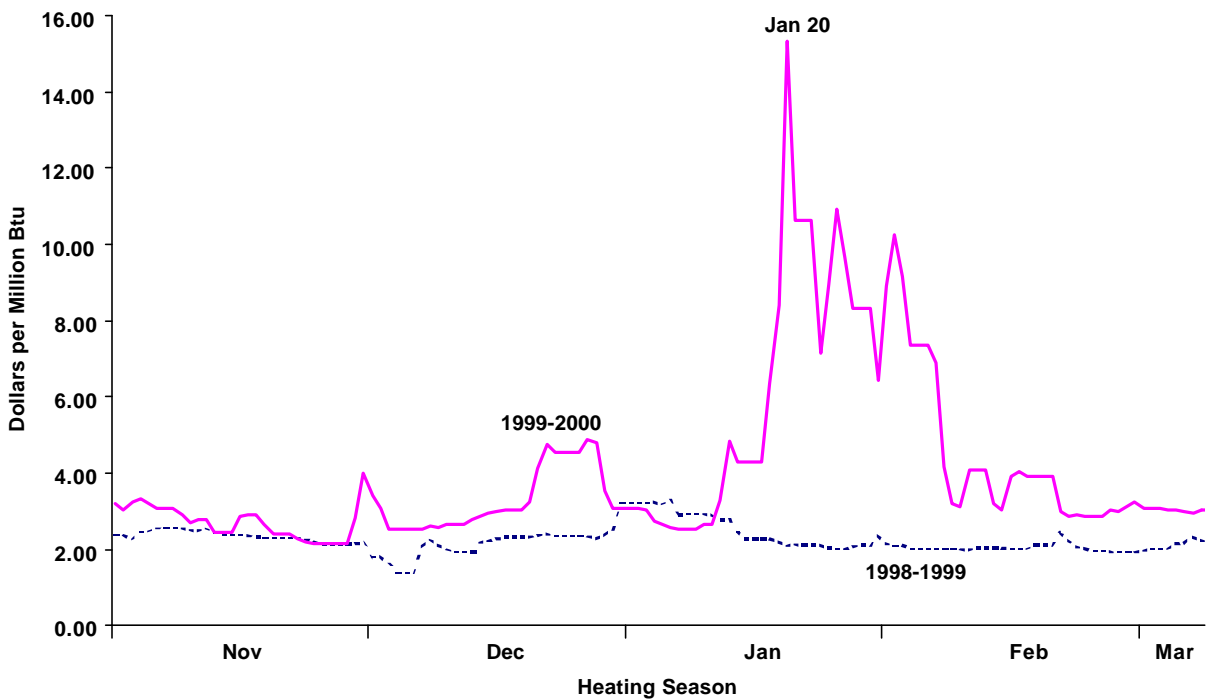
⁵The prices for gas traded at Transco Zone 6 in New Jersey are used as indicators of spot prices for the New York citygate. See *GasDaily* (Arlington, VA: Financial Times).

Figure 2. Spot Price of Natural Gas at the Boston Citygate, Heating Seasons 1998-1999 and 1999-2000



Source: Algonquin citygate spot price, Financial Times, *Gas Daily* (various issues).

Figure 3. Spot Price of Natural Gas at the New York Citygate, Heating Seasons 1998-1999 and 1999-2000



Natural gas consumption in January and February 2000 also increased by a significant percentage in both New England and the Middle Atlantic states. For example, for both January and February, consumption of natural gas for all sectors was 13 percent higher in Connecticut than year-earlier levels and 4 percent higher in Pennsylvania. The increased consumption also resulted in extensive use of underground storage stocks.

About 3,101 billion cubic feet (Bcf) of working gas storage⁶ was on hand at the end of October 1999, which was 112 Bcf more than the average (2,989 Bcf) for the previous five years (1994-98) and the second-highest level in 7 years.⁷ Net withdrawals during the next 2 months were relatively small (517 Bcf or 21 percent below the 5-year average of 625 Bcf). But net withdrawals from U.S. natural gas storage facilities for January 2000 exceeded the previous single-month record by almost 30 Bcf as 780 Bcf was taken from storage to meet demand. The Consuming East region⁸ reported net withdrawals of 527 Bcf or 67 percent of the January total. The week of January 28, 2000, was the largest recorded weekly drawdown from eastern storage facilities with 158 Bcf withdrawn. The cold weather carried over into the first week of February, and net withdrawals for February in the Consuming East region were 289 Bcf or 13 percent more than withdrawals in February 1999. The relatively high prices that continued throughout most of the heating season probably contributed to the increased utilization of storage during a generally warmer-than-normal winter, as companies chose to use their lower-cost inventories as they expected prices to decline in time to replenish stocks.

Low Distillate Stocks Set the Stage for Heating Oil Price Spikes in January 2000

U.S. distillate inventories (including both heating oil and diesel fuel) were at typical stock levels of 145 million barrels on October 1, 1999,⁹ but were well below normal by the end of December and even more so by late

⁶Working gas is the volume in an underground storage reservoir available for withdrawal. A volume of gas (known as base gas or cushion gas) is needed as permanent inventory in a storage reservoir to maintain adequate pressure and deliverability rates.

⁷Energy Information Administration, *Natural Gas Weekly Market Update* (November 8, 1999), Web Site: <http://www.eia.doe.gov>.

⁸A regional storage designation used by the American Gas Association. It includes all states east of the Mississippi River except Alabama and Mississippi and also includes Iowa, Nebraska, and Missouri.

⁹Data for distillate stocks and consumption are from the Energy Information Administration Oil and Gas Information Research System, November 1, 2000.

January. From December 17, 1999, to January 14, 2000, distillate stocks at the primary level fell by 10 million barrels to 119 million barrels, which was 5 million barrels below the low end of the normal range¹⁰ despite warmer-than-normal temperatures. At the time, it was suggested that Y2K precautionary stocking at the consumer level was a possible cause for the sharp decline in supplier stocks prior to the onset of cold weather.

This pattern was also seen in the New England and Central Atlantic states.¹¹ The pace of the distillate stock drawdown was remarkable, particularly in New England, where stocks fell from more than 13 million barrels in early December to less than 4 million barrels by late January. Stocks in New England were consumed at the rate of 289 thousand barrels per day in December and 363 thousand barrels per day in January, implying that just over 12 days of supply remained in storage at the end of January. In the Central Atlantic, the level of stocks was much higher, and the pace of decline was not as dramatic, but went on longer, falling from almost 33 million barrels at the beginning of November to 18 million barrels by late January. Daily consumption rates in the Central Atlantic averaged 667 thousand barrels in December and 694 thousand barrels in January, with 26 days of supply remaining in storage at the end of January.

Refinery outages at the end of the week of January 21 resulted in a temporary loss of new supply, and sent more buyers into the distillate spot market. When refiners cannot produce enough supply to meet their contracts, customers must enter the spot market to purchase the product from others. Weekly data indicate that for the 4-week period ending February 4, 2000, East Coast distillate stocks fell by almost 20 million barrels or 41 percent during that time, and some terminal outages occurred.

The rapid depletion of stocks led to progressive increases in spot market prices. Low distillate stocks leave little cushion to absorb sudden changes in supply or demand that increase the possibility of price runups. Between January 14 and February 4, 2000, New York Harbor spot prices for home heating oil rose from \$0.76 to \$1.77 per gallon,¹² a 133-percent increase. Retail prices of home

¹⁰Normal range estimated based on: Energy Information Administration, *Weekly Petroleum Status Report*, DOE/EIA-0208(2000-2) (Washington, DC, January 14, 2000), Table A1.

¹¹The Central Atlantic includes Delaware, Maryland, New Jersey, New York, Pennsylvania, and the District of Columbia.

¹²There are 42 gallons of heating oil per barrel.

heating oil and diesel quickly rose in response. In the 3 weeks between January 17 and February 4, New England residential heating oil prices rose by 66 percent from \$1.18 to \$1.97 per gallon. During the same period, retail diesel fuel prices rose by 47 percent from \$1.44 to \$2.12 per gallon.

The market pressures were resolved in February 2000 with the arrival of new supply and a return to warmer weather. Most of the new supply came from imports attracted by the high prices. Prices receded both in the spot markets and at the retail level, although high crude oil prices continued to keep distillate fuel oil prices high relative to the previous year.

Concerns About High Prices and Supply Constraints

The high prices and supply constraints in the Northeast during January and February 2000 raised many questions and caused great concern last winter, particularly since a large percentage of households in the region, especially in New England, use oil as their main heating fuel. In February 2000, Secretary of Energy Bill Richardson held a series of public meetings with various government, industry, and consumer representatives to discuss what may have caused the extreme market conditions in the Northeast and how to avoid such problems in the future. During the meetings, some participants pointed to interruptible gas service contracts as a major contributor to heating oil price spikes because of the increased demand for backup fuel when gas deliveries are suspended. Under interruptible contracts, a customer agrees to gas service without guaranteed performance in return for discounted rates. In many if not most cases, customers turn to distillate fuel oil or another type of fuel oil as an alternative fuel when gas service is disrupted.

Also in February 2000, Senator Joseph Lieberman asked the Department of Energy to study the impact of service interruptions by natural gas suppliers on the home heating oil market in the Northeast this past winter (see Appendix A). Specifically, he asked for an investigation of “the extent of interruptible natural gas contracts and the level of new demand they may be adding to the heating oil market in the Northeast.” He also asked:¹³

¹³In addition, Senator Lieberman asked if interruptible gas contracts threaten the stability of the home heating oil market and if so what steps should be taken to alleviate the problem (see Appendix A for a copy of his letter). Such policy questions are beyond the scope of the Energy Information Administration and are not addressed in this analysis.

- ! At what point do natural gas contractors refuse service to interruptible gas contract-holders?
- ! How often in the recent past have users of interruptible gas contracts created a significant unforeseen demand on home heating oil in the Northeast?
- ! What other backup fuels do interruptible contract users utilize?

To meet Senator Lieberman’s request and to evaluate concerns raised at the public meetings Secretary Richardson directed DOE’s Office of Policy and the Energy Information Administration (EIA) to undertake a study of how service interruptions by natural gas suppliers affected the home heating market this past winter. In response, EIA surveyed major gas suppliers and customers in the Northeast on the extent of natural gas service interruptions during the 1999-2000 heating season and the types of fuels burned as alternatives to natural gas.¹⁴ Data compiled from companies in New England were used as the basis for a report with policy recommendations issued by DOE’s Office of Policy in November 2000 that addressed the role of interruptible gas contracts in the New England heating oil market.¹⁵ An earlier EIA report that addressed the ability of Northeast natural gas customers to switch to distillate fuel oil was released in May 2000.¹⁶

Report Purpose and Structure

This report expands upon DOE’s and EIA’s two earlier reports and examines natural gas interruptions in the context of the overall energy market in the Northeast. The current report is intended to provide a more

¹⁴In order to assess the gas interruptible market, EIA developed two surveys: Form EIA-903, “Natural Gas Service Interruptions in the Northeast During December 1999, and January and February 2000,” and Form EIA-904, “Customer Survey of Natural Gas Service Interruptions in the Northeast During January and February 2000.” The respondents to Form EIA-903 were 34 natural gas companies who accounted for 94 percent of the volumes delivered to interruptible end users in the Northeast in 1998, while respondents to Form EIA-904 were 97 end users in New England who receive natural gas under interruptible service contracts (see Appendix B for details on the data collection methodology).

¹⁵U.S. Department of Energy, *The Role of Interruptible Natural Gas Customers in New England Heating Oil Markets: A Preliminary Examination of Events in January-February 2000*, DOE/PO-0063 (Washington, DC, November 2000).

¹⁶Energy Information Administration, *The Northeast Heating Fuel Market: Assessment and Options*, SR/OIAF/2000-03 (Washington, DC, May 2000).

complete picture of regional interruptions in gas service, the responses of interruptible gas customers, and impacts on the distillate fuel oil market. The geographic scope of the study has been extended beyond New England to include New York, New Jersey, and Pennsylvania.¹⁷ An expanded geographical scope and more complete data are important because of the relatively large volumes of interruptible gas service and sizeable distillate market in the larger region, and because Senator Lieberman's request for a DOE study applied to the entire Northeast region. The report also provides more detail on interruptions by type of customer, such as power plant vs. small commercial facility. In addition, the analysis compares the January–February 2000 price spike with other recent price spikes to determine the factors common to each of the events and to provide a framework for better understanding the impact of gas service interruptions on distillate fuel oil markets.

The report has five chapters and four appendices. Chapter 2 provides background information on natural gas markets in the Northeast and the role of interruptible contracts in the region's energy market. It also discusses the types of alternative fuels used by companies when gas service is interrupted. Chapter 3 examines the main factors that affect heating oil and natural gas prices by comparing market events during other periods of sharp price increases in recent years. It looks at such factors as weather, fuel demand, supply disruptions, stock levels, and service and delivery constraints. Chapter 4 provides an analysis of the information derived from EIA surveys of gas suppliers and customers, and Chapter 5 presents a summary of market implications. The four appendices provide supplemental information and details on the methodology used in the analysis.

¹⁷ In this report, the Northeast comprises the New England and Middle Atlantic states (Census Divisions 1 and 2). New England (Census Division 1 and Petroleum Administration for Defense District (PADD) 1a) includes Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut. The Middle Atlantic (Census Division 2) includes New York, New Jersey, and Pennsylvania.

2. Interruptible Gas Market in the Northeast

Introduction

Energy end users include residential and commercial customers as well as industrial firms and electric utilities. These customer groups have different energy requirements and thus quite different service needs. In the natural gas market, consumers contract for either firm or interruptible service. Residential and small commercial customers such as households, schools, and hospitals use natural gas primarily for space and water heating and need a reliable supply. Such customers require on-demand service with no predetermined quantity restrictions, known as firm service. In contrast, larger commercial, industrial, and electric utility customers often have fuel-switching or dual-fuel capabilities and can receive natural gas through a lower priority and less expensive service known as interruptible service. Energy supply reliability can be effectively handled at the customer level by the ability to switch quickly to an alternative fuel.

The infrastructure for transporting and delivering natural gas is designed and operated primarily to meet the need for firm service. Because the peak demand for natural gas tends to be seasonal, interruptible service contracts allow pipeline and distribution system operators to increase utilization of their fixed assets and better manage costs of service on average. These arrangements allow operators to maximize economic efficiency by meeting the needs of their committed firm service customers while providing service during off-peak periods to interruptible and seasonal customers. At the same time, these arrangements provide opportunities for large-volume energy consumers such as industrial firms and electric generators to attain lower-cost energy supplies. However, the resulting prevalence of dual-fired equipment establishes a framework in which fuel switching is expected, which in turn has the potential for significant impact on multiple fuel markets.

This chapter provides background information on natural gas markets in the Northeast to establish a framework for understanding the role of interruptible contracts in the region's energy market. The discussion includes a description of interruptible contracts and of the alternative fuels used by companies when gas service is interrupted. Service interruptions generally result in the use of onsite stocks of backup fuels as a replacement for natural gas, purchases of backup fuels, or a reduction in operations.

Characteristics of the Northeast Natural Gas Market

The Northeast Region is the most highly populated of the regions¹ and consumes the most energy. Yet natural gas represents a somewhat lower proportion of total energy consumed: 21 percent versus a national average of about 24 percent. However, this share has grown over time; between 1990 and 1997, natural gas consumption in the Northeast grew at a faster average annual rate than overall energy use, 4.9 percent versus 1.2 percent. This growth in natural gas consumption, as well as the spread between natural gas and overall energy use, was among the highest of the regions.

The greatest demand for natural gas in the region occurs during the winter. Overall, the Northeast is the third coldest region and has some of the coldest weather in the nation along its northern tier. Withdrawals from storage are necessary to meet peak demand, since total pipeline capacity entering the region plus regional gas production account for only about two-thirds of the region's peak demand.

Natural gas consumers in the Northeast must rely on an extended interstate pipeline system to bring supplies from outside the region because local production is quite limited. Regardless of the source of the gas, however, its delivery during the heating system depends on a relatively fixed pipeline system. The bulk of the natural gas supply arrives through a single corridor from the Southwest through Pennsylvania and New Jersey, although recent construction projects have substantially increased the supply capability of the interstate pipelines entering the region from Canada. The supply flexibility in the Northeast is more limited than in other regions, which are both closer to the major producing regions in the Southwest and western Canada and which have multi-directional access to storage and other pipeline

¹The six regions examined in this portion of the analysis were the Northeast (Federal Regions 1, 2, and 3), Southeast (Federal Region 4), Midwest (Federal Region 5), Southwest (Federal Region 6), Central (Federal Regions 7 and 8), and Western (Federal Regions 9 and 10). Energy Information Administration, *Deliverability on the Interstate Natural Gas Pipeline System*, DOE/EIA-0618(98) (Washington, DC, May 1998). The Northeast region, as defined in the *Deliverability* report, differs from the Northeast regional designation used elsewhere in this report in that it includes the District of Columbia and four additional states: Delaware, Maryland, Virginia, and West Virginia.

supplies. Supplies within the region reach consumers primarily through local distribution companies (LDCs). An extensive distribution network of pipelines is in place in much of the region (except for Maine, New Hampshire, and Vermont).

End-Use Consumption

Residential and commercial natural gas consumption (mostly space-heating demand) accounts for the largest share of the regional natural gas market (59 percent in 1999). Industrial and electric generation sectors represent 33 and 8 percent, respectively (Figure 4). Consumption by sector varies throughout the year. Daily residential use during February is more than seven times the average in August, the month with the lowest gas consumption (Figure 5). As consumption of natural gas increases, capacity into the region is utilized to a greater extent for short periods of time.

Although natural gas can be stored in the vicinity of major consumption markets, the nature of the gas system causes much of the supply to be provided on a “just-in-time” basis. Limited capability for onsite storage at a customer’s location means that the system must meet customer requirements under a wide range of operating conditions with an upper limit on flow potential. Therefore, this system of just-in-time supply may make unexpected and significant spikes in demand difficult to satisfy.

Natural Gas Supply

Sources of gas in the Northeast include production, imports, transported volumes, and storage withdrawals (Figure 6). Production of natural gas in the region is limited to states in the Middle Atlantic Census division.² Produced volumes are rather small: 8 percent of the total volume delivered to end users in the Middle Atlantic in 1999 and 6 percent of total end-use deliveries in the Northeast as a whole. The Northeast received 59 percent of current supply (excluding storage)³ from other U.S. regions, 18 percent from pipeline imports of Canadian gas, and 3 percent from liquefied natural gas (LNG) imports that were delivered to Massachusetts from overseas. New England, in particular, is highly dependent on flows from other U.S. regions, with 78 percent of

current supply from the domestic transportation network. Although LNG imports represent only a small part of Northeast regional supply, they comprised 9 percent of New England supplies in 1998 and 19 percent in 1999. LNG volumes more than doubled in 1999 to 129 billion cubic feet (Bcf) compared with 62 Bcf in 1998.

The key issue for the natural gas infrastructure is the ability of the supply system to meet gas requirements at times of peak demand. Although delivery capability depends primarily upon the pipeline infrastructure, there is some operational flexibility that can expand deliverability although usually at increasing costs. System operators rely on various methods to manage demand and obtain suitable supplies. To ensure delivery to customers who contract for firm service, supplies from the pipeline system may be supplemented with inventories drawn from regional underground storage facilities. Storage withdrawals require prior injections so they do not add to net supplies for the entire year. However during the heating season they are a key element of supply used to meet elevated demand levels. As demand rises to peak levels, maintaining gas service to firm customers often requires the use of increasingly costly measures, such as LNG storage and propane. Demand can be managed by removing some users from the system during peak periods, usually under the terms of interruptible service contracts.

Interstate Pipeline Capacity

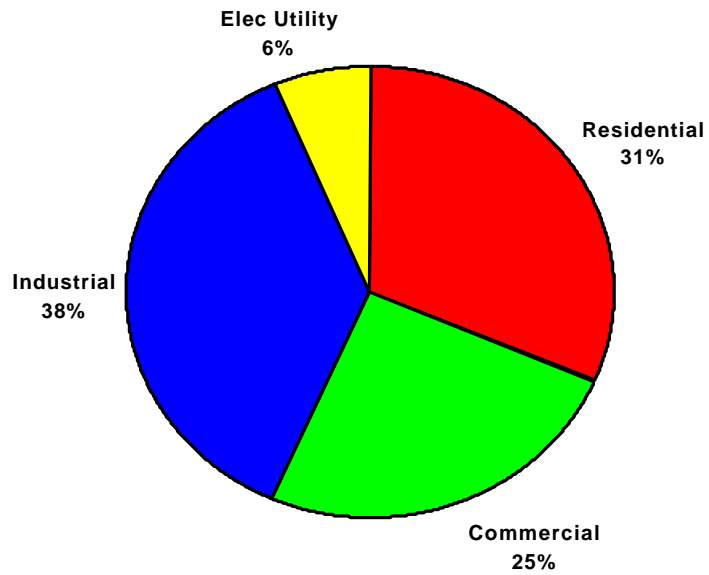
The Northeast market has been the target of several pipeline construction projects in recent years. Pipeline capacity entering the Northeast region grew by 13 percent from 1996 to the end of 1998. Expansion continued in 1999 with the completion of nine projects providing 556 million cubic feet (MMcf) per day of new capacity into the region, or about 0.2 trillion cubic feet per year, and another 984 MMcf per day within the region. More than a third of the added capacity in 1999 (547 MMcf per day)⁴ was associated with the Maritimes and Northeast Pipeline and Portland Gas Transmission System projects, which transport Canadian gas to the New England area. Those two projects alone increased overall pipeline capacity into the Northeast by 4 percent. The Maritimes and Northeast Pipeline establishes a link

²The Middle Atlantic (Census division 2) includes New York, New Jersey, and Pennsylvania.

³Current supply is the sum of production, imports, and net inflow from other domestic regions. It excludes storage withdrawals.

⁴Capacity of the new pipelines total 578 MMcf per day (MMcf/d), but part of the project included conversion of a 31-MMcf/d line back to oil use, so the net gain in new capacity is 547 MMcf/d.

Figure 4. Shares of Natural Gas Deliveries to the Northeast by Sector, 1999



Total End-Use Deliveries = 3.04 Trillion Cubic Feet

Source: Energy Information Administration, *Natural Gas Annual 1999*.

Figure 5. Daily Average Natural Gas Consumption in the Northeast by Sector by Month, 1990-1999

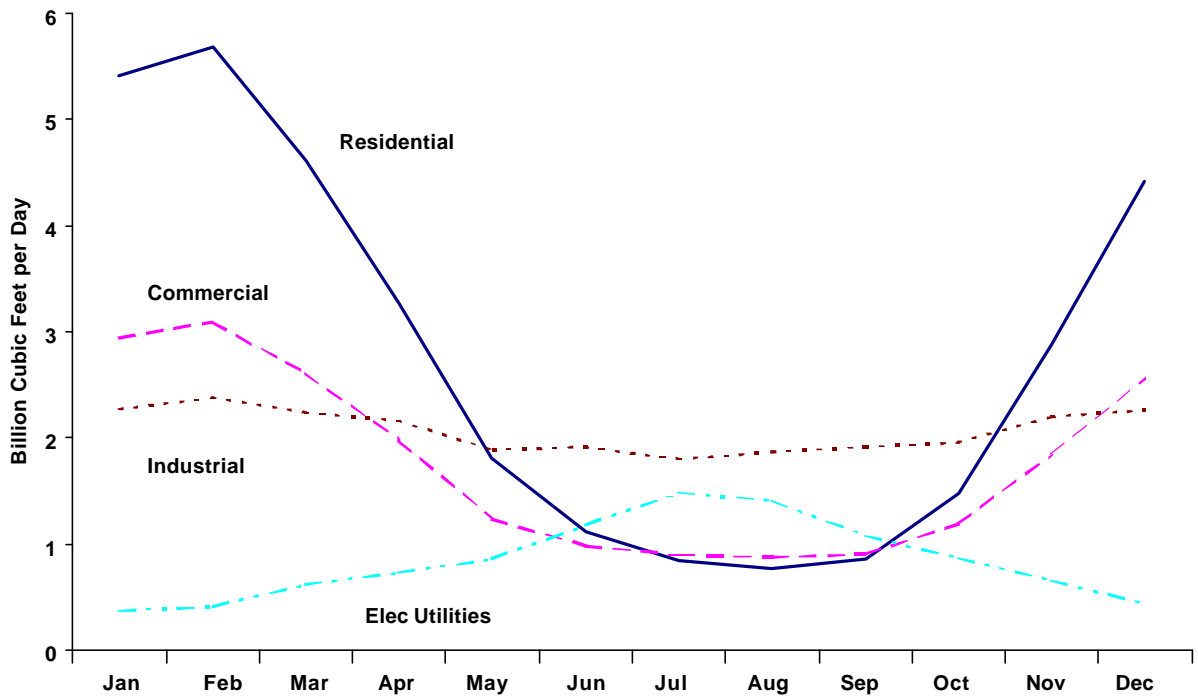
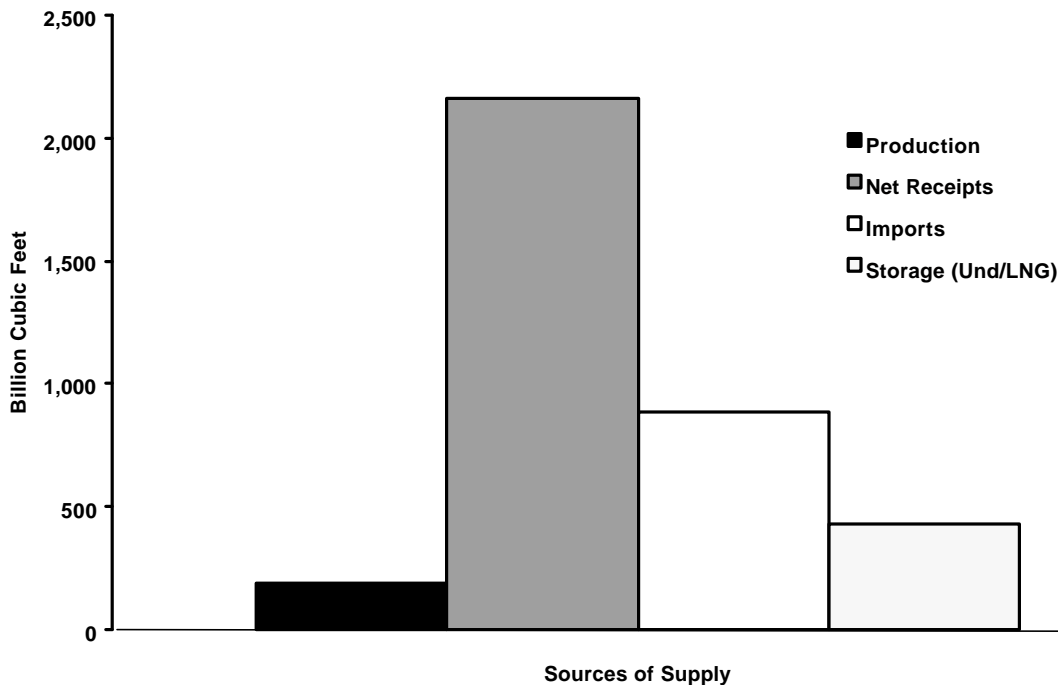


Figure 6. Distribution of Natural Gas Supply Sources in the Northeast, 1999



Source: Energy Information Administration, *Natural Gas Annual 1999*.

between the Sable Offshore Energy Project in the northern Atlantic and New England markets. The Sable Island project has about 3 trillion cubic feet of recoverable gas resources and is designed to supply about 530 MMcf per day to U.S. and Eastern Canadian markets, with about 400 MMcf per day directed to New England. With the Maritimes & Northeast Pipeline, import capacity to the Northeast from Canada increased to 2,956 MMcf per day in 1999, up 24 percent from 2,393 MMcf per day in 1997.

The dependence on volumes transported into the region underscores the importance of transportation capacity. In 1999, the interstate pipelines entering the Northeast region had the capability to transport 13,090 MMcf per day, with much of the capacity directed to New York City, Boston, Massachusetts, and the Philadelphia/Trenton area (Figure 7). The states of Pennsylvania and New York are the key transit points for gas deliveries within the region. These states have the largest underground storage capacity in the region, as well as some of the largest entering and exiting capacities and annual flow rates to New England.

Existing pipeline capacity in many parts of the Northeast region is adequate to meet current firm-service demand.

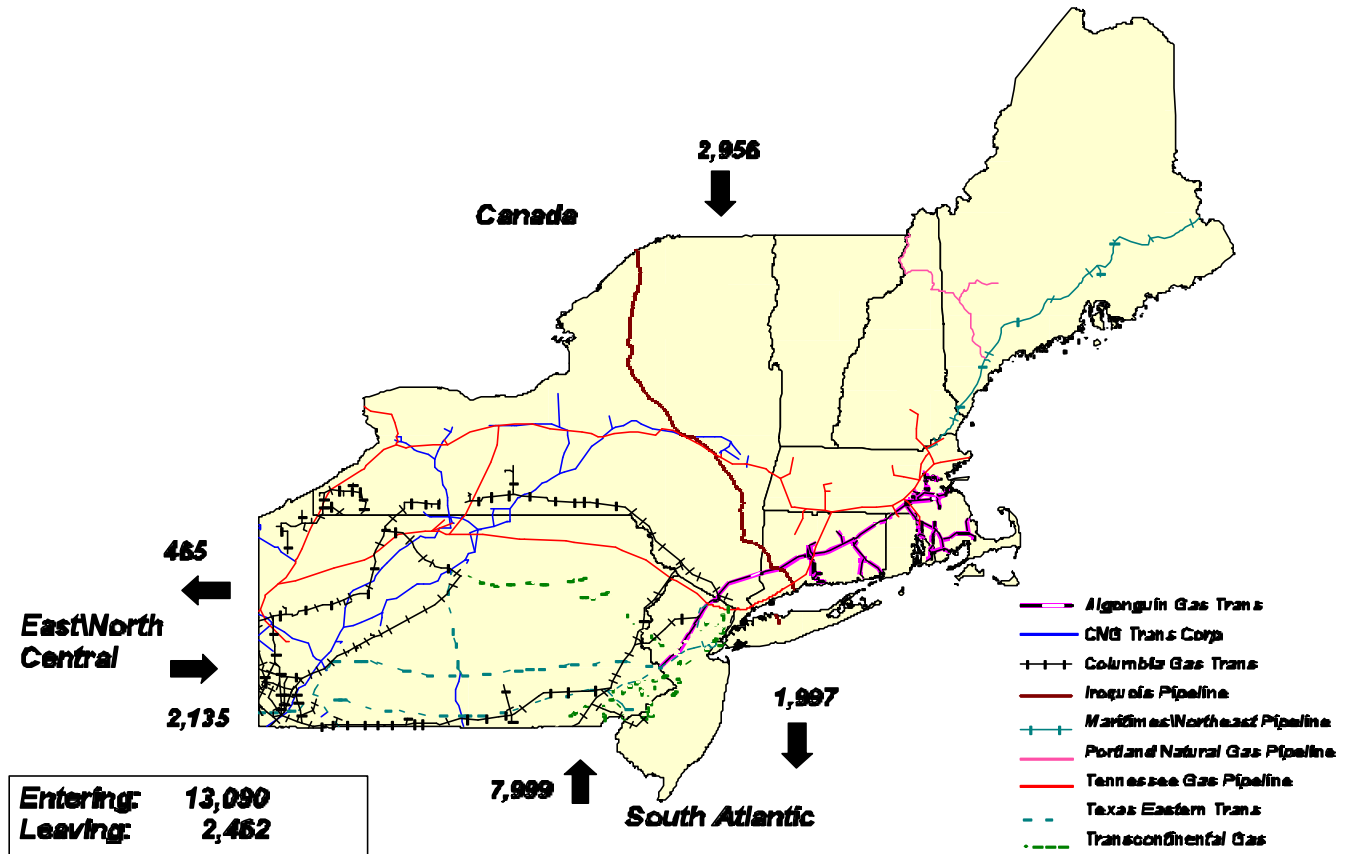
However, most pipelines are heavily, if not fully, utilized during periods of peak demand. In certain cases, line-packing⁴ is used to augment capacity during a time of peak demand to ensure that firm service is met.

About three-quarters of the capacity into the region is supplied somewhat equally by three long-distance trunkline systems: Transcontinental Gas Pipe Line Corporation, Texas Eastern Transmission Corporation, and Tennessee Gas Pipeline Company. In 1996, the utilization rates (daily flow as a percent of estimated capacity) on these pipeline systems as they entered the region averaged 80 percent. Tennessee Gas Pipeline had the highest utilization (90 percent) and the highest actual volume (2.8 Bcf per day) into the region. These pipeline systems bring gas from the producing areas of Texas, Louisiana, and the Gulf of Mexico to the Northeast through the southeastern states to Pennsylvania.

The largest major regional pipeline companies, CNG Transmission and Columbia Gas Transmission, have an

⁴Line-packing is a method to increase pressure in the pipeline. The maximum design pressure of the pipeline can be increased to allowable standards as a temporary source of extra supply.

**Figure 7. Interstate Natural Gas Pipeline Capacity for the Northeast, 1999
(Million Cubic Feet per Day)**



Note: Figure shows major lines. Capacity values show total regional flow capacity.

Source: Energy Information Administration (EIA), EIAGIS-NG Geographic Information System, as of December 1999.

extensive network of local delivery points and pipeline interconnections that supply many of the major local distribution companies in the region. By far, the largest flows into the region are from the U.S. Southwest producing area via the Southeast into Pennsylvania and New Jersey.

In addition to the pipelines entering the region, several smaller interstate pipeline companies operate entirely within the region. Foremost among these is Algonquin Gas Transmission Company, which has the capacity to move 1.2 Bcf per day from New Jersey into New York. Algonquin, with 1,056 miles of trunk transmission lines, distributes the gas received in New Jersey to New York, Connecticut, Rhode Island, and Massachusetts.

Storage

Storage gas is essential for providing reliable service. On average, net storage withdrawals provide 25 percent of more of Northeast natural gas consumption during the winter season. However, reliance on storage can be much higher in some peak demand periods. Two types of gas storage are currently in use in the Northeast: underground sites—primarily, depleted oil and gas reservoirs⁵—and above-ground LNG facilities. Depleted oil and gas reservoirs generally take 5 months or more to fill and can be emptied over a 3-month period. LNG storage has a higher deliverability (or drawdown rate

⁵Salt cavern sites are becoming common in other regions of the country, but the only one in the Northeast as of December 1998 was the N.Y. State Electric & Gas facility in Seneca county.

relative to stock levels), but it is used only for short durations, generally to satisfy peak periods of extreme demand, owing to its relatively higher cost and slow refill capability.

The Northeast has a total storage capacity of about 966 Bcf and a working gas capacity⁶ of almost 510 Bcf (Table 1). The primary component of this storage capacity, 95 percent, is in underground facilities in New York and Pennsylvania. However, because of the relatively slow maximum rate at which gas can be withdrawn from these facilities compared with LNG, they account for only 72 percent of the region's maximum daily deliverability. Because of drawdown rates, LNG storage units contain only 8 days of supply when filled, as compared with more than 57 days of supply available on average from the underground units when they are filled.⁷ Compared with other market areas, the Northeast makes the most extensive use of LNG. The peak-day deliverability of LNG in the region, 3.4 Bcf per day, is 39 percent as large as the total daily deliverability from underground storage facilities.

Gas storage allows supplies to be acquired during periods of slow demand and subsequently delivered to end users during peak demand periods. However, storage utilization strategies by LDCs during the winter tend to be somewhat complex. For LDCs, which generally are responsible as the "supplier of last resort,"⁸ their withdrawal strategies often reflect their concerns about being able to meet demand surges in the event of a late season cold snap. A consequence of such a strategy is that early season withdrawals are reduced in favor of later withdrawals and may lead to higher prices in the short run.

Ideally, gas storage facilities are sited close to major markets in order to minimize the time and expense required to move supplies to consumers and avoid potential transportation bottlenecks when demand surges.

⁶A volume of gas (known as base gas or cushion gas) is needed as permanent inventory in a storage reservoir to maintain adequate pressure and deliverability rates, so that only the working gas capacity proportion of the total storage capacity is available for use.

⁷Days of supply is measured as the ratio of working gas capacity to peak-day deliverability. LNG supplies and normal underground storage should not be combined for this calculation. The addition of LNG distorts the calculation because it has a very high deliverability for only short durations. In practice, flows diminish as underground stocks are depleted, and actual drainage of all working gas from depleted reservoirs would require more time. The maximum deliverability rate is calculated for a full reservoir.

⁸Designated by the state public utility commission to have the responsibility to offer natural gas service to all consumers who request it within a geographic area.

Proximity of storage facilities to end users reduces the need for construction of additional pipeline transportation capacity to meet peak demands, allowing long-distance transportation lines to be designed to accommodate average annual flows, with some excess for responding to demand surges. Off-peak transportation would move gas for baseload demand, storage replenishment, and incremental service to low-priority customers not supplied during peak periods. Local distribution networks in the Northeast already are designed to meet very high demand surges.⁹ For example, the 1999 flow capacity of transportation pipelines into New England was only 2.7 Bcf per day, but local gas utilities managed peak deliveries of 3.4 Bcf on January 17, 2000.¹⁰ The incremental sendout during a period of peak demand is usually a combination of storage gas, LNG imports, and propane.

Contracts for Natural Gas Service

A key objective of natural gas system operators is to meet the demand requirements of its core (firm) customers (primarily residential and small commercial customers) on peak days. In general, the larger the proportion of residential and commercial space-heating customers to total customers, the more variable the load profile. For the heating season, the LDC will contract for firm supplies and transportation with pipeline companies to ensure that sufficient supplies will be available for its core customers. Many LDCs are mandated or encouraged by their state public utility commissions (PUCs) to reserve a certain amount of capacity for reliability of service and keep a certain level of stocks on hand that exceeds peak demand.

Because natural gas demand is seasonal and pipeline systems generally are designed to handle expected loads during periods of peak demand, spare capacity usually is available during off-peak periods, even after accounting for gas to replenish storage inventories. The combination of fixed pipeline capacity and variable load has led to the development of interruptible service contracts for some natural gas customers. Under such contracts, a customer agrees to gas service without guaranteed performance in

⁹In some areas, gas is delivered directly to consumers by interstate pipeline companies, bypassing the LDCs. This practice is not thought to be widespread in the Northeast.

¹⁰"New England's Natural Gas Industry Reaches New Growth Levels," New England Gas Association Press Release (March 23, 2000), web site biz.yahoo.com/prnews/000323/ne_gas_ass_1.html.

Table 1. Gas Storage Capacity and Deliverability in the Northeast, 1999

Region/State	Working Gas Capacity (million cubic feet)	Total Capacity (million cubic feet)	Peak-Day Deliverability ^a (million cubic feet per day)	Days of Supply at Full Capacity
Middle Atlantic				
Underground				
New York	84,638	188,474	1,167	72.5
Pennsylvania	397,987	750,007	7,571	52.6
Total	482,625	938,481	8,738	55.2
LNG				
New York	3,399	3,399	772	4.4
New Jersey	4,712	4,712	624	7.5
Pennsylvania	4,503	4,503	634	7.1
Total	12,614	12,614	2,030	6.2
New England				
Underground	0	0	0	--
LNG				
Connecticut	2,549	2,549	127	20.1
Massachusetts	9,399	9,399	985	9.5
New Hampshire	4	4	5	0.8
Rhode Island	2,469	2,469	261	9.5
Total	14,421	14,421	1,378	10.5
Northeast				
Underground	482,625	938,481	8,738	57.4
LNG	27,035	27,035	3,408	7.9
Total Northeast	509,660	965,516	12,146	— ^b

LNG = Liquefied natural gas.

^aPeak-day deliverability at 12,146 million cubic feet per day is available only for about 8 days. For the remainder of the winter, without LNG, peak-day deliverability is 8,738 million cubic feet per day.

^bLNG totals should not be added to underground storage, because LNG is normally used to satisfy peak demand when underground storage is also being used.

Sources: Energy Information Administration (EIA), EIAGIS-NG Geographic Information System, Underground Natural Gas Storage Database and LNG Facilities Database, as of November 2000.

return for discounted rates. Roughly 10 to 15 percent of all primary arrangements for natural gas deliveries by interstate pipeline companies (excluding transportation for other pipelines) in 1997 were on an interruptible basis.¹¹

Interruptible service contracts vary in terms and conditions but, generally, allow for service interruptions as a result of either temperature threshold triggers or system operating conditions, such as when line pressure is threatened by high rates of drawdown (see box, “Triggers for Interruption,” p. 17). LDCs or pipeline companies may reserve the right to interrupt or curtail service in the event of an emergency, for maintenance of the system, or in order to continue service to their firm service customers. LDCs also interrupt gas service to their nonfirm customers to prevent the use of high-cost equipment or supply options, such as propane injection. In addition, some contracts provide service for only a limited period, such as a month, or on a seasonal basis with suspensions of service scheduled during the winter.¹² Suspension of service is not considered an interruption as long as the terms of the arrangement are met during the period of performance for the contract.

Interstate transporters and LDCs go to great lengths to avoid performance failure under firm service contracts because of the serious implications for their customers and others.¹³ The companies also try to continue service even under interruptible contracts, subject to the availability of capacity during peak demand periods and the ability to continue service without resort to high-cost measures. During periods of heavy demand, however, such as during the heating season, interruptions under interruptible contracts are a regular feature of the gas industry as a whole. The movement to regulatory reform at the Federal and state levels has not altered the basic role or impact of interruptible gas contracts.

¹¹Interstate Natural Gas Association of America, *Gas Transportation Through 1997*, Report No. 99-01 (April 1999). The stated percentages reflect primary capacity contract arrangements. Through capacity release transactions, at least some of the capacity held by firm contracts is resold on an interruptible basis.

¹²For example, both utilities that serve New Hampshire require all interruptible customers to be offline for a month during the heating season; the LDC must notify customers by September 1 which 30 days of the heating season will be interrupted.

¹³Although quite rare, and not the case in January and February 2000, interruptions may occur under firm service contracts when conditions diminish or jeopardize system capability to the point that deliveries cannot meet all of the supplier’s firm contract obligations.

The Role of Interruptible Natural Gas Service

Interruptible service arrangements provide opportunities for large-volume energy consumers such as industrial customers and electricity generators to obtain energy supplies at lower prices, which enhances the general efficiency of the overall economy. Also, when interruptible customers use the natural gas system, at least some of the resulting revenues are applied to reducing transportation costs for firm customers. If interruptible natural gas customers became firm customers, new capacity might have to be built unless uncommitted capacities were available for firm service. Costs could increase for firm customers using the system because revenues from interruptible service would no longer be available to reduce costs. Also, pipeline operators could be faced with more unused off-peak capacity to auction off, with a very limited base of seasonal users, thereby reducing the value of the interruptible capacity. Pipeline companies currently gain some revenues from the sale of interruptible capacity. There could be a considerable loss of efficiency in the operation of the gas market and the economy in general if customers with switchable capacity were required to consume natural gas year round.

Interruptible service contracts have become part of standard business practices for many large-volume energy users such as power generators. Until recently, electricity generators using natural gas as their primary fuel have been reluctant to commit contractually to firm (365-day) gas service because of the high costs for such service. Electricity generators may opt for alternative fuel use when using interruptible gas service. Some options include building a short-duration storage facility for distillate (or residual) fuel oil or shutting down the generator when gas service is actually interrupted and importing power from an adjacent region. Another alternative might be to contract for a variety of semi-firm services (for up to 365 days) but allow a local gas distribution company the right to call on the gas for a specified number of days. Because many winters have been warm in the past 5 years, interruptible gas service has effectively turned into firm service without the higher costs. Under these circumstances, the incentive for generators to commit to costlier firm service options has been limited.

Natural gas service may also be suspended voluntarily by customers who switch to other fuels or reduce operation,

Triggers for Interruptions

Contracts for interruptible natural gas service specify the particular terms and conditions under which service will be interrupted. Local distribution companies (LDCs) set out these conditions of service in public utility commission (PUC) approved filings referred to as tariffs. Under the majority of interruptible tariffs in the Northeast, LDCs reserve the right to interrupt or curtail service in the event of an emergency, for maintenance of the system, or in order not to compromise service to its firm service customers. Often the contract specifies a temperature threshold that will trigger an automatic curtailment in service. The customer, in most cases, can have the option of having either a manual or automatic shutoff valve or a manual or automatic temperature control to indicate an interruption in service.

In the event of an interruption in service that is not an emergency, the LDC will notify the customer or automatically curtail service within a maximum of 3 working days or in some cases in as little as 2 hours. If the customer only has manual controls, which means that the LDC will not shut off gas service automatically without customer notification, the LDC will try to contact customers to inform them of the interruption. However, if an interruption occurs and the customer does not curtail its use of gas for whatever reason, certain penalties will apply during times of unauthorized use. In addition, if a customer continues its unauthorized gas use for a period over 24 hours, the LDC may apply more severe penalties such as the termination of the interruptible sales or transportation agreement.

In the event of an emergency, which could include a problem in the system or a recently issued operational flow order by a pipeline company serving the system, the LDC may interrupt service with only an hour notice to the customer. It can be difficult to provide notification in such a short period of time, which could result in the use of unauthorized gas by the customer. The LDC usually does not assume any responsibility for the use of unauthorized gas in the event of an emergency, so the customer is solely responsible for being aware and informed of any interruptions or curtailment of service. (In the tariff agreements reviewed for this analysis, a 24-hour period is the normal amount of time unauthorized gas may be used before more serious penalties are imposed, which can include but is not limited to a termination of the contract agreement.)

In contracts that set temperature-specific terms for interruption, LDCs can give a manual or automatic temperature control option as an alternative notification method in the event of an interruption. The customer may have the option either to have service automatically shut off when the temperature reaches a certain degree or the customer may be able to shut off gas service manually when the temperature reaches the specific trigger degree determined by the LDC. In certain contracts, the shut off temperature is specified, while in other contracts the shut off temperature may vary, depending on factors that can include weather, supply, and available capacity. Under the temperature-control option, service is resumed when the outside temperature reaches a certain degree for a sustained period of time determined by the LDC.

even when delivery capacity is available (see box, “Economic Switching,” p. 18). For example, some demand shifted from natural gas to distillate fuel oil during January and February 2000 because of the relative fuel prices. The additional demand from customers who voluntarily choose to switch despite the availability of gas service could be significant and would have the same impact on distillate fuel oil markets as equivalent demand owing to interruptions. This aspect of customer demand is examined further in Chapter 4. It is not discussed further here because, although it is arguably related to the availability of interruptible service, it is not a direct

consequence of supplier performance under interruptible service contracts.

Backup Fuels Used by Natural Gas Customers

Customers with interruptible service need dual-fuel facilities and equipment to burn an alternative fuel if they plan to continue operating during a natural gas interruption. Some contracts specify that interruptible gas customers keep an “adequate” supply of alternative fuel on hand and maintain the dual-fuel equipment necessary

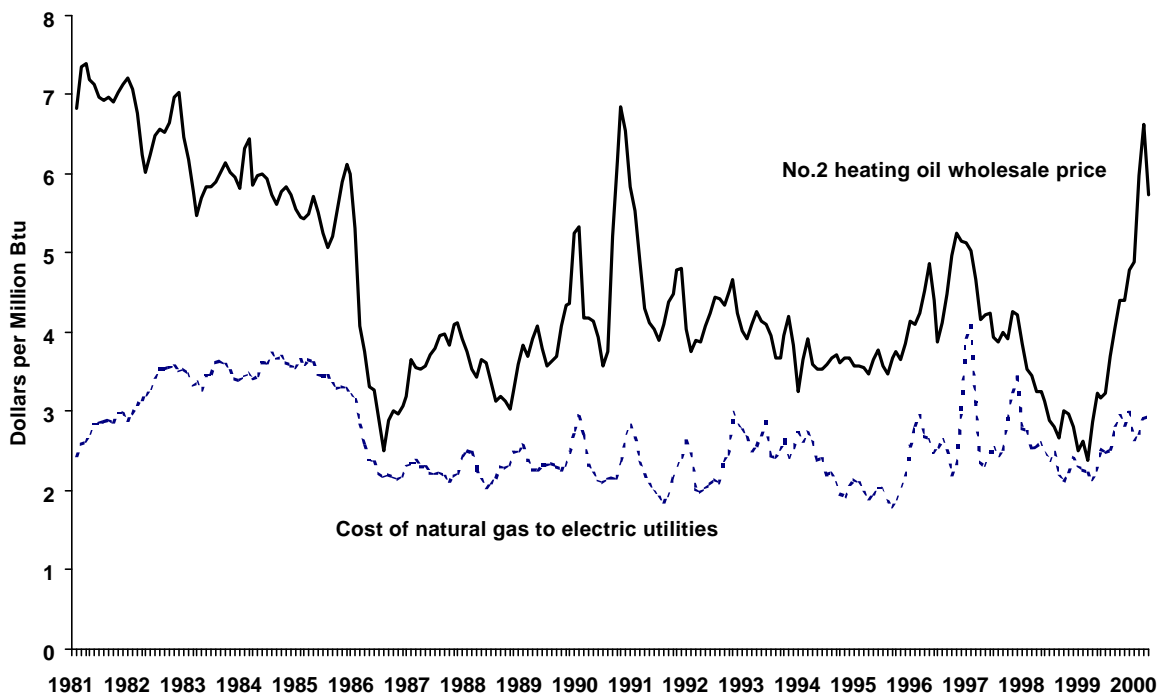
Economic Switching

Dual-fuel equipment, found mostly in large commercial, industrial, and electricity generation applications, can be adjusted to switch between combustion of one fuel to another. While the cost of installing dual-fuel capable equipment is higher than for dedicated equipment, there are paybacks over the life of the equipment. Dual-fuel customers can better manage costs by the appropriate choice of fuels. Another benefit for companies with dual-fuel burning capability is the possibility to contract for a more favorable interruptible tariff for natural gas.

The choice of which energy to consume at a dual-fuel burning facility is frequently driven by price on a dollar per Btu basis, relative efficiency in combustion, availability or security of supply, emissions, and other important considerations. Natural gas/distillate and natural gas/residual are the most common dual-fuel installations. The natural gas/distillate dual-fuel combination is more critical during a winter event owing to the cascading impact on the home heating oil market.

Dual-fuel-capable customers frequently opt to use natural gas for its price competitiveness. In the industrial and electric generation sectors, historically natural gas has been the more economic fuel to consume (see the following chart). In actuality, it is difficult to identify these customers as “natural gas customers” or “distillate customers” because of the switching that takes place. In effect, these customers are simply “energy customers.”

U.S. Average Natural Gas and Distillate Prices, January 1981 - March 2000



Note: No. 2 distillate heating oil wholesale prices and the cost of natural gas to electric utilities are representative of energy costs to dual-fuel capable facilities.

Source: Energy Information Administration, Short-Term Energy Outlook Query System., November 14, 2000.

Economic Switching (Continued)

Economic switching occurs when dual-fuel facilities switch fuels to consume a more price-advantageous fuel. Price differentials between distillate and natural gas theoretically could widen to the point that all dual-fuel facilities would migrate to the alternative fuel.

During a winter event, dual-fuel facilities have the capacity to alleviate demand pressures by responding to price signals and switching to another fuel. Economic switching is in contrast to the switching that is forced on dual-fuel-capable customers when natural gas companies invoke contractually-allowed service interruptions to maintain supplies for firm service customers.

Irrespective of the cause, the upper limit of the switching that can occur is the total capacity of dual-fuel facilities. In the Northeast, the maximum demand that can be placed on distillate by dual-fuel customers who either switched to distillate for price considerations or were interrupted is around 133 thousand barrels per day (see table below). It is possible that distillate suppliers would not have to absorb a full 133 thousand barrels per day from dual-fuel customers since complete switching by all dual-fuel customers is unlikely. Given an option, many facilities choose not to switch, if at all possible, because of the transitory nature of the price differential, environmental regulations, convenience, or other reasons. In addition, dual-fuel facilities have two other courses of action that would not further tighten energy supplies: drawing from customer-owned energy stockpiles and scaling down or suspending operations.

Estimated Distillate Fuel Oil Switching in the Northeast by Sector
(Thousand Barrels per Day)

Sector	Daily Average Switchable Volumes in December–February
Commercial	86
Industrial	16
Electric Generation ¹	31 ²
Total	133

¹Because usually only one-third of distillate consumption for electricity generation occurs in the winter months (December, January, and February), the consumption shown is the estimated winter use portion, assuming that 40 percent of the year's distillate use might occur in the winter of an unusual year.

²Winter only.

Source: Adapted from Energy Information Administration, *The Northeast Heating Fuel Market: Assessment and Options*, SR/OIAF/2000-03 (Washington, DC, May 2000), Table ES-1.

to utilize the fuel. However, of the states in the Northeast, only New York and New Jersey have statewide regulations regarding adequate supply and these are relatively new requirements. In mid-August 2000, the New York State Public Service Commission ordered that interruptible contract holders have a 7-to-10-day supply of backup fuel in storage at the start of the 2000-01 heating season.¹⁴ In September 2000, the New Jersey Board of Public Utilities ruled that all interruptible gas customers using distillate fuel oil as an alternative fuel have a 7-day supply on hand by November 1, or equivalent firm supply arrangements if onsite storage capacity is less than 7 days.¹⁵ In Massachusetts, a generic clause that required interruptible contract holders to have a sufficient supply of backup fuel was deleted from the tariff in 1993, because customers wanted to have the right to shut down if they chose instead of fuel switching or paying a higher firm service price.

The two most common alternative fuels for interruptible natural gas customers in the Northeast are No. 2 distillate fuel oil and No. 6 residual fuel oil, although No. 4 distillate oil, kerosene, and propane are also used.

- **No. 2 distillate oil** is most commonly used as an alternative fuel in the commercial and the light industrial sector, for example, schools, apartment buildings, and offices. It is used to heat residential and commercial buildings and to fire industrial and electric utility boilers. The residential plus commercial sectors accounted for more than 90 percent of total distillate fuel oil consumption in the region. Industrial firms and power plants accounted for smaller shares, 8 percent and 2 percent, respectively, on an annual basis. However, while small on an annual basis, the role played by industrial users and power plants can vary significantly during the course of a year.

¹⁴New York utilities are required to implement a special information plan to ensure that all interruptible customers are prepared to leave the gas system during periods of peak demand and that they have other options available. "NY PSC Approves Measures to Help Ensure Reliability of Supplies for Natural Gas Customers in the Coming Winter," New York State Public Service Commission Press Release, Docket 00066/00G0996 (August 16, 2000), web site: <http://www.dps.state.ny.us>.

¹⁵The New Jersey rules (Docket No. GO00020088, 9-20-00) apply only to interruptible customers using No. 2 fuel oil, No. 4 fuel oil, jet fuel, or kerosene as alternative supply. Wholesale electric generators, including cogeneration customers with wholesale electric contracts, are exempt. The stated intent of the order is to ensure that interruptible customers comply with system interruption notices so that all firm customers will receive reliable service. Large penalties will be charged to any customers who ignore notices of interruption. See the New Jersey Board of Public Utilities web site at <http://www.bpu.state.nj.us/>.

- **No. 6 residual fuel oil**, which is what remains after lighter petroleum products have been removed in the refining process, is used for the production of electric power, space heating, and various industrial purposes. Even though it requires preheating equipment, it is the most economical oil alternative, which accounts for its widespread use by large-volume industrial and electric utility users in the Northeast. Its high sulfur content, however, makes it the least favorable alternative fuel oil from an environmental standpoint.
- **No. 4 distillate oil**, which is a mixture of distillate and residual fuel oils, is much less commonly used as an alternative fuel by the commercial and industrial sectors in the Northeast than either No. 2 distillate or No. 6 residual oil. Most industrial consumers use No. 4 as an alternative to residual oil. Unlike No. 6 residual fuel oil, No. 4 fuel oil does not require the use of preheating equipment, but it is not as economical to burn in large volumes as residual oil. In addition, No. 4 oil has a higher sulfur content than No. 2 distillate, so small-volume users from the commercial sector prefer No. 2 distillate as a cleaner alternative. The supply of No. 4 fuel oil is smaller than that of No. 2 distillate or No. 6 residual, in correspondence to its demand in the market.
- **Kerosene** is used for residential and commercial space heating, and is used as a blending agent to keep heating oil and diesel fuel from thickening during cold weather. It falls within the light distillate range of refinery output that mainly includes diesel fuel and jet fuel oils.
- **Propane**, a gas, is used as a fuel in the residential, commercial, and industrial sectors, and is important as a petrochemical feedstock. It is also used by natural gas suppliers for peak shaving, wherein a propane-air mix of about 55 percent propane and 45 percent air is injected into the natural gas system as a partial replacement for up to one half of the natural gas. This propane-air mix has burning characteristics similar to natural gas, with about 35 percent higher Btu value.

The additional demand on petroleum markets as a result of gas service interruptions particularly affects the regional home heating market. More than half of the households in New England and nearly a third in the Middle Atlantic States heat with distillate fuel oil. Nationwide, distillate fuel oil accounted for only 8

percent of the energy delivered to the residential sector in 1997, but 73 percent of that consumption occurred in the Northeast. Even with the occasional surge in heating oil prices, heating with distillate fuel oil in the Northeast on average has been less expensive historically than heating with natural gas.

Although generally small in comparison with residential use, distillate fuel oil use in other sectors in the Northeast can have a significant impact on prices, especially when demand is strong and supplies are tight. As in the residential sector, distillate fuel oil use in the commercial sector has declined over the past 20 years. In the commercial sector, distillate fuel oil consumption declined from 18 percent of total commercial energy use in the Northeast in 1980 to 12 percent in 1997.

The consumption of distillate fuel oil in the industrial sector in the Northeast is divided nearly equally between manufacturing and nonmanufacturing uses. In nonmanufacturing industrial uses, where distillate fuel oil is used primarily for onsite transportation, it is unlikely that a significant portion of it could be switched easily to another fuel. Within the manufacturing segment in the Northeast the key uses of distillate are as a boiler fuel (37 percent), as a process fuel (32 percent), for heating and ventilation (12 percent), and for onsite transportation (10 percent).

The vast majority of the fuel oil used for electricity generation is residual fuel oil. Distillate fuel oil is limited in applications because of its relatively high price. Typically, it is used in small amounts in steam plants for flame control and in relatively inefficient combustion turbines and internal combustion engines when the demand for electricity is high and other fuels are unavailable.

Summary

Interruptible service contracts are a regular feature of the natural gas market in the Northeast. They allow large-volume energy consumers with fuel switching or dual-fired fuel capability to purchase natural gas at lower rates than those charged for firm service. At the same time, they allow local distribution companies and pipeline operators to increase utilization of their fixed assets and better manage costs of service on average. Sales of off-peak interruptible capacity generate revenues that contribute toward at least a portion of the system's capital costs, potentially providing benefits to firm service customers as well. Higher utilization overall enhances the economic return on pipeline and distribution assets.

3. Natural Gas and Distillate Market Dynamics During Severe Winter Events

In recent years, distillate fuel oil markets in the Northeast have experienced several price spikes during the winter. In these cases, distillate prices suddenly surged above crude oil prices, remaining volatile and elevated for several weeks. Each incident tended to include a combination, but not necessarily all, of the following factors: weather (severe cold temperatures), increased demand for all fuels, fuel oil supply disruptions because of refinery outages or delivery problems, interruptions of gas service, and relatively low stocks of fuel oil and/or natural gas. Despite the many similarities among the incidents, there were differences as well. The relevance of these factors during previous winters can be considered by comparing the events of four selected periods of cold temperatures and distillate and/or natural gas price spikes in the Northeast: December 1989 to January 1990, January to February 1994, February 1996, and January to February 2000.

This chapter examines the dynamics of natural gas and distillate fuel oil markets during these four periods of unusually high gas or heating oil prices in recent years and enumerates the most likely factors that affected heating oil demand and supply and thus contribute to spikes in natural gas and/or heating oil prices. It does not attempt to quantify the relative contribution of each factor to the overall increase in fuel prices, but it does provide a framework for understanding the role of gas service interruptions and their possible impact on distillate fuel markets.

December 1989 to January 1990

The coldest weather in the United States in 102 years hit in December 1989, disrupting supplies of natural gas and petroleum products. By the weekend of December 23, the cold weather that had been affecting the Mid-continent and Northeast extended to the Gulf Coast. The cold front froze water pipes and damaged valves and instruments, and many oil refineries were either partially or completely shut down, leading to disruptions in petroleum supplies. Frozen equipment also caused curtailments of natural gas production, which likely led to more fuel switching than might otherwise have been the case.

Natural gas stocks in underground storage on November 1, 1989, were 3,268 billion cubic feet (Bcf) compared with the average 3,187 Bcf in reserve on November 1 during the previous 5 years.¹ Natural gas consumption in December rose in response to the cold weather, with deliveries to the residential and commercial sectors in the Northeast up 29 and 25 percent, respectively, compared with the previous year. Deliveries were only 1 percent higher to the industrial sector than year-earlier levels but 67 percent higher to the electric generation sector. The tightness in supplies was reflected in gas prices to the industrial and electric sectors, which increased from \$4.33 and \$3.74 per million Btu (MMBtu) to \$4.97 and \$4.65 per MMBtu, respectively, between November and December.²

Although the cold snap initially affected petroleum processing, by the second and third weeks of December refiners were able to respond to the demand surge by increasing distillate production to the highest level seen at any point during the 3 years before 1989. In response to the high prices, imports also increased, but with a lag in time. Before these volumes could be delivered, the Northeast remained dependent on its modest stocks. U.S. distillate stocks at the primary (refinery, pipeline, and bulk terminal) level were more than 14 million barrels (almost 12 percent) below average when the 1989-90 winter heating season began, and half this shortfall was on the East Coast. Stocks at electric utilities (tertiary or consumer level) were plentiful, though, and could have covered the sector's entire consumption of distillate during this time period.³ The timing of the event, early in the heating season, may have forced utilities into the market to save stocks for later in the season.

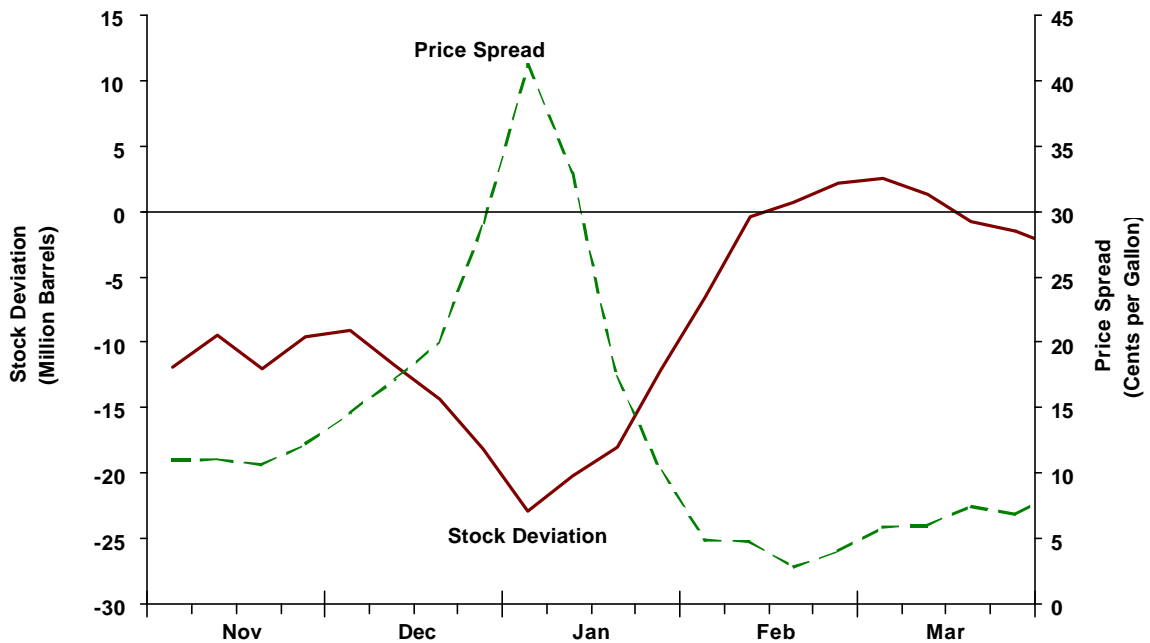
The tight market conditions for distillate supplies affected the price differential between distillate and crude oil. During the peak of the winter 1989-1990 event, crude oil

¹Natural gas data contained in this section are drawn from Energy Information Administration, *Natural Gas Monthly*, DOE/EIA-0130 (Washington, DC), various issues.

²Energy Information Administration, *Natural Gas Monthly*, DOE/EIA-0130 (Washington, DC), various issues. Spot natural gas prices, which are more representative of the prices paid by large consumers, were not available during this period owing to the newness of the spot natural gas market.

³Energy Information Administration, *Effects of Interruptible Natural Gas Service: Winter 1989-1990*, SR/OG-91-01 (Washington, DC, June 1991), pp. 9 and 17.

Figure 8. Winter 1989-90: East Coast Distillate Stock Variations from Average and the Spread Between Distillate and Crude Oil Prices



Note: Price spread is the weekly average New York Harbor No. 2 heating oil price minus the West Texas Intermediate crude oil price. Stock deviation is the week-ending stock level minus the average week-ending level for the given week, calculated from 1989 through 1999.

Sources: **Spot Prices:** DRI Platt's Daily prices averaged over a week. **Week-Ending Distillate Stocks, January 1990, Forward:** Energy Information Administration, *Weekly Petroleum Status Report*, Table 10. **Week-Ending Distillate Stocks, November and December 1989:** American Petroleum Institute.

was \$21.70 per barrel (\$27.65 in 2000 dollars) compared with the 2000 event which had an underlying crude oil price of \$28.06 per barrel. With primary stocks well below normal, distillate price spreads⁴ at the beginning of December were 15 cents per gallon and growing (Figure 8). The New York Harbor price for home heating oil was 61.4 cents per gallon at the beginning of the month and 92.9 cents per gallon by the end of the month. The price spiked at the end of the month when the distillate spread peaked at more than 41 cents.

Despite the high underlying cost of crude oil and the wide spreads between distillate and crude oil prices that developed as a result of the cold weather, distillate had about a \$0.50 per MMBtu price advantage over natural gas in the industrial and electric generation sectors. At the time, just more than 128 thousand barrels per day of

estimated switchable capacity was in place⁵ that could have been used by interrupted gas customers or customers switching to distillate to take advantage of a possible price advantage. This distillate price spike seems to have been motivated by a combination of causes, including the weather (severe cold temperatures), increased demand for all fuels, fuel oil supply disruptions because of refinery outages, suspension of gas service to interruptible customers, and relatively low stocks of fuel oil. The events and conditions surrounding natural gas and distillate fuel oil markets at the time, particularly those pertaining to natural gas interruptions, were analyzed in detail in the Energy Information Administration (EIA) report *Effects of Interruptible*

⁴No. 2 heating oil in the New York Harbor minus West Texas Intermediate.

⁵Estimate based on the methodology used in the Energy Information Administration report, *The Northeast Heating Fuel Market: Assessment and Options*, SR/OIAF/2000-03 (Washington, DC, May 2000), Table ES-1, using data from: •EIA, *Commercial Building Energy Characteristics, 1992*, DOE/EIA-0625(92), p. 28, and •EIA, *Effects of Interruptible Natural Gas Service: Winter 1989-1990*, SR/OG-91-01, p. 13.

Natural Gas Service: Winter 1989-1990. The analysis shows that weather was the major driving force behind

the distillate price increase (see box below, “An Analysis of Distillate Prices in the Winter of 1989-1990”).

An Analysis of Distillate Prices in the Winter of 1989-1990

Episodes of sudden price spikes in heating oil markets are not uncommon, with a number of occurrences since the winter of 1989-1990. Most of these events have not been examined rigorously to assess the contributing factors behind the price spikes, but one exception is the event in the 1989-1990 winter. In a report *An Analysis of Heating Fuel Market Behavior 1989-90*, the Energy Information Administration (EIA) estimated the amount of incremental distillate demand by electric utilities and analyzed a set of factors behind the price surge and estimated the relative contribution of each to the overall price rise. Much of the 1989 to 1990 information in this section is drawn from that report.

Additional distillate fuel oil consumption in December 1989 because of cold weather was estimated to be 40.3 thousand barrels per day, including the 13.2 thousand barrels per day from the curtailment of natural gas service provided to electric utility customers. The remaining 27.1 thousand barrels per day was credited to a number of different factors, the most important being the increase in demand from existing residential, commercial, and electric utility customers, and from industrial customers who switched from natural gas.

An econometric model was created to explain distillate price increases, including weather, crude oil prices, and primary distillate stock levels as explanatory factors. According to the analysis, all these factors had a statistically significant contribution to the increase in distillate prices. Distillate purchases by electric utilities accounted for 34 percent of the December 1989 spike in the distillate price in the Central Atlantic Region, with roughly half of this effect being attributable to those purchases necessitated by interruptions of natural gas service (Table 2).

Of an almost 20-cent-per-gallon change in the residential price for distillate, 3.48 cents came from gas interruptions to the electric utility sector, while the remainder was identified as being driven by weather, increased electric utility purchases not caused by interruptions, increased crude oil prices, and inventory levels. Twenty-one percent of the price increase, 4.12 cents, was attributable to other factors that could have included voluntary switching and gas service interruptions to industrial customers, but a reliable division of this increment is not possible based on the reported results. Thus, the incremental distillate demand from gas customers played a significant role in the price rise to residential customers in the Central Atlantic region during December 1989. The factors contributing to the price rise in 2000 and their relative importance may not have been the same as in 1989 as markets have changed since that time and specific variables were a different size.

Table 2. Contribution of Selected Variables to the December 1989 Distillate Fuel Oil Price Spike in the Central Atlantic Region

Factor	Contribution (cents per gallon)	Percentage Contribution
Weather	6.86	35
Total Impact of Electric Utility Purchases of Distillate	6.73	34
Electric Utility Purchases of Distillate Attributable to Natural Gas Interruptions	3.48	18
Electric Utility Purchases of Distillate Not Attributable to Natural Gas Interruptions	3.25	17
Crude Oil Prices	1.64	8
Primary Distillate Inventories	0.25	1
Portion of the Price Change Explained by Other Factors	4.12	21
Total Change in Residential Price from Nov to Dec 1989	19.60	100

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

Source: Energy Information Administration, *Effects of Interruptible Natural Gas Service: Winter 1989-1990*, SR/OG-91-01 (Washington, DC, June 1991), Table ES-1.

January to February 1994

January 1994 was 15 percent colder than normal in the Northeast, and for one week during the month temperatures were 40 percent below normal.⁶ Unlike in December 1989, the cold weather did not extend to the Gulf Coast, and deliveries of natural gas and petroleum products to the Northeast were not disrupted.

At the start of the 1993-94 heating season, underground natural gas stocks in the Northeast were 20 Bcf (5 percent) lower than the 1990-through-1999 average for the month (Figure 9). By New Year's Day 1994, 332 Bcf was in underground storage in the Northeast compared with a 344 Bcf average. After the weather turned, the spot price for natural gas at the New York citygate⁷ increased from \$2.58 per MMBtu on January 18, 1994, then spiked to \$7.50 before settling at \$4.70 per MMBtu 2 weeks later and persisting at that level for another 2 weeks (Figure 10). Almost 20 percent more natural gas was consumed in January 1994 than in January 1993, despite the fact that deliveries to the electric generation sector were less than half the amount sold in January 1993. By the end of February 1994, stocks were 46 Bcf below the 10-year average.

Distillate stocks on the East Coast began the winter of 1993-94 at above average levels and stayed about 7 million barrels above through the beginning of January (Figure 11). During the first 5 weeks of 1994, East Coast stocks declined by 31 million barrels. Distillate/crude oil spreads during January rose by 5 cents per gallon to reach 15 cents per gallon. By the last week of the East Coast stock decline (ending February 4, 1994), distillate stocks were 12 million barrels below average, and distillate spreads peaked shortly thereafter at 25 cents per gallon. The spot price for home heating oil in the New York Harbor increased from 47 to 60 cents per gallon. Throughout the period, crude oil prices remained relatively low. In the peak distillate price week in 1994, the crude oil price averaged less than \$15 per barrel (35 cents per gallon), compared with prices of near \$30 per barrel in early 2000.

⁶Petroleum Industry Research Foundation, "Oil Markets During the Cold Weather: The Buck Stops Here," Memorandum Submitted to the Subcommittee on Energy and Power of the Energy and Commerce Committee, U.S. House of Representatives (February 18, 1994).

⁷The prices for gas traded at Transco Zone 6 are used as indicators of spot prices for the New York citygate. See *Gas Daily* (Arlington, VA: Financial Times). Transco No. 6 spot price for natural gas is a reasonable surrogate for the wholesale prices that large commercial, industrial, and electric generation customers pay for energy.

Estimates of voluntary fuel-switching from natural gas or interruptions of natural gas service attributable to the 1994 cold front were never made, although the decline in temperatures may have triggered a few unusual gas service interruptions. With respect to fuel switching, distillate enjoyed at most only a \$0.20-per-MMBtu cost advantage at any time—a weaker inducement to switch than was the case in 1989-1990.

The distillate price spike in 1994 seems to have been motivated by a different combination of factors than in 1989-1990. Once again, the weather was a key influence as it increased demand for all fuels, but it did not cause disruptions of fuel oil or natural gas supplies this time. Another factor that contributed to the price surge was the relatively low level of distillate stocks.

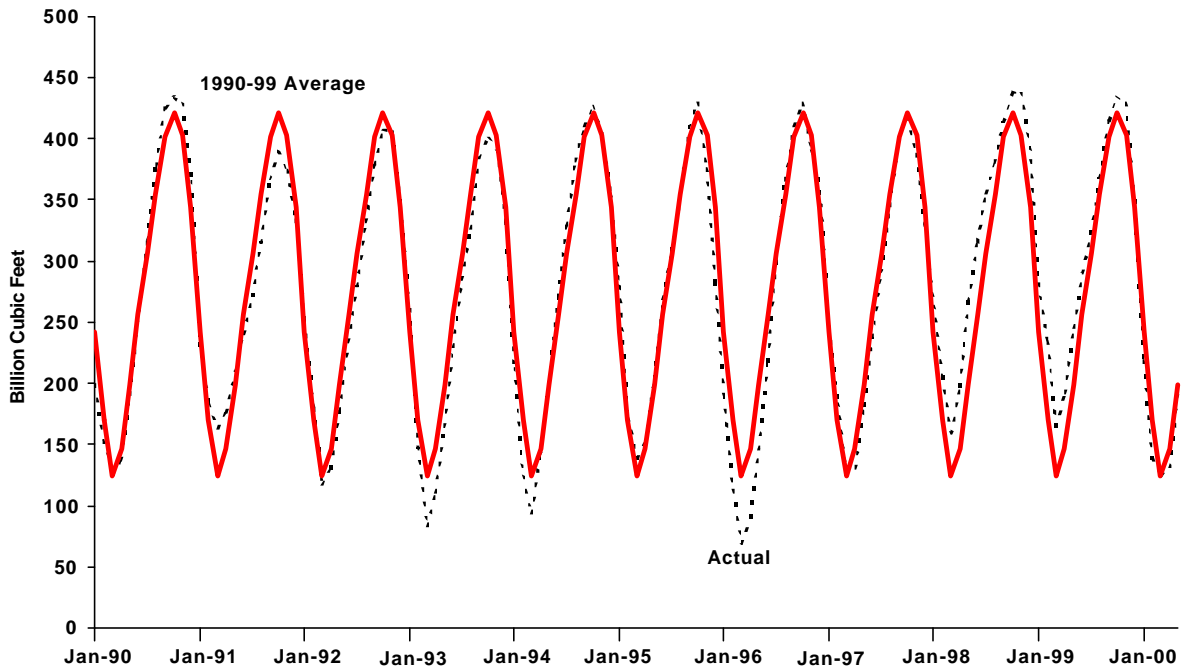
February 1996

Temperatures on the East Coast were consistently at or somewhat below normal levels from the beginning of the 1995-96 heating season through most of January. By the last week in January, a front moved into the Northeast and temperatures dropped almost 30 degrees. The cold front did not move into natural gas production areas and affect flow from this source. The cold weather event of 1996 was notable for the comparatively late start of the cold weather and the lack of a spike in distillate prices in both the Northeast and Midwest, despite higher natural gas prices and relatively cold temperatures in both regions.

Before the onset of the heating season, underground natural gas stocks in the Northeast were about 2 percent above the 1990-through-1999 average of 421 Bcf. After a short cold wave in early January, stocks were left at 79 percent of the 1990-through-1999 average for the month. The first day of February heralded a cold front that ultimately caused stocks to be drawn almost 7 percent faster than the average. Natural gas consumption in the Northeast was about equal to consumption in the previous year, despite a 60-percent decline in consumption for electric generation.⁸

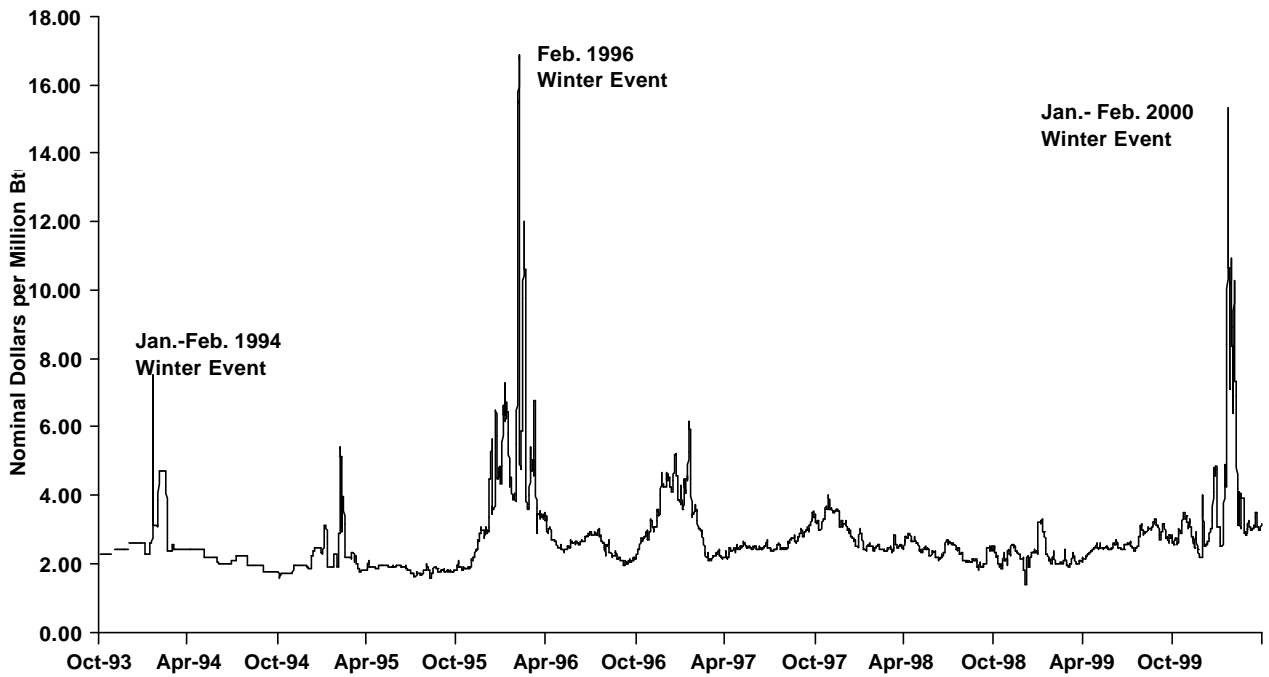
⁸Energy Information Administration, *Natural Gas Monthly*, DOE/EIA-0130 (Washington, DC), various issues.

Figure 9. Working Gas in Underground Storage in the Northeast, January 1990 – March 2000



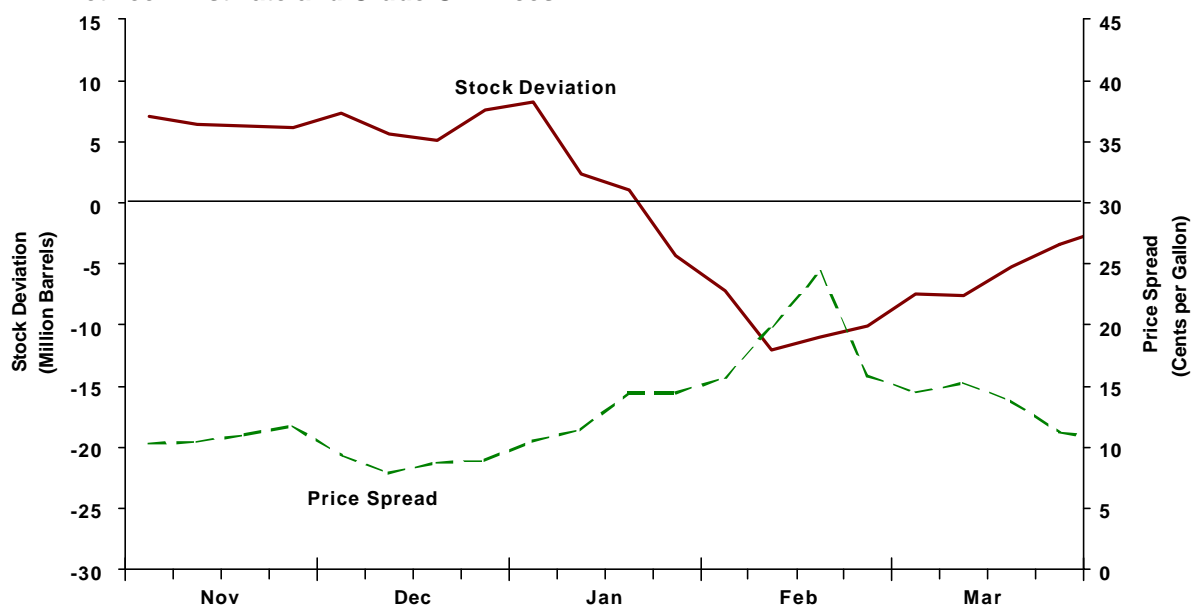
Source: Energy Information Administration, *Natural Gas Monthly* (various issues), Table 14.

Figure 10. Spot Price of Natural Gas at the New York Citygate, October 1993 - March 2000



Source: Financial Times Energy, *Gas Daily* (various issues). The price for gas traded at Transco Zone 6 is used as indicator of spot prices for the New York citygate.

Figure 11. Winter 1993-94: East Coast Distillate Stock Variations from Average and the Spread Between Distillate and Crude Oil Prices



Note: Price spread is the weekly average New York Harbor No. 2 heating oil price minus the West Texas Intermediate crude oil price. Stock deviation is the week-ending stock level minus the average week-ending level for the given week, calculated from 1989 through 1999.

Sources: **Spot Prices:** DRI Platt's Daily prices averaged over a week. **Week-Ending Distillate Stocks, January 1990, Forward:** Energy Information Administration, *Weekly Petroleum Status Report*, Table 10. **Week-Ending Distillate Stocks, November and December 1989:** American Petroleum Institute.

Toward the end of January 1996, the spot price for natural gas at the New York citygate was \$4.50 per MMBtu (Figure 12). On February 2, the New York spot price was \$15.50 per MMBtu and went as high as \$16.75 on February 5. The spot price stayed ahead of January prices most days through February 20. For the better part of 3 weeks, the spot price of natural gas exceeded oil by at least \$0.70 per MMBtu, and was over \$11 per MMBtu for two days during the period. The spot price for heating oil in New York climbed by less than 30 percent.

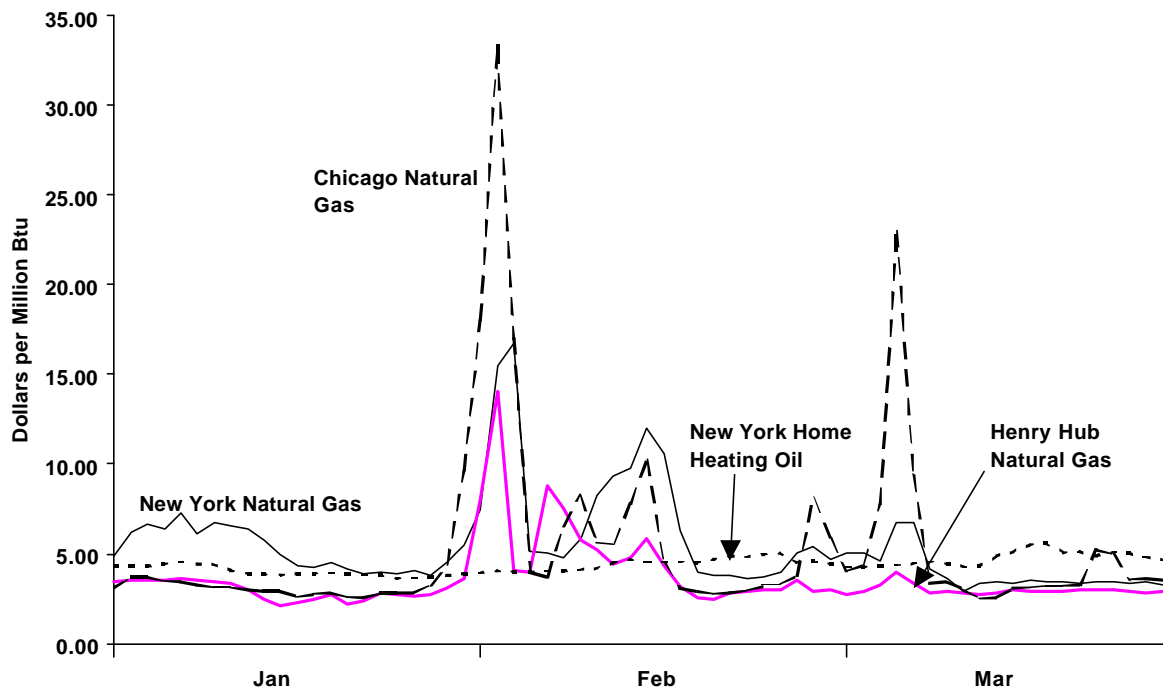
The Midwest also suffered from the same cold front that swept through the Northeast. Spot natural gas prices in the Midwest spiked even more severely than in the Northeast. During the last week of January through the first week in February, the Chicago spot natural gas price topped out at more than \$30 per MMBtu, while the spot price of distillate rose to the equivalent of just over \$4 per MMBtu (Figure 12).

The extremely high prices for natural gas in both the Northeast and Midwest likely reflect gas service interruptions and may have led to voluntary fuel-switching from gas. Distillate fuel oil enjoyed a significant

price advantage over natural gas, and dual-fired energy customers would have shifted to the less costly fuel wherever possible. Natural gas service interruptions were not estimated for this period, but temperatures were cold enough to have invoked clauses for natural gas interruptions. Also, the extremely high gas commodity prices would have precluded continuation of interruptible service in cases where it required the use of such high-cost gas supplies.

For the week ending February 16, 1996, distillate stocks were 10.7 million barrels below the 10-year average. The absence of a sustained runup in distillate fuel prices during this period is noteworthy because temperatures were cold and distillate inventories were quite low—conditions that were present at the time of each of the other distillate price spikes. Based on this example, an absolute causal relation between this set of factors and distillate fuel oil price spikes does not exist. Furthermore, this example introduces the possibility that the timing of the event is a contributing factor in the extent of distillate price spikes. A cold snap later in the heating season allowed a draw on stocks without significantly affecting distillate prices.

Figure 12. Winter 1996 Spot Prices



Source: **Natural Gas Prices:** Financial Times Energy, *Gas Daily*, (various issues); **New York Home Heating Oil:** Reuters *News Service*. No. 2 Heating Oil, New York Harbor converted to million Btu using 5.825 million Btu per barrel.

January to February 2000

Northeast weather in January and February 2000 was warmer than normal. The regional data on a monthly basis, however, obscure significant variation during some weeks in the period. During the week of January 22, 2000, temperatures in the Northeast shifted from being up to 17 percent warmer than normal to as much as 24 percent colder than normal. This increased weekly heating requirements by an estimated 40 percent. The cold pattern persisted for 3 weeks.

At the end of December 1999, natural gas stocks in the Northeast were 4 Bcf above the 1990-1999 monthly average of 344 Bcf. As temperatures plummeted, natural gas companies withdrew more from storage than ever before.⁹ Natural gas deliveries to the Northeast increased by almost percent over year-earlier levels even after accounting for a 20-percent drop in gas consumption for

power generation.¹⁰ Tight regional natural gas supplies caused the spot price at the New York citygate to move from \$6.34 per MMBtu on January 18 to \$15.34 per MMBtu on January 20. Gas prices never dipped below \$6.41 per MMBtu during the next 3 weeks.

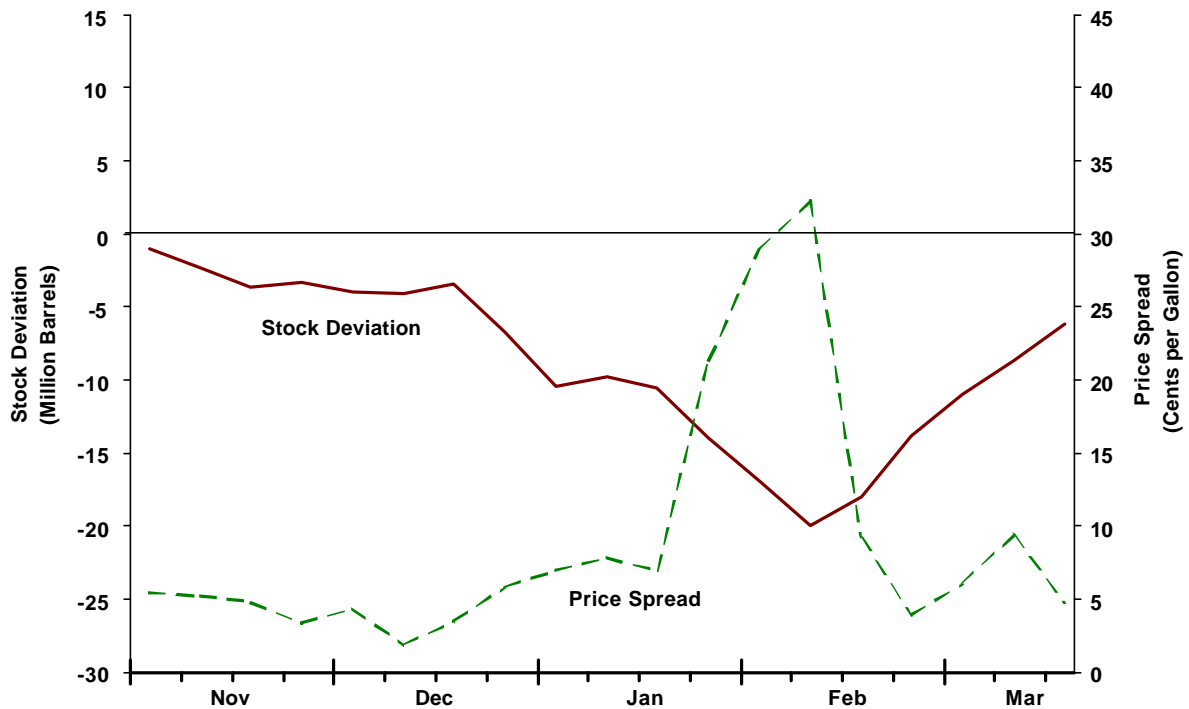
As the heating season of 1999-2000 began, distillate stocks at the primary level were about average (Figure 13). From December 17, 1999, to January 14, 2000, stocks fell by 12 million barrels, ending at a level that was 10 million barrels below average. At the time, Y2K precautionary stocking at the consumer level was suggested as a possible cause for the sharp decline in stocks prior to the onset of cold weather.¹¹ Distillate/crude oil spreads were well below seasonal averages in December, and they rose only modestly in early January, still remaining below average.

⁹Energy Information Administration, *Natural Gas Monthly*, DOE/EIA-0130 (Washington, DC), various issues. Net withdrawals from storage during January 2000 were an all-time high for any month. February 2000 withdrawals were a record for the month of February.

¹⁰Because of a lack of respondents, does not include Massachusetts, New Jersey, and New York. Energy Information Administration, *Natural Gas Monthly*, DOE/EIA-0130 (Washington, DC), various issues.

¹¹In conducting a survey on January and February 2000 natural gas interruptions, EIA found some evidence that supported a build of Y2K precautionary stocks.

Figure 13. Winter 1999-2000: East Coast Distillate Stock Variations from Average and Spread Between Distillate and Crude Oil Prices



Note: Price spread is the weekly average New York Harbor No. 2 heating oil price minus the West Texas Intermediate crude oil price. Stock deviation is the week-ending stock level minus the average week-ending level for the given week, calculated from 1989 through 1999.

Sources: **Spot Prices:** DRI Platt's Daily prices averaged over a week. **Week-Ending Distillate Stocks, January 1990, Forward:** Energy Information Administration, *Weekly Petroleum Status Report*, Table 10. **Week-Ending Distillate Stocks, November and December 1989:** American Petroleum Institute.

This changed in the latter half of January, as the average weekly distillate spread during the third week increased by 14 cents per gallon over the level of the previous week as the region waited for new supply to relieve the market stress.

The patterns in the distillate spreads were reflected in product prices. New York Harbor spot heating oil prices soared from about 76 cents per gallon on January 14, to a peak of \$1.77 on February 4. Between January 17 and February 7, New England residential heating oil prices rose by 66 percent, from \$1.18 to \$1.97 per gallon.

The distillate price spike in January-February 2000 seems to have been motivated by a combination of factors similar to those in previous events. The weather was

severely cold, which increased demand for all fuels. Fuel oil supply disruptions occurred as some refineries experienced production problems and the chain of replacement supplies was disturbed when ice-blocked harbors prevented barges from delivering distillate. At the same time, the diminished stocks of distillate in the region were inadequate to compensate for these supply difficulties.

Although reliable estimates of interruptions to interruptible gas customers were unavailable, a number of speakers at meetings held by Secretary of Energy Richardson in February identified gas service interruptions as an important contributing factor. At the time, analysts estimated that the substitution of gas with distillate fuel oil caused over 100 thousand barrels per day of incremental demand during the second half of January to early

February.¹² Results of EIA's efforts to assess the volumetric impact on distillate markets owing to gas service interruptions during January through February 2000 are contained in Chapter 4 of this report.

Summary

The specific influences driving distillate prices in severe winter events vary but some have been recurring. Low distillate stocks along with low temperatures contributed to higher distillate fuel oil prices in the Northeast in 1989, 1994, and 2000, with 1996 serving as an exception. Generally, when East Coast distillate stocks fell to 10 million barrels below average, a price spike followed. In the most severe incidents, 1989-1990 and 1999-2000, stocks ultimately fell to 20 million barrels below average.¹³

Even though a connection between distillate prices and incremental demand from fuel-switching energy

customers may be present on the East Coast, the relationship, if there is one, appears to be weaker in the Midwest. The greater reliance on nearby refinery supplies in the Midwest seemed to prevent an acute disruption in distillate fuel oil prices in 1996. In addition, timing of the winter event can also dampen price spikes. Unusual weather occurring later in the heating season perhaps allows customers to drawdown stocks with little concern for later needs, thereby taking the pressure off prompt supplies. In 1996, cold temperatures late in the winter in the Northeast caused East Coast distillate stocks to fall to 10 million barrels below average and yet distillate spot prices were unaffected.

Natural gas interruptions are a contributing factor to the increase in demand as shown in 1989 and suggested for other years. The next chapter explores the magnitude of incremental distillate volumes attributable to interruptible gas service contracts.

¹²Petroleum Industry Research Foundation, "What Happened to Heating Oil?" (New York, New York, March 2000), p. 6.

¹³This analytical observation is drawn from Appendix C of the Energy Information Administration report, *The Northeast Heating Fuel Market: Assessment and Options*, SR/OIAF/2000-03 (Washington, DC, May 2000).

4. Interruptions in Natural Gas Service in January and February 2000

Assessing the impact that interrupted natural gas customers may have had on the market for distillate fuel oil requires an understanding of the relationship between the oil and gas markets. Both fuels are used for heating and can be used almost interchangeably in many industrial applications by dual-fuel customers who have the proper equipment. The disruption in the supply of natural gas last winter to some customers holding interruptible service contracts turned some of these customers to their backup fuels. This would have increased the demand for distillate and placed upward pressure on distillate prices. The actual effect on price would depend upon the responsiveness of buyers and sellers to changes in price and the magnitude of the additional demand for distillate.

In order to determine the extent of gas service interruptions in January and February 2000 and the resulting actions of affected customers, the Energy Information Administration (EIA) surveyed major gas suppliers in the Northeast and a sample of end users who receive gas under interruptible service contracts.¹

! Form EIA-903, “Natural Gas Service Interruptions in the Northeast During December 1999, and January and February 2000,” was sent to 34 natural gas companies who accounted for nearly all the volumes delivered to interruptible end users in the Northeast in 1998. Respondents provided information on volumes of gas associated with interruptible and firm service, the volume and timing of interruptions, and the names and backup fuels of interrupted customers.²

! Form EIA-904, “Customer Survey of Natural Gas Service Interruptions in the Northeast During January and February 2000,” was sent to 101 end users in New England who receive natural gas under interruptible service. A total of 97 respondents

provided information on the volumes of gas delivered, the volumes interrupted, and the days interrupted. They also provided data on backup fuel use, including volumes purchased and consumed, inventory levels, and storage capacity.

This chapter examines the data collected from these surveys to determine the extent of gas service interruptions last winter, whom they affected, and their timing. It also compares customer reactions to gas service suspensions based on customer type and type of backup fuel used. For purposes of the analysis, customers were divided into large-volume and small-volume users. In a separate analysis effort, customers were grouped into nine categories according to business sector. The larger entities included power producers who had very different reactions to service interruptions than the smaller customers. The analysis also compares the responses furnished by gas distributors with the responses provided by the interrupted customers in the two surveys.

Overall, an estimated 805 trillion Btu of natural gas was delivered to the Northeast during January and February 2000.³ Of this amount, 719 trillion Btu was provided under firm contracts and 86 trillion Btu under interruptible contracts.⁴ Despite the severe weather in the region during that time, no firm service customers experienced service interruptions. Reported interruptions in service to interruptible gas customers resulted in the nondelivery of an estimated 12.4 trillion Btu of natural gas, or 13 percent of the total volumes that could have been delivered under interruptible arrangements, according to estimates derived from the survey of local distribution companies (LDCs) and pipeline companies.⁵

Although the interruptions in gas service likely were greater relative to previous years' mild winters, the EIA-903 survey data indicate that the interruptions in January and February 2000 represented a relatively small portion of the gas suppliers' planned level of service for

¹See Appendix B for details on the data collection methodology and Appendix C for copies of the survey forms.

²In general, an “interruption” is said to have occurred when an interruptible gas customer experiences an unexpected and involuntary suspension in service. In responding to Form EIA-903, however, service providers gave estimates of interruptions that included some suspensions or cutbacks in service initiated by the customer. Although not interruptions per se, these reductions in gas consumption did result in increased use of backup fuels.

³Energy Information Administration, *Natural Gas Monthly*, DOE/EIA-0130 (Washington, DC), various issues.

⁴Interruptible deliveries are derived from Form EIA-903 data. Firm deliveries are derived as the difference between total deliveries and interruptible deliveries.

⁵Estimates of the amount of gas that could have been delivered are based on maximum daily quantities, contract amounts, or planning levels as provided by LDCs and pipeline companies about their service arrangements.

interruptible customers. Moreover, the additional demand in the distillate market from interrupted natural gas customers may not have been as large in terms of the volume of distillate fuel oil purchased as previously thought.

Nevertheless, the additional demand from interrupted customers could have had a significant impact on the distillate market price. If supplies are tight, even relatively small volumes of additional purchases from any source can result in a disproportionate price response. Although volumes resulting from reported gas service interruptions may seem relatively small, they put pressure on a market already under considerable demand stresses. This analysis does not address how much gas interruptions affected price. However, the chapter provides a framework for understanding the complexities of the interruptible gas market.

Interruptible Contracts and Interrupted Service in January–February 2000

Contracts for natural gas delivery service vary among the different gas companies. Some companies offer several different tariff schedules and others offer only one or two types.⁶ The distinguishing traits of the contracts are the quality of service offered (firm or interruptible),⁷ the triggers for potential interruptions, the requirement for alternative supplies, and other terms or conditions (see Chapter 2, “Triggers for Interruptions,” p. 17).

Firm service contracts generally stipulate a maximum daily quantity (MDQ) that the distributor will deliver. In practice, the MDQ often does not impose a strict obligation on the gas supplier because firm service consumers may demand less than the MDQ. However, in periods of high demand the MDQ represents the greatest daily volume of natural gas that the gas company is obligated to deliver to or on behalf of the customer.⁸ In contrast to the firm service contracts, interruptible

contracts generally do not stipulate an MDQ. However, many of the gas suppliers have planned service levels that specify volumes they anticipate delivering to their interruptible customers if conditions permit. Maximum daily quantities differ from the planned service levels in that the MDQ constitutes the maximal contractual obligation that the gas company must honor, whereas the planned service level embodies an a priori expectation of what the company will deliver if capacity is available.⁹ In other words, during periods of high demand the MDQ is compulsory, whereas the planned service level is discretionary subject primarily to available pipeline capacity.

Based on their reported planned service levels, gas suppliers in the Northeast planned to deliver 98 trillion Btu under interruptible contracts during January and February 2000: 14 trillion Btu in New England and 84 trillion Btu in the Middle Atlantic. These potential deliveries under interruptible service provide a useful benchmark with which to compare the actual deliveries during the same period, which totaled 86 trillion Btu in the Northeast: 11 trillion Btu in New England and 75 trillion Btu in the Middle Atlantic.

Compared with the definition of an interruption posited in this report (see Chapter 1, “Defining an Interruption,” p. 2), the reported interruption data from EIA-903 overstate the involuntary interruptions that occurred during January and February 2000 in that they include some volumes for customers with seasonal service (that had terminated before the January and February period) and for those who already may have switched to another fuel for economic reasons. Service suspensions specified in seasonal or short-term contracts should not be considered an interruption because these contracts generally stipulate that these customers cease consuming gas at a specific time during the heating season. This implies that the seasonal customers’ demand for distillate or other alternative fuels is not directly germane to the current issue of unexpected interruptions of service. Seasonal shifts also are a part of the regular demand load experienced in other fuel markets during the winter, and these sales already should be factored into the suppliers’ planning. Seasonal gas service interruptions are a regularly scheduled event that generally occurs prior to

⁶A tariff is a compilation of all the effective rate schedules for a company, along with general terms and conditions of service, whereas a contract is a legally enforceable agreement between two or more parties who negotiate the specific terms and conditions of the agreement.

⁷Quality of service in this chapter is broadly categorized as either firm or interruptible service. Additional discussion of the numerous distinctions in service quality is located in Chapter 2.

⁸Certain high priority customers, such as residential end users, may not have a limiting MDQ.

⁹Form EIA-903 actually requested, “cumulative maximum daily quantity of gas to be provided under these contracts in each period.” Because the MDQ does not strictly apply with regard to interruptible contracts, many of the natural gas companies provided the levels of service that they anticipated delivering as a proxy for MDQs.

January. In contrast, the involuntary interruptions during January and February 2000 were largely unexpected and could have contributed to the sudden unexpected surge in distillate demand.

Despite the likely overstatement of volumes, the interruption data reported by the gas suppliers provide important insights.

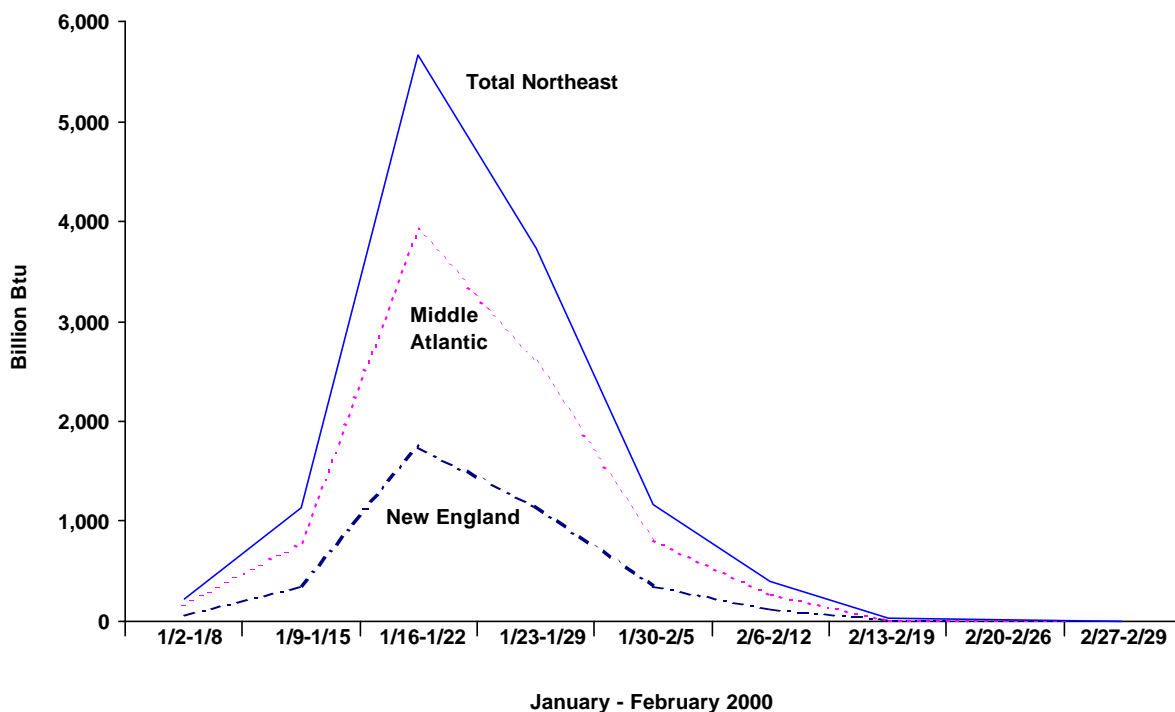
- ! Reported interruptions peaked during the week ended January 22 for both New England and the Middle Atlantic with service interruptions of 1,736 billion Btu and 3,933 billion Btu, respectively (Figure 14). These volumes were approximately half of the planned service levels to interruptible customers for that week.
- ! During the peak week ended January 22, reported interruptions represented the rough equivalent of total planned service levels for interruptible customers in New England but only 39 percent of planned service levels in the Middle Atlantic.
- ! During the third and fourth weeks of January, reported interruptions totaled 9,399 billion Btu or 76

percent of total interruptions during January and February.

- ! Cumulative reported interruptions during January and February totaled 3,786 billion Btu in New England and 8,578 billion Btu in the Middle Atlantic, representing 28 percent and 11 percent of the regions' planned service levels, respectively. No firm service customers were interrupted.

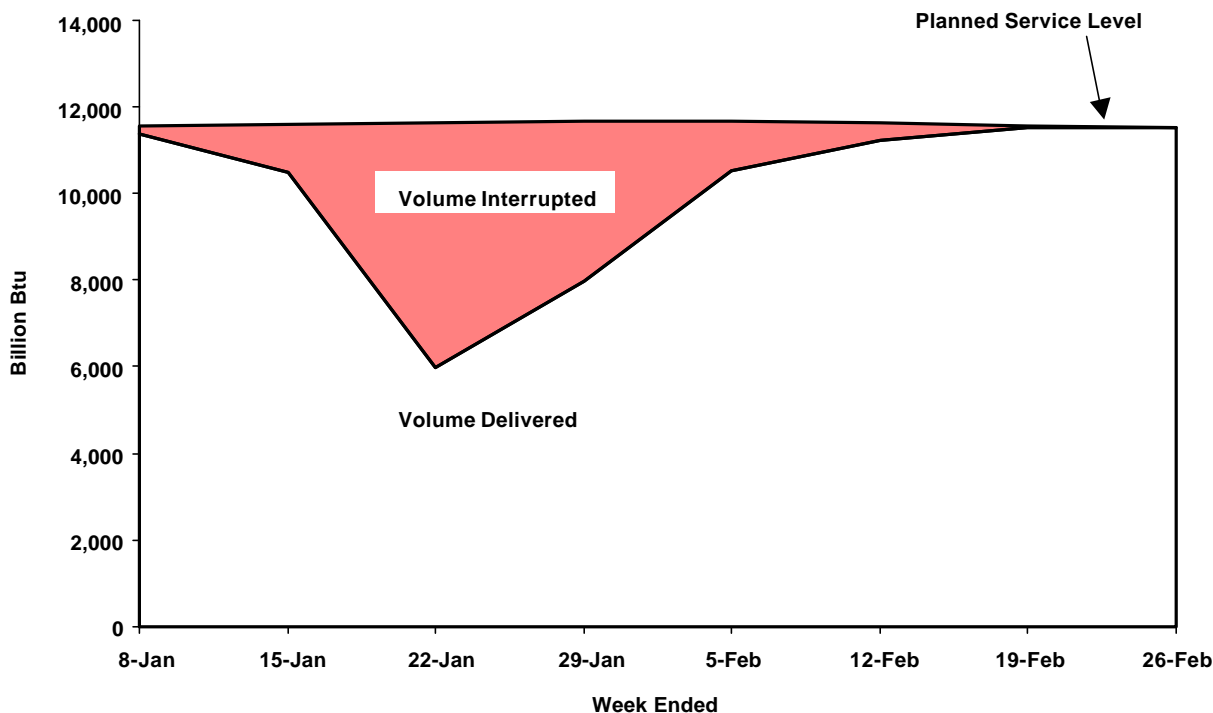
During the third week of January when interruptions peaked, reported interruptions were 5,669 billion Btu of the planned service level of 11,657 billion Btu, so approximately half of the planned service level under interruptible service was actually delivered. However, reported interruptions were relatively small fractions of planned volumes for the entire sample period (Figure 15). The magnitude of the relative surge in reported interruptions in the third week in January underscores the importance of interruptions as a load management tool for distribution and pipeline companies. However, it also shows how the interruptions peak during the worst weather when distillate markets may already confront strong demand pressure.

Figure 14. Reported Natural Gas Volume Interrupted by Week, January and February 2000



Source: Energy Information Administration, Form EIA-903 "Natural Gas Service Interruptions in the Northeast During December 1999, and January and February 2000."

Figure 15. Planned Level of Service to Interruptible Customers and Actual Volumes Delivered, January and February 2000



Source: Derived from Energy Information Administration, Form EIA-903, "Natural Gas Service Interruptions in the Northeast During December 1999, and January and February 2000."

Backup Fuels

Most of the interruptible service customers (in terms of number of customers and volumes interrupted) who were interrupted, as identified by the LDCs and pipeline companies, used distillate fuel oil as their alternative fuel, although the relative dependence on distillate varied between New England and the Middle Atlantic. In the EIA-903 survey, respondents were asked to list the types of interruptible service and the alternative fuels for each customer interrupted, reflecting at least 75 percent of the total volume interrupted or no more than 50 customers. The raw data generated by the survey responses were used to estimate the total for the entire population in the region.¹⁰ The resulting data provide an estimate of the volume of reported interruptions by the types of

alternative fuels available to the interrupted end user (Figure 16).¹¹

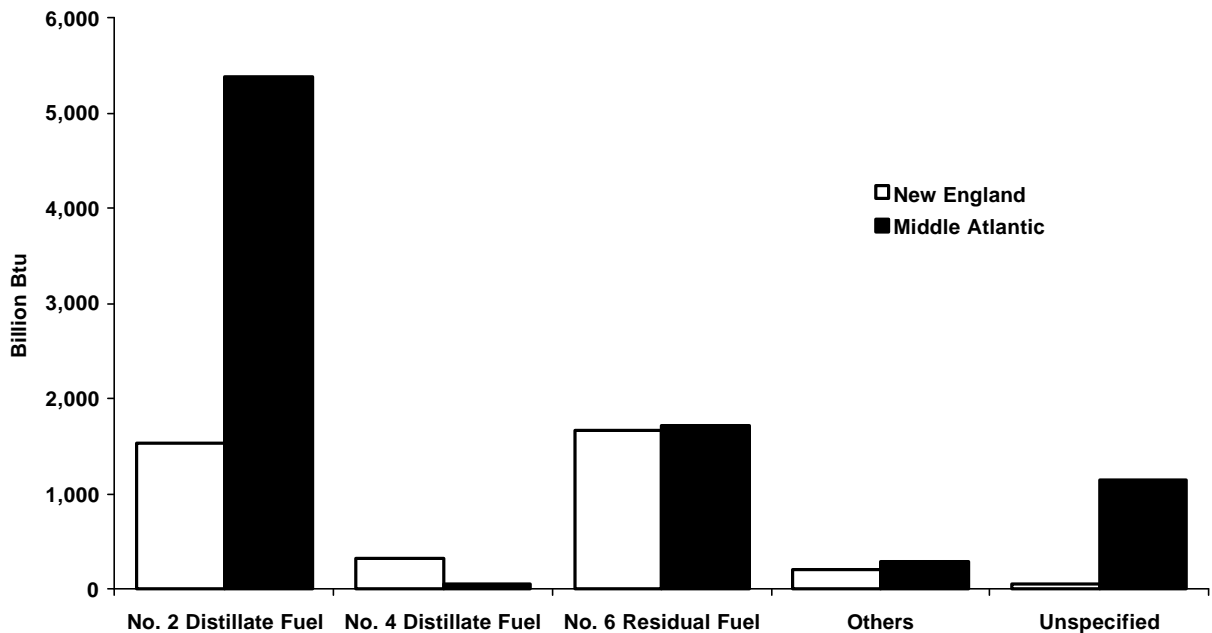
The volumes of interrupted natural gas deliveries were converted into their thermal equivalents in terms of the customer's backup fuel type to provide an estimate of the potential incremental demand for each fuel type (Table 3). For example, the 6,912 million Btu of interrupted volume of natural gas deliveries in the Northeast for customers using No. 2 distillate as backup fuel is equivalent to 1,187 thousand barrels of No. 2 distillate if these interrupted customers chose to offset all the interrupted natural gas with equivalent volumes of distillate.

The volume of reported gas interruptions equivalent to volumes of backup fuels is provided in this report as an indicator of the potential magnitude of backup fuel

¹⁰The raw sample data accounted for 11.7 trillion Btu of interruptions. This quantity was inflated by 6 percent to generate the population estimate of reported interruptions (12.4 trillion Btu). See Appendix B, Table B1.

¹¹The unspecified volumes consist of interruptible customers for which the natural gas companies did not furnish alternative fuel information.

Figure 16. Reported Volume of Natural Gas Interrupted in Terms of Equivalent Volumes of Backup Fuel, for January and February 2000



Note: Other includes kerosene, propane, and power grid.

Source: Energy Information Administration, Form EIA-903 "Natural Gas Service Interruptions in the Northeast During December 1999, and January and February 2000."

purchases. Estimates of average daily volume by week were computed for the volumes of distillate fuel oil equivalent to the volume of reported interruptions for interruptible gas customers in the Northeast identified on EIA-903 as having distillate fuel oil as a backup fuel. Two sets of estimates are provided to reflect uncertainties inherent in the estimates. To account for interruptions by gas service providers outside the respondent group, the pairs of estimates rely on reported volumes that then were expanded to the total volume (Table 4).

The range for average daily potential distillate purchases was between 78 and 84 thousand barrels per day at its peak during the third week of January. This estimate overstates the actual volume of backup fuel purchases to offset the interrupted volumes. Some customers who experienced interruptions suspended or scaled back operations rather than replacing the full volume of interrupted gas supplies with backup fuels. In certain cases, some of the interrupted gas volumes were replaced with backup fuels from inventories rather than with new purchases of backup fuels.

The estimated range of 78 to 84 thousand barrels per day of potential incremental distillate consumption is consistent with estimates published in earlier works. Earlier estimates had indicated that interruptions in natural gas service and economic switching caused an incremental demand of up to 100 thousand barrels per day for distillate fuel oil from the middle of January to early February 2000.¹² Since the earlier estimates include the full volumetric impact of both interruptions and economic switching, they naturally would be larger. If the larger estimates are reliable, the 78 to 84 thousand barrel per day range shows more than 15 percent of the fuel shifting from gas to distillate is due to factors outside gas service interruptions. These distinctions have important implications for further analysis or policy formulation.

¹²Energy Information Administration, *The Northeast Heating Fuel Market: Assessment and Options*, SR/OIAF/2000-03 (Washington, DC, May 2000), p. 44. Petroleum Industry Research Foundation, Inc., *What Happened to Heating Oil?* (March 2000), p. 6.

Table 3. Reported Volume of Natural Gas Interruptions Expressed in Terms of Equivalent Volumes of Backup Fuel, for January and February 2000

Fuel Type	New England	Middle Atlantic	Total Northeast
No. 2 Distillate			
Natural Gas Interruptions (Million Btu)	1,541,142	5,371,213	6,912,355
Fuel Equivalence (Thousand barrels)	264.6	922.1	1,186.7
Percent of Total	40.7%	62.6%	55.9%
No. 6 Residual			
Natural Gas Interruptions (Million Btu)	1,665,795	1,715,556	3,381,351
Fuel Equivalence (Thousand barrels)	265.0	272.9	537.8
Percent of Total	44.0%	20.0%	27.3%
No. 4 Distillate			
Natural Gas Interruptions (Million Btu)	332,360	56,986	389,346
Fuel Equivalence (Thousand barrels)	54.9	9.4	64.3
Percent of Total	8.8%	0.7%	3.1%
Kerosene			
Natural Gas Interruptions (Million Btu)	0	53,298	53,298
Fuel Equivalence (Thousand barrels)	0.0	9.4	9.4
Percent of Total	0.0%	0.6%	0.4%
Propane			
Natural Gas Interruptions (Million Btu)	24,075	84,285	108,360
Fuel Equivalence (Thousand barrels)	0.6	0.0	7.2
Percent of Total	0.7%	1.0%	0.9%
Other			
Natural Gas Interruptions (Million Btu)	173,990	147,360	321,350
Percent of Total	4.6%	1.7%	2.6%
Unspecified			
Natural Gas Interruptions (Million Btu)	48,787	1,148,909	1,197,696
Percent of Total	1.3%	13.4%	9.7%
Total			
Natural Gas Interruptions (Million Btu)	3,786,149	8,577,607	12,363,756

Note: Heat content used for No. 4 distillate was 6.056 million Btu per barrel (MMBtu/barrel), for kerosene 5.670 MMBtu/barrel, and for propane 6.287 MMBtu/barrel. Other includes coal, electricity, jet fuel and shut down.

Source: Derived from Energy Information Administration, Form EIA-903 "Natural Gas Service Interruptions in the Northeast During December 1999, and January and February 2000."

Customer Type

The detailed customer data provided by gas companies on Form EIA-903 were grouped into nine different categories or customer types: electric generation, product manufacturing, chemical and asphalt, textile and paper products, agricultural and food products, educational services, health services, housing, and general services (Figure 17).¹³ The most prominent feature that emerges from these groupings is that the electric power generation facilities account for the largest share of interrupted

volumes. For the overall sample, electric generation facilities experienced over 25 percent (1,428 billion Btu) of the reported interruptions that were known by industry type (5,583 billion Btu), and among distillate users electric generation facilities experienced over 44 percent (1,252 billion Btu) of the 2,788 billion Btu of interruptions known by industry type (Figure 18).

Although the electric generation facilities constituted the largest volumes among the nine customer types, interrupted volumes to a subset of three of the customer types enumerated above—educational services, health services, and housing—exceeded the interrupted volumes to electric generation facilities. Together, these "human

¹³As described in the box "Human Needs Customers and Interruptible Natural Gas Service" (p. 41), only 50 percent of interrupted volume data were available for this portion of the analysis.

Table 4. Estimated Volume of Distillate for Complete Replacement of Natural Gas Interruptions by Week in the Northeast, January and February 2000

Week Ended	Percent of Total Reported Interrupted Volume	Average Daily Volumes (Thousand Barrels)	
		Low Case	High Case
January 8	1.8	3	3
January 15	9.2	16	17
January 22	45.8	78	84
January 29	30.0	51	55
February 5	9.5	16	18
February 12	3.3	6	6
February 19	0.2	0	0
February 26	0.1	0	0
February 29	0.1	0	0
Weekly Total	100.0	170	183

Note: Natural gas volumes converted using 5.825 million Btu per barrel of distillate..

Source: Derived from responses to the Energy Information Administration surveys: Form EIA-903, "Natural Gas Service Interruptions in the Northeast During December 1999, and January and February 2000," and Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition."

needs" interruptible customers accounted for almost 30 percent of the interrupted service volumes among all interruptible customers. Among interruptible customers that use distillate fuel oil as their backup fuel, human needs customers are the second largest group with over 26 percent of service interruptions (see box, "Human Needs Customers and Interruptible Natural Gas Service," p. 41).

How Customers Responded to Interruptions (Form EIA-904)

Overview of Customer Survey

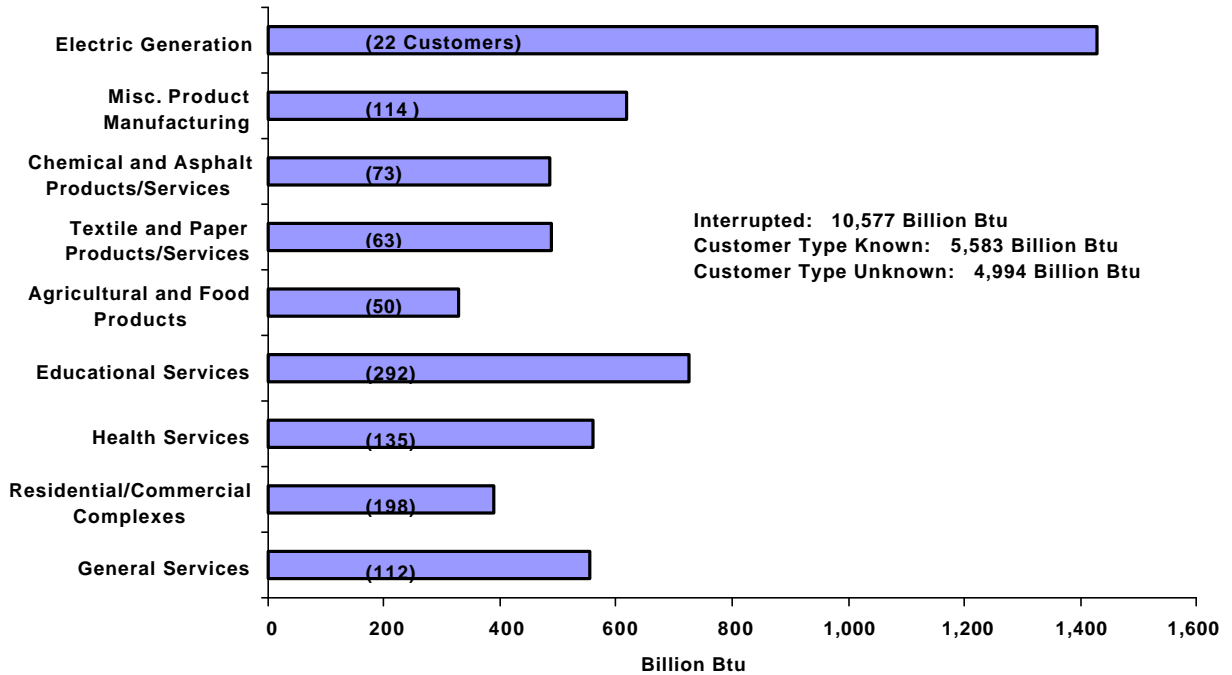
For information on purchases, consumption, and inventories, EIA surveyed a sample of gas customers in New England who according to information provided by gas suppliers on Form EIA-903 experienced an interruption in natural gas service during January-February 2000. Because of the emphasis in this report on distillate fuel oil demand, all the customers that were

identified as having distillate as a backup fuel were included in the sample. Some customers identified on EIA-903 as not having distillate fuel oil as a backup fuel were also included in the sample to verify the accuracy of the EIA-903 information.¹⁴ These customers were selected on the basis of interrupted volume—the two largest per reporting company—and by a random sample of the remaining New England customers identified by service providers as experiencing interruptions. A total of 97 customers provided responses to Form EIA-904, of which 67 were reported by their gas service provider as using distillate as a backup fuel and 30 were reported as using other backup fuels.

The analysis in this section is based on data from 40 of the 97 customers who responded to EIA-904. These

¹⁴EIA found several cases where the gas service providers reported the wrong backup fuel for an end user, but the low frequency was judged not significant enough to invalidate the responses overall. In addition, EIA found a number of cases in which the supplier reported that it interrupted a customer's gas supply while the customer reported that it switched to an alternative fuel because it was less expensive.

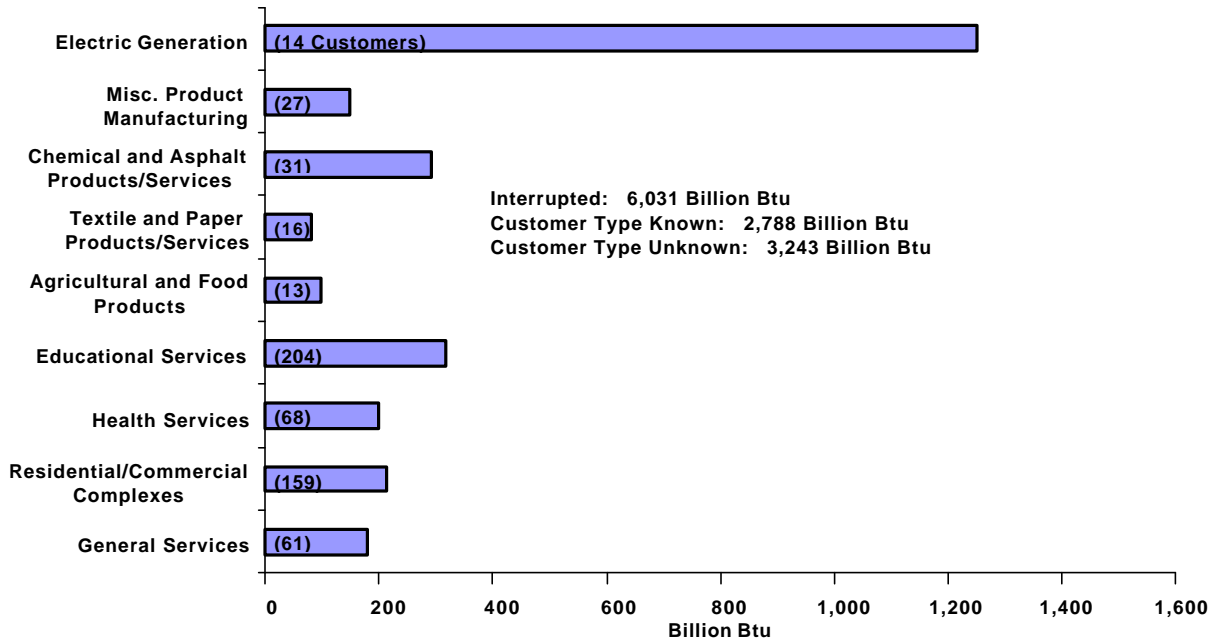
Figure 17. Reported Volume of Natural Gas Interrupted by Customer Type, for January and February 2000



Note: Customer-specific information presented here do not include information for all interrupted customers. The data are not drawn from a complete census or statistical sample.

Source: Energy Information Administration, Form EIA-903 "Natural Gas Service Interruptions in the Northeast During December 1999, and January and February 2000."

Figure 18. Reported Volume of Natural Gas Interrupted for End Users with Distillate Fuel Oil as the Backup Fuel by Customer Type, for January and February 2000



Note: Customer-specific information presented here do not include information for all interrupted customers. The data are not drawn from a complete census or statistical sample.

Source: Energy Information Administration, Form EIA-903, "Natural Gas Service Interruptions in the Northeast During December 1999, and January and February 2000."

Human Needs Customers and Interruptible Natural Gas Service

One of the issues surrounding the January to February 2000 event pertained to the type of customer being interrupted from natural gas service. Traditionally, large dual-fired industrial and electric generation facilities, including nonutility generators (NUGS), have been the major users of interruptible natural gas service. However, smaller companies and organizations also have adopted interruptible natural gas service as a way to minimize total energy costs. Some of these smaller companies and organizations, such as hospitals, residential complexes, and schools, are called human needs customers because of the possible impact on the immediate well-being of individuals. This is in contrast to offices, light manufacturers, industries, and others whose operations have a somewhat less immediate effect on individual well-being. Unlike other customers, the suspension of operations by hospitals, residential complexes, and, to some extent, schools is not a viable option for mitigating the effect of an interruption of natural gas service. Reliance on alternative fuels as a backup when natural gas service is interrupted is an essential part of energy acquisition strategies for human needs customers.

The surveys conducted by EIA following the January to February 2000 event provide some insight on the extent of interruptions and the backup fuel situation for human needs customers. Data from the EIA-903 survey sample were grouped by industry to characterize the volumes interrupted during January through February 2000. However, an estimate of all interruptions by industry types was not made because of the high level of nonresponse for the detail needed to categorize customers. In addition, survey response rates varied by region with significantly less detailed data provided in New York, Pennsylvania, and New Jersey, even though total interruptions were more extensive in those states. The results of the EIA-903 survey allowed about 50 percent of the interrupted volume data for January through February 2000 to be identified by industry.

The reported human needs customers, appearing in the educational, health services, and housing/lodging categories, together accounted for about 30 percent or 1,676.5 Btu of the interruptions that could be identified by industry type. EIA survey results document the interruption of 625 human needs users in the Northeast in January through February 2000. The largest reported interruptions on a per customer basis occurred in the health services sector where the average interruption was 4.2 billion Btu for 135 customers for a total of 560.6 billion Btu interruptions in this category. In the education sector, 292 customers experienced a total reported interruption of 726.7 billion Btu for an average of 2.5 billion Btu per school. In the housing/lodging sector, 198 customers experienced a total reported interruption of 389.2 billion Btu for an average of 2.0 billion Btu. Human needs customers relied less heavily on distillate for backup fuel than average for the Northeast (44 percent versus 56 percent).

Since suspension of operations is not a desirable option for most human needs customers, stocks and alternative supplies are crucial. Only 15 human needs customers with distillate backup responded to the EIA-904 survey. The results from the EIA-904 survey indicated that these customers, like others interrupted, purchased to replace fuels burned during the break in natural gas service so as not to deplete stocks. Distillate inventories at human needs facilities prior to the interruptions were the equivalent of 65 billion Btu and ended the last week in February at 48 billion Btu. The 15 responding human needs users, on average, had the capacity to store more than 22 days' worth of consumption on site and had 15 days' worth in inventories.

customers are those who experienced interruptions of natural gas service during January–February 2000, purchased or consumed distillate as a backup fuel, and provided data that were internally consistent. The data obtained from EIA-904 are based on a limited sample and are not conclusive for the overall customer population. Thus, the estimates cannot be aggregated as a measure of the incremental purchases that an influx of interrupted gas customers may have applied on demand in the distillate

market. However, the data are useful for illustrative purposes to describe behavior in reaction to shifting market conditions, including gas service interruptions, during the period. As such, they serve as a basis for insights regarding market behavior as an aid for possible policy formulation.

In nearly all cases, natural gas cannot be stored economically by end users. Instead, it is supplied on a

just-in-time basis, such that deliveries and consumption coincide, so gas purchases are equivalent to gas consumption. In contrast, distillate consumers must maintain some distillate inventories on site at their facilities. The presence of onsite inventories provides some flexibility in timing of purchase decision for most customers. Once an interruptible customer has decided to offset an interruption to gas service, the customer must also decide how much to purchase and how much to consume from inventory. Because purchases of distillate oil rather than consumption affect the market, purchases are the appropriate variable for measuring the amount of incremental demand for distillate heating oil.

For the majority of the 40 customers, the volume of distillate fuel oil consumed was roughly comparable, in terms of heat content, to the volume of interrupted gas deliveries. In terms of overall volume, however, respondents to Form EIA-904 reported that less than half of the total volume of gas interrupted during January and February 2000 was replaced by the consumption of distillate fuel oil. The lower-than-expected distillate consumption results from the actions of the larger firms, representing over 82 percent of the interrupted volume, who as a group reduced operations rather than use backup fuel to replace all interrupted gas supply. This finding indicates that, all else equal, using the total volume of gas interruptions for customers with distillate fuel oil backup as a proxy for their consumption or purchases of distillate fuel oil overstates their actual consumption or purchases.

The impact of interruptible gas customers on the distillate fuel oil market would have been mitigated if, in response to the suspension of natural gas service, interruptible customers consumed distillate from their onsite inventories rather than purchasing distillate to provide supplies or to maintain inventory levels. Based on information from the EIA-904, about 88 percent of the distillate fuel oil consumed over the 2-month period came from purchases and 12 percent from onsite inventory. Between January 1 and the end of February 2000, onsite inventories reportedly were drawn down by approximately 17 percent.

More important, during the week ended January 22, 2000, when the largest gas interruptions occurred, many smaller volume end users replaced almost 90 percent of their distillate consumption with purchases instead of drawing down inventories. Although the depletion of distillate inventories could not have replaced all of the interrupted natural gas during January and February

2000, using more stocks from inventory and changing the timing of replacement fuel purchases might have reduced the pressure on the distillate market. While these purchasing decisions can be made with accuracy given perfect hindsight, it should be noted that backup fuel purchasing decisions are normally made under conditions of considerable uncertainty. These data suggest that customers maintain multiple days' supply at a fairly stable level. Drawing down stocks before seeking replacement purchases may be perceived as a risk that would jeopardize operations to an unacceptable degree.

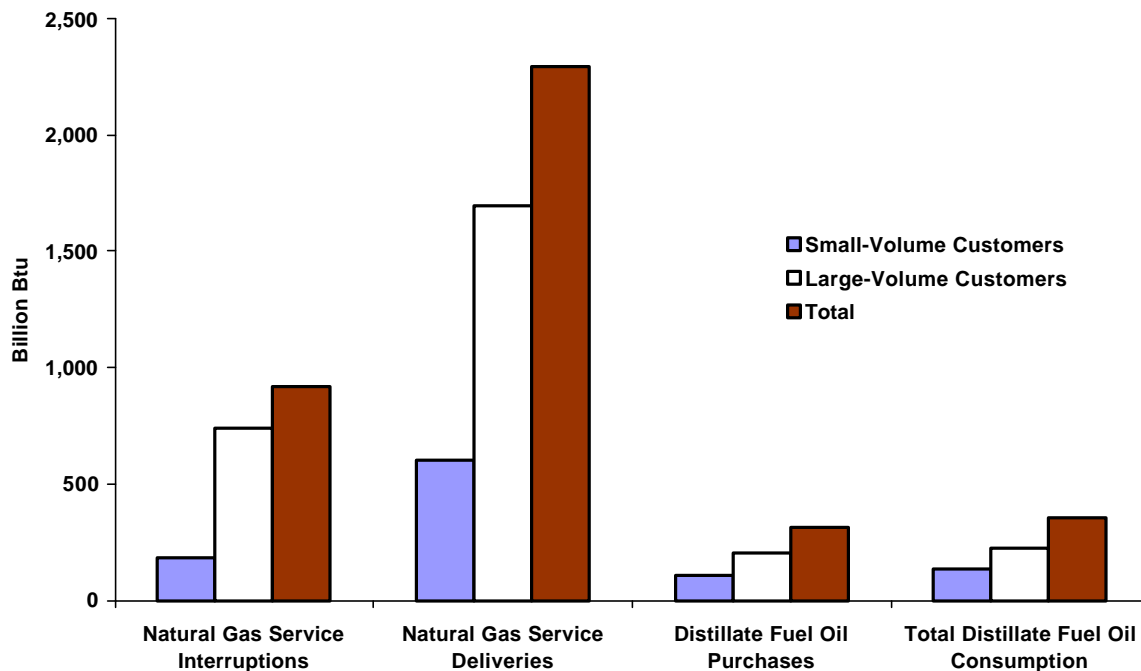
Customer Reactions to Interruptions

In evaluating how interruptible natural gas customers responded to interruptions during the January-February 2000 period, partitioning the data set by size of the customer prevents the activities of the large-volume customers from overshadowing the behavior of their more numerous albeit smaller counterparts. Of the 40 customers in the sample, the customer with the largest interruptions reported interruptions over the 8-week period that were more than 10,000 times greater than those for the smallest firm over the same period. Likewise, other variables of interest, such as distillate consumption and purchases, differed across firms by similar orders of magnitude (Figure 19). The four largest firms in terms of volume interrupted constitute over 82 percent of the 897,825 million Btu of total interruptions captured in the survey, while the other 36 firms account for the remainder. Thus, the principal variables of interest aggregated across all firms in the sample can lead to conclusions about the behavior of the typical firm in the sample that may characterize the behavior of the larger firms, but may not accurately describe the behavior of the majority of firms.

Furthermore, the four largest-volume firms in the sample include nonutility generators (NUGs) and cogeneration facilities (cogens). This provides a second rationale for partitioning the sample, as the underlying economics of decisions facing electricity producers may differ significantly from the circumstances that confront the non-electricity producing companies.

Of the customers in the sample, only the power producers use their fuel as a primary variable input to the production process, whereas for the other types the use of fuel takes on a much smaller role in production. For example, electric generation facilities must burn fuel to produce electricity. Therefore, the fuel used in production constitutes a fundamental component of the end product.

Figure 19. Data Reported by Interrupted Natural Gas End Users in New England During January and February 2000



Source: Energy Information Administration, Form EIA-904 "Customer Survey of Natural Gas Service Interruptions in the Northeast During January and February 2000."

Other industrial producers may burn gas, petroleum, or other fuels to power their plants, but other inputs are more integral to the final product or service.

Since the cost of natural gas or oil likely constitutes the dominant portion of the power producers' variable cost structure, one would expect that the amount of fuel purchased by these firms would be greatly affected by changes in the fuel price. Therefore, the prevailing spread between the prices of electricity and the gas or oil that might be used as an input would prove the determining factor in their short-run production decision. In contrast, other types of companies would have a much lower degree of sensitivity in this respect because the fuel cost likely constitutes a much smaller part of their operating costs.

Several conspicuous characteristics emerge from comparing the selected large-volume and small-volume customers that responded to the EIA-904. Key differences include the relative size of storage capacity compared with average daily requirements, inventory management practices, and the extent to which firms

replace the gas service interruption with distillate. For example:

- ! The small-volume customers offset over 78 percent of their interrupted natural gas service with purchases of equivalent volumes of distillate fuel oil during the 8-week period and 78 percent during the third week of January. In contrast, the large-volume customers offset only 28 percent over the 8-week period and 60 percent during the third week of January.
- ! Both types of customers maintained a fairly constant level of distillate inventories. Throughout the 8-week period the large-volume customers maintained their inventories at an average of about 83 percent full and the small-volume customers maintained inventories at 68 percent of their distillate capacity.
- ! Based on the maximum potential interruptions, the small-volume customers had 14.3 days of distillate storage capacity available and 9.8 days of distillate inventories on hand. In contrast, large-volume customers had only 3.7 days of storage capacity and 3.1 days of inventory.

Actions of Large-Volume Customers

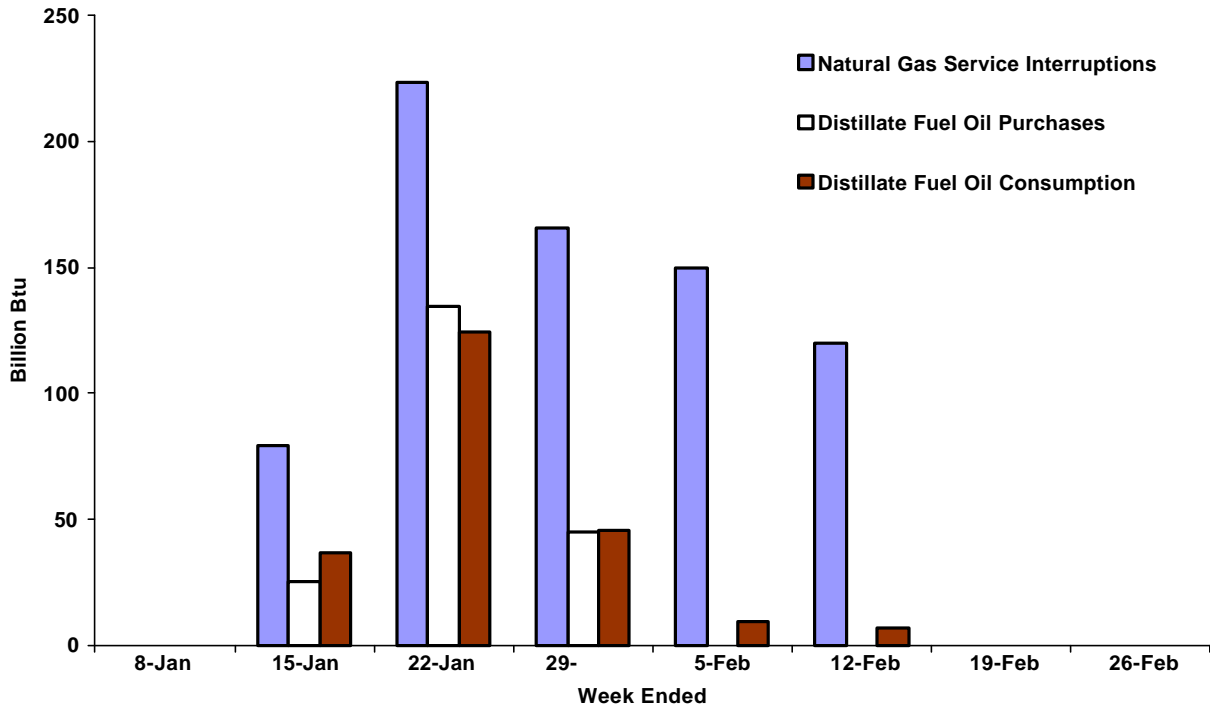
Throughout the 8-week period surveyed in EIA-904, the volume of the natural gas service interruptions exceeded the amount of distillate consumption and distillate purchases in each week, because some of the large-volume customers chose to curtail or reduce their operations when their gas service was interrupted (Figure 20). Follow-up interviews with the respondents confirmed the supposition that at least some of the reduced operations for the electric power generators was due to the prevailing conditions in the market that did not warrant paying premium prices for the input fuel.

Distillate purchases and consumption were almost coincident throughout the weekly periods of the sample.

Although the large-volume customers did not necessarily replace interrupted gas consumption with distillate consumption, they did burn more fuel than they purchased. The sole exception to this finding occurred during the week ended January 22, when purchases exceeded consumption by 8 percent. However, in any week during the 8-week period, the large-volume customers replaced no more than 56 percent of the volume interrupted by consuming distillate.

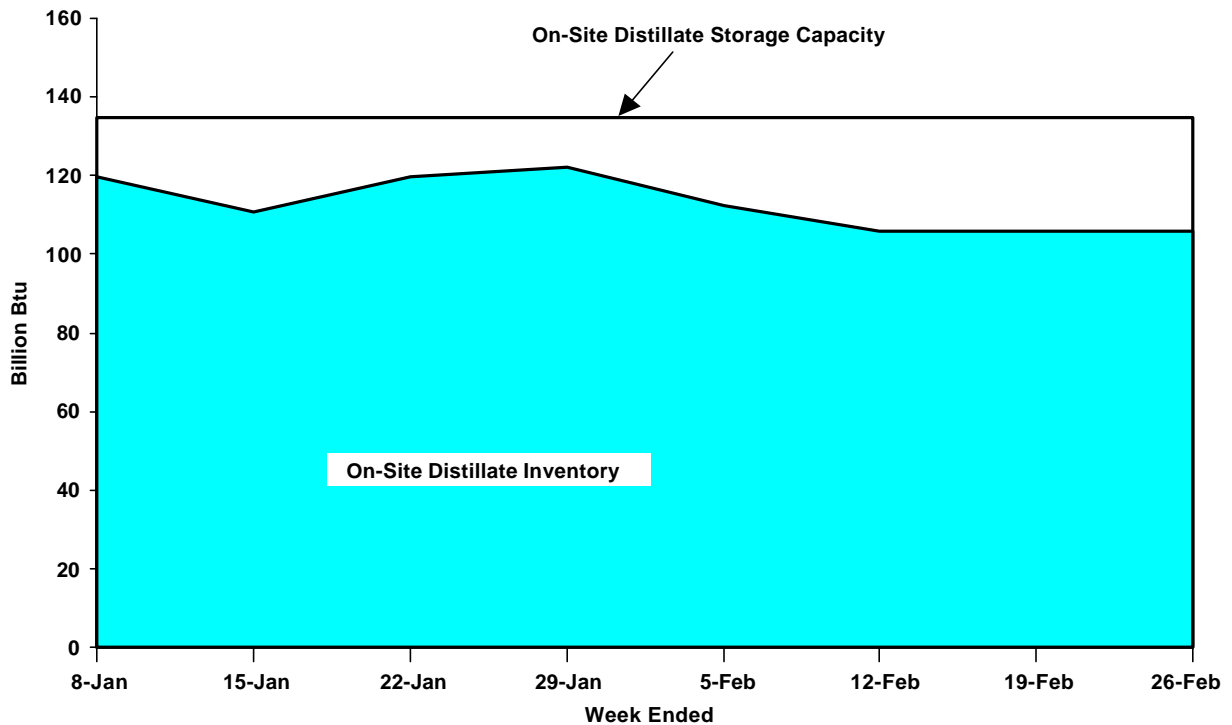
Distillate inventories of the large-volume respondents remained almost constant during January and February 2000 albeit with a slight downward trend (Figure 21). Throughout the 8-week period, these companies

Figure 20. Natural Gas Service Interruptions and Distillate Fuel Oil Purchases and Consumption for Large-Volume Customers in New England by Week During January and February 2000



Source: Energy Information Administration, Form EIA-904 "Customer Survey of Natural Gas Service Interruptions in the Northeast During January and February 2000."

Figure 21. Distillate Inventory and Storage Capacity for Large-Volume Customers During January and February 2000



Source: Energy Information Administration, Form EIA-904 "Customer Survey of Natural Gas Service Interruptions in the Northeast During January and February 2000."

maintained their inventories at an average of 83 percent full within a narrow range: 90 percent full at its maximum on the week after the largest interruptions, and 79 percent full in late February.

The large-volume customers would be unable to store enough distillate fuel oil to offset an interruption that lasts more than a few days. During January and February 2000, the large-volume customers had only 3.7 days of distillate storage capacity and 3.1 days of distillate inventories with respect to the potential volume of natural gas service interrupted.¹⁵ However, the apparent lack of distillate fuel oil capacity may simply reflect the broader

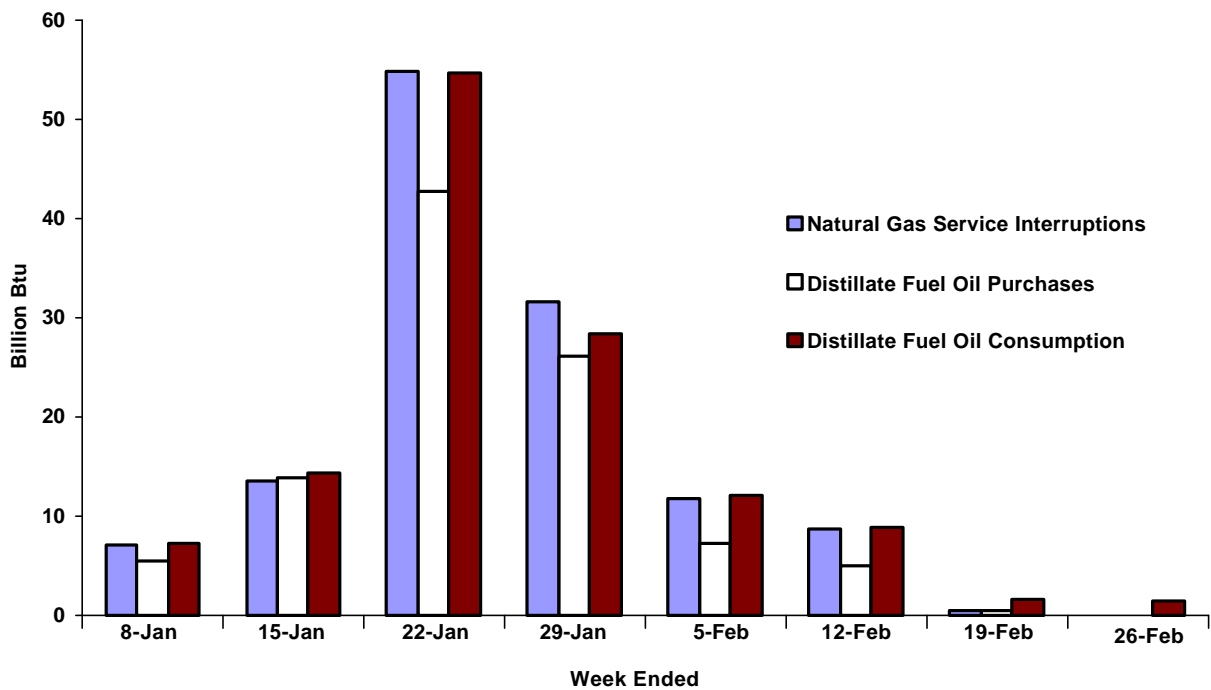
menu of options available to power producers. For example, the power producer could turn on an entirely different generator rather than use distillate fuel oil in the same dual-fuel unit, or buy electricity from elsewhere.

Actions of Small-Volume Customers

Among the respondents to EIA-904, the reaction of the selected smaller firms to interruptions differed from that of the large-volume customers. The small-volume customers more fully offset the interruption in gas service. Throughout the 8-week period, the small-volume customers offset over 78 percent of the interruptions with distillate purchases and a little over 100 percent of the interruptions with distillate consumption (Figure 22). This diverges from the behavior of the large customers who responded to the interruptions by curtailing operations to a greater extent throughout the period, and so consumption and purchases fell well below the level of interruptions. The large-volume customers replaced only 28 percent of the interruptions with distillate purchases and only 30 percent of the interruptions with distillate consumption.

¹⁵Using data from EIA-904, the number of days of storage capacity was computed by dividing capacity by the maximum average daily interruption that could be replaced. The maximum daily interruption that could be replaced is calculated by computing the 8-week average of natural gas volume delivered plus interrupted natural gas volume, and dividing by 7 days. This result was multiplied by the weighted average of the interruptible firms' assessment of the maximum percentage of natural gas needs that can be offset with distillate fuel oil (83 percent for large-volume customers and 74 percent for small-volume customers). Likewise the days of available inventory was computed by dividing the 8-week average of inventory by the maximum daily interruption that could be replaced.

Figure 22. Natural Gas Service Interruptions and Distillate Fuel Oil Purchases and Consumption for Small-Volume Customers in New England During January and February 2000



Source: Energy Information Administration, Form EIA-904 "Customer Survey of Natural Gas Service Interruptions in the Northeast During January and February 2000."

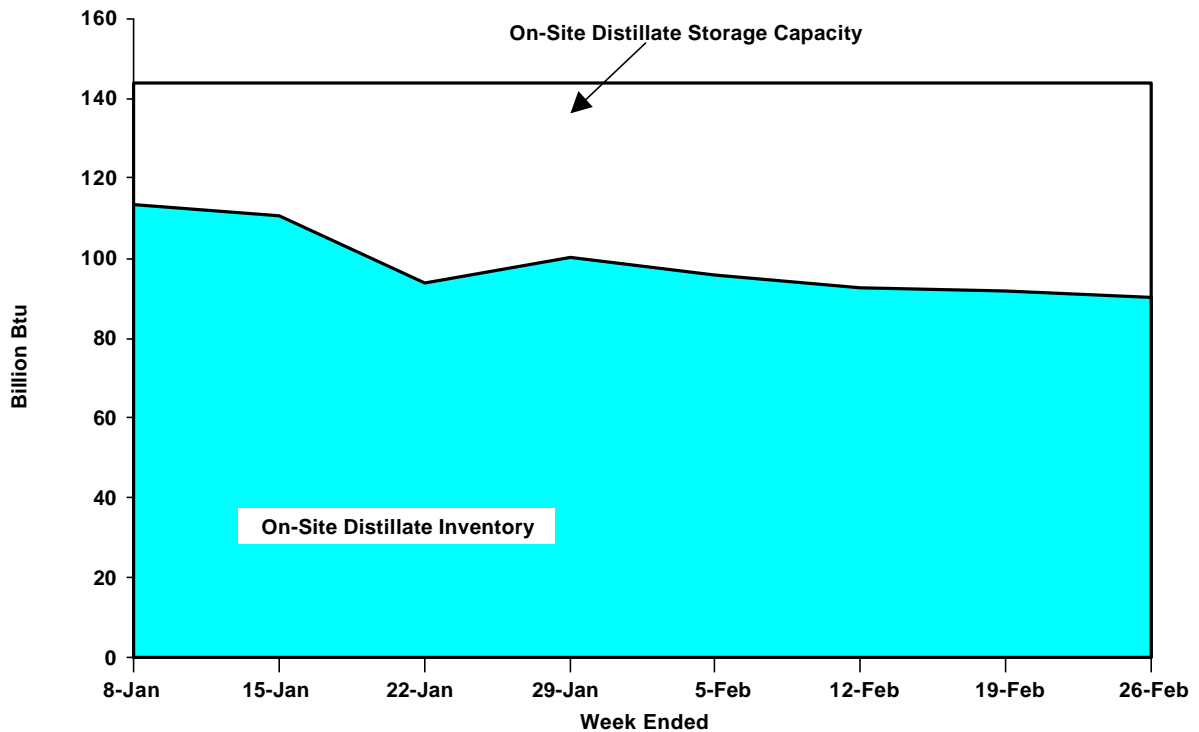
The pattern of distillate purchases and consumption by the small customers also differed from that of the large customers. Through most of the period and especially in the critical third week of January, distillate consumption by small customers exceeded purchases indicating that they relied more on inventories to offset energy volumes affected by gas service interruptions. As a result, the inventories of small-volume customers declined to a greater degree than was the case for the large-volume customers over the 8-week period, although both customer categories experienced a net inventory drawdown.

The small-volume customers had considerable excess capacity: on average they maintained inventories at 69 percent of their distillate capacity with 79 percent as the high during the period and 63 percent as the low (Figure 23). This fairly narrow range of inventories is consistent with the inventory range maintained by the large-volume customers. Although somewhat more variable than the larger customers' inventories, onsite distillate storage stocks for the smaller 36 customers also followed a

slightly downward trend during the sample period. It seems that both the large- and small-volume customers pursued a strategy to maintain onsite inventories at target levels. So, like the large-volume customers, the small customers offset the distillate that they consumed with purchases and maintained their inventories. However, the small-volume customers had much greater distillate storage capacity and onsite inventory relative to the potential volume of natural gas service interrupted than the larger customers who could only operate for a few days. During January and February, the small-volume customers had 14.3 days of distillate storage capacity available and 9.8 days of distillate inventories on hand.

Human needs customers (see box, p. 41) accounted for the majority of the interrupted natural gas service volumes among the small-volume customers. One reason is that some of them have their own electric cogeneration units, which they use to produce electricity for their own consumption. Thus some human needs customers have a second alternative in addition to distillate fuel oil when confronted with an interruption in natural gas service.

Figure 23. Distillate Fuel Oil Inventory and Capacity for Small-Volume Customers During January and February 2000



Source: Energy Information Administration, Form EIA-904 "Customer Survey of Natural Gas Service Interruptions in the Northeast During January and February 2000."

This possibility may mitigate both their exposure to gas service interruptions and their impact on the distillate fuel oil market.

Summary

The survey of gas suppliers (the LDCs and pipeline companies) indicates that while substantial volumes of gas service were interrupted, the aggregate volumes were less than a number of the early estimates that were used in the trade press and elsewhere during last winter. The investigation of customer behavior further indicates that one cannot simply equate the volumes of gas service interruptions with an increase in the aggregate demand for distillate in the entire Northeastern distillate market. Some customers relied on inventories for at least some of their fuel oil requirements, and both classes of customers generally burned less than an equivalent amount of distillate fuel oil.

The present end-use data indicate that a substantial portion of the total gas interruption during the critical third

week of January simply resulted in a lower level of operations for some customers. This outcome reduced some pressure that otherwise might have been imposed on the distillate market. A key portion of the reduction in overall energy demand was on the part of electric generation operators, who made the decision based on relative prices not to pursue distillate purchases. Thus, if electric demand, and consequently prices, had been strong enough to justify those purchases of distillate fuel oil, the price pressure on the distillate market would have increased more than it did.

Although the volumes of incremental distillate fuel oil demand driven by gas service interruptions are estimated at smaller amounts than previously expected, the findings of the present analysis highlight the complexities of these energy markets and their potential influence on each other. The present analysis provides findings that indicate the causes for fuel switching include business decisions as well as gas industry performance. Customer reactions to gas service interruptions are varied, reflecting differing operational objectives and economic circumstances.

5. Conclusion

The information on the weekly distribution of interruptions indicates that the greatest level of interruptions during the 1999-2000 winter was focused on the third week of January. Seventy-six percent of all reported interruptions¹ during January and February 2000 were contained in the third and fourth weeks of January. The analysis in this report shows that reductions in gas service due to reported interruptions for customers in the Northeast with distillate fuel oil as their backup were the equivalent of 78 to 84 thousand barrels per day of distillate during the peak week ended January 22. Average daily distillate consumption in the Northeast in January 2000 was 731 thousand barrels per day but probably rose above this level during the peak week. Actual distillate *purchases* resulting from the reported interruptions likely were less than the corresponding equivalent volume of distillate fuel oil, because some interruptible customers reportedly shut down operations temporarily while others drew down inventories slightly.

The estimated range of 78 to 84 thousand barrels per day of potential incremental distillate consumption is consistent with previously published estimates, which ranged up to 100 thousand barrels per day for distillate fuel oil for both interruptions and economic switching combined. If the larger estimates are reliable, the 78 to 84 thousand-barrel-per-day range clearly shows that more than 15 percent of the fuel shifting from gas to distillate is due to factors other than gas service interruptions.

These distinctions have important implications for further analysis or policy formulation. Understanding motivations behind customer behavior is essential to understanding gas and fuel oil markets at critical times of the year. This is particularly important for possible policy formulation to handle potential conditions leading to price spikes since the motives behind fuel switching differ greatly depending on whether they are caused by involuntary interruptions, seasonal contracts, or voluntary switching because of relative prices.

This study provides better information than previously available on the magnitude of fuel switching from gas to alternative fuels. It also contains information on customer behavior during the winter heating season, including times

of intense demand when interruptible gas service is not available. As such, this study provides a framework for improved understanding of the issues.

Distillate Market Dynamics

The distillate fuel oil price depends on a number of factors affecting demand and supply. Distillate demand consists of both demand from its regular users and demand from dual-fired users that may utilize distillate fuel oil periodically. Demand by the regular distillate customers depends on general economic conditions and weather, which affects heating requirements. Incremental demand for distillate fuel oil during the heating season consists primarily of demand by regular customers for distillate fuel oil for heating purposes and fuel-switching, both of which may be relatively inelastic. Energy demand for heating tends to be relatively unresponsive to price. Distillate demand for fuel-switching customers is driven by demand for produced output, whether electricity or industrial goods, which if sufficiently strong can cause the derived demand for energy by fuel-switching customers to be inelastic within a wide range of relative prices. Additionally, energy used for industrial applications generally is not a large portion of costs, so price increases may be absorbed within the cost structure for the overall operation.

Supply of distillate fuel oil depends on the flow of current production from refineries, interregional product transfers, imports, and inventories. If distillate demand expands to the limits of current supply, the market adjusts primarily by increasing prices, and additional demand from any source can result in a disproportionately large price response. At times of the most severe temperatures, demand for distillate surges, and gas service interruptions likely peak. These changes add to the demand pressure on a market that may already be close to its limits.

Distillate fuel oil price spikes historically have depended on a combination of conditions, which are not the same in all occurrences. As abnormally cold temperatures set in, low distillate fuel oil inventories may play a role in higher prices, but low inventories alone are not able to drive up prices as indicated in the market experience in 1996. Gas service interruptions contribute some portion of incremental demand at peak, but these volumes by themselves are not responsible for distillate fuel oil price

¹As described in Chapter 4, *reported interruptions* include some portion of volumes as a result of seasonal switching and economic switching in addition to interrupted gas volumes.

spikes. Gas service interruptions typically occur throughout the heating season, yet these events do not automatically result in distillate fuel oil price spikes. As discussed in Chapter 3, larger distillate fuel oil price spikes generally coincide with a disruption of one or more supply elements.

Customer Behavior

Customers who opt for interruptible gas service must have a strategy to respond to a possible suspension of gas service. A customer's choice should reflect the relative cost and benefits associated with each decision, which will vary depending on characteristics such as location or fuel-use technology for the particular application. The responses generally are one of two: shut down or burn an alternative fuel (although interrupted customers in a few cases were able to arrange continued gas deliveries through another supplier). If customers whose gas service has been interrupted choose to burn their alternate fuel, they face a secondary decision regarding replacement of at least some portion of the inventory drawdown with purchases of additional fuel.

The fuel oil purchase decision will be driven by the customers' perception of the adequacy of onsite inventory and the market conditions for the alternative fuel. The relative size of onsite inventory indicated by days-supply, as measured by the ratio of inventory to daily planned service, differs widely between large-volume interruptible customers and the small-volume users. Large-volume users had inventory equal to an average of 3.1 days supply. Small-volume users had capacity equal to requirements for almost 10 days.

The number of days supply reported by the large-volume customers is larger than previously hypothesized. Some analysts suggested that interruptible customers are compelled to enter distillate fuel oil markets immediately to purchase additional supplies. However, the levels held in onsite inventories by dual-fired energy customers in January and February 2000 represent a significant volume. While some concerns about the "Y2K" transition may have motivated the inventories recorded in the survey, the Y2K factor does not explain the customers' ongoing interest in replenishing their stocks in late January and early February, especially when distillate prices had spiked. When customers began to burn supplies, they initiated purchases to replenish their stores. So interruptions may lead to a fairly automatic response of purchases, but it is not because fuel is not on hand.

Instead, it is likely that customers have a standard level that is consistent with avoiding the risk of running out. Their aggregate behavior is such that in effect they offset most of their consumption with incremental purchases.

The Choice of Natural Gas or Petroleum

Fuel-switchable customers, who predominantly burn natural gas, can be an opportunity or a problem for operators in the alternative fuel markets. The infrequent purchases, unless they can be met from "current" supplies (domestic refinery production, interregional transfers, or imports), may result in problems of inventory management and customer relations for petroleum suppliers.

Carrying inventory to meet customer demands imposes a cost on petroleum suppliers. The low probability of sales to customers with irregular and infrequent purchases reduces expected net returns. Potential sales are uncertain and even when they occur are apt to be only for a brief period and typically during the heating season. The costs of unused inventories must be either recovered as an incremental charge from their regular customers or absorbed by the owners. In fact, petroleum suppliers, like many other industries, have shifted increasingly to a "just-in-time" delivery system that attempts to minimize the volume of inventory in serving all customers as an approach to managing costs.² This reaction to competition has lowered inventories, which reduces the industry backup to use for demand surges or disruptions in current supply.

The net benefits from the use of interruptible gas service depend on both the advantages of this service and the associated costs. In a broader perspective, it has been argued that dual-fired customers and their switching behavior promote efficiency because they switch from a scarce fuel (with higher prices) to one that is relatively more abundant (with lower prices). The economy at large benefits from the use of interruptible service by avoiding underutilization of gas industry infrastructure during non-peak periods and from energy at lower costs than otherwise would be the case. Not all the consequences of interruptible gas service are positive, however. When substantial interruptions occur, they may coincide with

²See, for example, "For Heating-Oil Firm in Vermont, Now Is the Winter of Discontent," *Wall Street Journal* (December 29, 2000).

already tight conditions in the petroleum product markets. The incremental demand from fuel-switching customers consumes a portion of the scarce supplies, and when petroleum prices rise it logically contributes at least some part of the price increase. The unexpected occurrence of sudden price shocks in the petroleum markets imposes an economic cost beyond the higher prices on participants in those markets. Costs resulting from gas service interruptions are a clear offset that reduces the net benefit of interruptible service. A thorough analysis of the economic merit of interruptible gas service is beyond the scope of the present study. However, the present work provides a set of data and other information that can serve as a useful basis for understanding the complexities of the interruptible gas market.

Implications for Energy Markets

Energy suppliers' best efforts to perform well may achieve benefits to the economy but they also may establish the foundation for episodes of market price spikes. The reduced energy prices because of the increased competition facing gas or petroleum suppliers provide benefits to consumers and the economy at large, but they undermine incentives to maintain infrastructures or inventories at levels sufficient to accommodate peak customer requirements in all situations.

Although the availability of low-cost fuel supply options creates economic benefits in most years, the resulting actions also can contribute to price fluctuations during severe winter events. These price increases can be a particular difficulty for customers on fixed or low incomes who receive fuel oil deliveries during times of elevated prices. In addition, small commercial consumers who rely on petroleum products to satisfy energy

requirements also may find their financial resources strained. The impact of these disruptions, as they influence fuel choice decisions and inventory planning, may offset some of the perceived benefits. However, expansion of the gas supply infrastructure to levels adequate to eliminate interruptions of gas service for all current users tends to be economically unattractive or infeasible.

Expansion of the gas delivery system would require substantial levels of new investment, the costs of which must be recovered in user fees in order to be economically justified. Additionally, seasonal demand for a significant portion of the customer base would result in unutilized capacity for some portion of the year. The operators of gas capacity, whether old or new, have an economic incentive to expand net revenues by increasing the total amount of service. Operators would either seek out new business that could not be offered continuously throughout the year (i.e., seasonal or interruptible service) or accept the presence of a productive asset being idle and not providing any return to the company.

Clearly this area of market behavior is a complex topic. Even if interruptible contracts had a limited role in recent fuel oil price spikes, that influence may be expected to increase over time. The trend for the distillate market, especially heating oil, in the Northeast has been toward declining volumes sold. Thus, the customer base is not expanding and the associated industry infrastructure and inventories are smaller. So even without further growth, the relative impact of present levels of fuel switching will grow relative to the regional distillate supply. Meeting the needs of regular and periodic customers will be an expanding challenge for market participants.

Appendix A

Analysis Request

JOSEPH I. LIEBERMAN
CONNECTICUT

COMMITTEES:
ARMED SERVICES
ENVIRONMENT AND PUBLIC WORKS
GOVERNMENTAL AFFAIRS
SMALL BUSINESS

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February 4, 2000

The Honorable William Richardson
Secretary
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Dear Secretary Richardson:

I am writing to request an immediate investigation into the prevalence and use of interruptible natural gas contracts and their impact on heating oil supply in New England, and prompt steps to alleviate any adverse consequences. My office has recently learned of a potentially large problem resulting from these types of contracts, under which a customer benefits from lower rates by accepting a contract for natural gas delivery that may be interrupted at the discretion of the gas supplier when supplies are limited and demand is high.

I understand that the recent supply shortage of home heating oil and continuing price spike in the Northeast is now being exacerbated by demand from interruptible natural gas contract-holders. Apparently, a large number of these contract-holders were told by their gas suppliers at the beginning of last week that they temporarily would not have access to natural gas for heating their homes. As a result, many of these customers turned to home heating oil as a substitute, which, according to the heating oil delivery industry, may be increasing demand by as much as two million gallons per day.

This type of interruptible contract may have the unintended consequence of contributing to heating oil price spikes and supply shortages. It has and may continue to account for unanticipated demand for home heating oil; these additional demands have the capacity to cripple the market in times of stress. I would like to know more about the extent of, the need for, and the potential consequences of interruptible contracts. Please promptly survey the extent of interruptible gas contracts and the level of new demand they may be adding to the heating oil market in the Northeast. Specifically, I would like to know the answer to the following questions:

- At what point do natural gas contractors refuse service to interruptible gas contract-holders?

- How often in the recent past have users of interruptible gas contracts created a significant unforeseen demand on home heating oil in the Northeast?
- Do interruptible gas (or other fuel source) contracts threaten the stability of the home heating oil market?
- What other backup fuels do interruptible contract users utilize?
- If you confirm there is a significant problem, what steps will you take in cooperation with industry to promptly alleviate it?

Thank you for your continued interest in this issue.

Sincerely,



Joseph I. Lieberman
United States Senator

Appendix B

Survey Data

Appendix B

Survey Data

In February 2000, Senator Joseph Lieberman of Connecticut requested an investigation into the prevalence and use of interruptible natural gas contracts and their impact on heating oil supply in New England. Specifically, Senator Lieberman requested that the Department of Energy (DOE) “promptly survey the extent of interruptible gas contracts and the level of new demand they may be adding to the heating oil market in the Northeast.”

Two survey forms were developed in response to this request: Form EIA-903, “Natural Gas Service Interruptions in the Northeast During December 1999, January and February 2000,” OMB No. 1905-0199, and Form EIA-904, “Customer Survey of Natural Gas Service Interruptions in the Northeast During January and February 2000,” OMB No. 1905-0200.

The Energy Information Administration (EIA) coordinated the development of the forms with staff from the Federal Energy Regulatory Commission (FERC), Interstate Natural Gas Association of America (INGAA), American Gas Association (AGA), New England Gas Association (NEGA), and the New York Public Service Commission (NYPSC). These consultations did not, however, include specific discussion of the detailed questions incorporated into these questionnaires. Additional preparatory work did include discussion of the form with two potential respondents and a review of a draft questionnaire by a manufacturing trade association.

Form EIA-903

Form EIA-903 initially was sent to nine local distribution companies (LDCs) in four of the Northeast States (Connecticut, Massachusetts, New Jersey, and New York). This allowed initial testing of the questionnaire prior to full distribution. These companies were selected on the basis of the amount of interruptible natural gas deliveries and the magnitude of gas volumes delivered to industrial (including nonutility generation) and electric utility sector end users in each state. These sectors are believed to be most affected by gas-service interruptions. The EIA-903 was subsequently sent to 21 additional LDCs and four pipeline companies. Based on responses to Form EIA-176, “Annual Report of Natural and Supplemental Gas Supply and Disposition,” for 1998, the

latest year for which interruptible delivery data were available, the 34 gas suppliers surveyed accounted for 94 percent of the natural gas deliveries to interruptible gas customers in the Northeast in 1998. The interruptible deliveries represented by surveyed gas companies in each state varied from 92 percent in New Jersey to 100 percent for three New England states. The state-level information was used to estimate the total interruptions to account for those gas service providers not included in the EIA-903 survey (Table B1).

Form EIA-903 consists of six parts:

- ! Part I identifies the company and requests contact information and conversion factors from volumes of gas to Btu heat content to allow the analyses of different respondent data on a uniform basis.
- ! Part II A asks the company to describe its interruptible gas service tariffs or contract categories. Part II B asks the company to list, for all tariffs and contract categories listed in Part II A, monthly data for December 1999, January 2000, and February 2000, and weekly data for January and February 2000. The requested data include the maximum daily quantity, total deliveries interrupted in each period, number of days interrupted, and the number of days of service with flow restrictions to customers.
- ! Part III asks for the company to list its customers who were interrupted during January and February 2000. Specifically, Part III asks for the customer name, volume interrupted, customer contact person, phone number or e-mail address, and the type of the alternative fuel capability for each customer that could have been used in January-February 2000 to replace the volume of gas that was interrupted.
- ! Part IV requests maximum daily quantity and total interruptions for firm service contracts.
- ! Part V asks for a list of interrupted firm service customers.
- ! Part VI asks for a list of customers who declined gas service after interruptions were ended, whether under a firm or interruptible contract.

Table B1. Natural Gas Interruptions in the Northeast During January and February 2000, by State

State/Region	Raw Data from Form EIA-903 (MMBtu)	Respondents' Share of 1998 Interruptible Gas Deliveries (Percent)	Estimated Natural Gas Interruptions (MMBtu)
New England			
Massachusetts	2,507,687	97	2,585,244
Other	1,184,029	98	1,200,905
Total	3,691,716	97	3,786,149
Middle Atlantic			
New York	2,325,640	94	2,474,085
Other	5,629,555	93	6,103,522
Total	7,955,195	93	8,577,607
Northeast	11,646,911	94	12,363,756

MMBtu = Million Btu.

Source: Energy Information Administration. **Raw Data:** Part II of Form EIA-903, "Natural Gas Service Interruptions in the Northeast During December 1999, and January and February 2000." **1998 Share of Interruptible Gas:** Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition" (1998).

To aid its analysis, EIA assigned a Standard Industrial Classification (SIC) code and description to more than 1,000 customers listed in the responses to Part III of EIA-903. The addition of the SIC codes allowed for an analysis of interruptions by business sector. The two-digit SIC codes were grouped into the following categories:

- ! Agricultural/Food Products: 01-16, 18-21, 51
- ! Textile and Paper Products/Services: 22-27
- ! Chemical and Asphalt Products/Services: 28-29
- ! Misc. Product Manufacturing: 30-39, 50, 52-59
- ! General Services: 17, 40-45, 62-64, 66-69, 71-79, 83-97
- ! Electricity Generation: 49
- ! Health Services: 80
- ! Educational Services: 82
- ! Residential/Commercial Complexes, Lodging: 65, 70.

The interrupted volumes from Part III as classified by SIC code are shown by category in Table B2. Most of the interrupted volume in the Middle Atlantic region could not be classified into SIC category, whereas over 99 percent of the New England volume was assigned SIC codes. The total volume reported in Part III of Form EIA-903 of 10,577,444 MMBtu is less than the Part IIB total of 11,646,911 MMBtu because respondents were not asked to provide information on all interrupted customers. Part III of EIA-903 requested customer information for at least 75 percent of total gas interruptions, up to a total of 50 customers. In practice,

many respondents provided information for a larger number of customers.

In most cases gas service providers reported their interrupted customers' alternative fuel on Part III of the EIA-903. EIA conducted a followup investigation with customers to identify the alternative fuel information which was not reported by the gas companies. Through this followup investigation, EIA was able to assign the proper alternative fuel to customers who represented over 50 percent of the interrupted volumes for which this information was missing. EIA was also able to allocate interrupted volumes of gas accurately among the various alternative fuels for several respondents. After the direct assignments and allocations were completed, EIA assigned the remaining interrupted volumes with unreported alternative fuels to an "unspecified" category.

In total, backup fuels were identified on the EIA-903 Part III for 99 percent of the interrupted volumes in New England and 87 percent of the interrupted volumes in the Middle Atlantic region (Table B3). At the state level, the calculation for alternative fuel resulted in completed assignments for New Jersey, Connecticut, Maine, New Hampshire, Rhode Island, and Vermont. Massachusetts was 92 percent complete, while New York was 75 percent complete and Pennsylvania 65 percent complete.

Table B2: EIA-903 Part III Interruptions and Customers by SIC Group and Region

Customer Category (SIC/Unknown)	Northeast		Middle Atlantic		New England	
	Volume (MMBtu)	No. of Customers	Volume (MMBtu)	No. of Customers	Volume (MMBtu)	No. of Customers
SIC Group						
Chemical / Asphalt	486,171	73	385,943	48	100,228	25
Textile & Paper	488,265	63	82,608	27	405,657	36
Educational Services	726,691	292	342,160	230	384,531	62
Agricultural / Food	330,392	50	145,464	33	184,928	17
Health Services	560,625	135	280,391	77	280,234	58
Residential/ Commercial	389,224	198	255,467	152	133,757	46
Misc. Product Man	619,644	114	141,119	38	478,525	76
Electricity Generation	1,428,398	22	321,205	10	1,107,193	12
General Services	553,734	112	269,368	52	284,365	60
Total SIC Group	5,583,403	1,059	2,223,985	667	3,359,418	392
Unknown	4,994,041	21	4,966,801	12	27,240	9
Total	10,577,444	1,080	7,190,786	679	3,386,658	401

SIC = Standard Industrial Classification. MMBtu = Million Btu..

Source: Energy Information Administration, Form EIA-903, "Natural Gas Service Interruptions in the Northeast During December 1999, and January and February 2000."

Table B3. Share of Natural Gas Interruptions by Alternative Fuel and State/Region for January and February 2000

State / Region	No. 2	No 4	No 6	Other	Unspecified
New England					
Massachusetts	42.8	7.0	48.2	0.2	1.9
Other	36.3	12.6	35.0	16.2	0
Total	40.7	8.8	44.0	5.2	1.3
Middle Atlantic					
New York	53.7	2.0	9.7	9.1	25.6
Other	66.2	0.1	24.2	1.0	8.5
Total	62.6	0.7	20.0	3.3	13.4
Northeast	55.9	3.1	27.3	3.9	9.7

Note: Other includes propane, jet fuel, kerosene, electricity, coal, and shut down. Unspecified includes not specific, none specified, and no alternative fuel.

Source: Energy Information Administration, Form EIA-903, "Natural Gas Service Interruptions in the Northeast During December 1999, and January and February 2000," Part III.

The percentages shown for alternative fuel types in Table B3 include these EIA adjustments achieved in followup contacts.

Data Adjustments

As discussed earlier, EIA performed a significant amount of followup work to correct and complete the responses to the EIA-903. However, additional adjustments were required before EIA could conduct an analysis of natural gas interruptions and their impact on fuel oil markets in the Northeast. These adjustments were necessary because the EIA-903 survey was not sent to every gas service provider in the Northeast region and the surveyed gas companies were not asked to provide information on all interrupted customers. EIA first estimated the total volume of interrupted gas reported on Part II of Form EIA-903 to account for those gas companies in the Northeast that were not included in the survey. As stated earlier, the 34 companies surveyed represented about 94 percent of the 1998 annual interruptible natural gas deliveries in the Northeast, with individual state coverage ranging from 92 to 100 percent. The state percentages were applied to the respective total gas interruption by state derived from Part II of EIA-903 resulting in an increase from the reported interruption (raw data) of 11,646,911 MMBtu to a total reported interruption of 12,363,756 MMBtu in the Northeast for January and February 2000 (Table B1).

Once the raw interruption data were estimated to represent the entire Northeast region, EIA separated the interruptions among the various alternative fuels to assess the potential volumetric impact that natural gas interruptions may have had on the distillate market and other alternative fuel markets. The assignment of natural gas interruption volumes to alternative fuels was accomplished using the information from Part III of EIA-903. The alternative fuel information derived from Part III (Table B3) was used to allocate the inflated gas interruption of 12.4 trillion Btu among the various alternative fuel and unspecified categories. The allocation was performed on each state's data and summed to arrive at the regional totals of natural gas interrupted by associated alternative fuel.

This procedure provided a base line estimate for the total volume of gas interruption that could have affected the No. 2 fuel oil market in the Northeast during January and February 2000. A second or high estimate of the volume of gas interrupted with No. 2 as an alternative fuel was developed by assigning half of the unspecified volumes to

the No. 2 category. Table B4 details the results of these calculations. The numbers shown in Table B4 were then used for the analyses, tables, and charts in the body of this report.

Form EIA-904

EIA developed a customer survey to collect specific information about customers' alternative fuel capabilities and activities during a natural gas service interruption and to check information provided by the natural gas service providers. Form EIA-904 was a customer-oriented survey designed to collect weekly information for January and February 2000, including the volumes of gas delivered, the volumes interrupted, the days interrupted, and the alternative fuel use including volumes purchased and consumed and weekly inventory levels and storage capacity. A customer in the EIA-904 survey was a consuming site so a single company with multiple sites comprises multiple customers.

Form EIA-904 was targeted to all customers identified in the responses to Form EIA-903 that were interrupted and had distillate fuel oil as a backup fuel to natural gas. Additional customers who were reported to have an alternative fuel other than distillate were also included in the survey to cross check the responses to the EIA-903. Customers in New York, New Jersey, and Pennsylvania were not included in the EIA-904 survey because responses to the EIA-903 from gas service providers in these states were received after the mailing date for the EIA-904 survey. As a result, the EIA-904 sample was not statistically designed to collect information from the entire Northeast region. The results from the analysis of EIA-904 data are provided as illustrative, but they are not definitive for all customers in the Northeast and the results cannot be aggregated for regional totals.

Survey forms were mailed to 101 potential respondents, three of which duplicated other EIA-904 requests and one customer who was dropped because it could not be contacted by phone or mail, resulting in responses from 97 unique customers. Follow-up contact was made with every customer in the EIA-904 survey reported to have been a distillate user, to verify whether No. 2 distillate fuel oil was in fact the alternative fuel source to natural gas, and to ensure internal consistency of the reported data.

Table B4. Estimated Natural Gas Interruptions by Alternative Fuel Capability, January–February 2000 (Million Btu)

State / Region	Total	No 2: Low Estimate	No 2: High Estimate	No 4	No 6	Other	Unspecified
New England							
Massachusetts	2,585,244	1,105,676	1,130,070	180,992	1,245,851	3,938	48,787
Other	1,200,905	435,466	435,466	151,368	419,944	194,127	0
Total	3,786,149	1,541,142	1,565,536	332,360	1,665,795	198,065	48,787
Middle Atlantic							
New York	2,474,085	1,328,588	1,645,140	48,768	239,394	224,232	633,103
Other	6,103,522	4,042,625	4,300,528	8,218	1,476,162	60,711	515,806
Total	8,577,607	5,371,213	5,945,668	56,986	1,715,556	284,943	1,148,909
Northeast	12,363,756	6,912,355	7,511,203	389,346	3,381,351	483,008	1,197,696

Note: Other includes propane, jet fuel, kerosene, electricity, coal, and shut down. Unspecified includes not specific, none specified, and no alternative fuel.

Source: Energy Information Administration, Form EIA-903, "Natural Gas Service Interruptions in the Northeast During December 1999, and January and February 2000."

Discrepancies Between EIA-903 and EIA-904 Results ***Insights***

Several customers surveyed by Form EIA-904 reported data that were inconsistent with the information provided on EIA-903 by their gas supplier (Table B5). In some cases, there were differences in the backup fuels identified as being useable for a given customer. Of the 97 respondents to EIA-904, 67 were identified as having No. 2 distillate as an alternative fuel by their gas service providers on Form EIA-903, while only 50 of those customers surveyed reported having No 2 distillate alternative fuel capability. In all cases that this discrepancy occurred, the customer information on the EIA-904 was assumed to be more reliable because they were reporting on their own operations. In addition, about 40 percent of the EIA-904 respondents claimed that no interruption of service occurred during January-February 2000, whereas their service provider reported on EIA-903 that an interruption of service did occur during the period. The EIA-904 respondents stated that either they had a seasonal contract and therefore did not expect to receive gas, that they voluntarily switched to their alternative fuel for economic reasons, or they in fact continued to receive gas throughout the reporting period.

Although responses to Form EIA-904 accounted for only a small portion of the natural gas interruptions in the Northeast (less than 10 percent of the interrupted customers and about 18 percent of the interrupted volume reported on Part III of EIA-903), EIA gained valuable insights through these data and information gathered through the follow-up investigation of EIA-903 information. EIA found a number of customers in both surveys that continued to receive gas from their original supplier or a different supplier while the gas service provider reported that the customer was interrupted. In addition, there were several instances in which the gas companies reported customers as interrupted when in fact the customers received gas under seasonal contracts which do not provide gas service during the months of January and February.

Table B5. Difference Between EIA-904 and EIA-903 Survey Information About Companies Used in the EIA-904 Sample

Respondent Information	Reported on Form EIA-903			Reported on Form EIA-904			
	Number of Companies			Number of Companies			
	With Distillate Capability	Without Distillate Capability	Total	With Distillate Capability	Without Distillate Capability	Alternative Fuel Unknown	Total
Interrupted and Consumed Distillate	62	–	62	41	–	–	41
Interrupted and Consumed Other Fuel	–	26	26	2	10	–	12
Not Interrupted	5	4	9	6	4	29	39
Data not cleaned	–	–	0	1	2	2	5
Total	67	30	97	50	16	31	97

Source: Energy Information Administration, Form EIA-903, "Natural Gas Service Interruptions in the Northeast During December 1999, and January and February 2000," and Form EIA-904, "Customer Survey of Natural Gas Service Interruptions in the Northeast During January and February 2000."

Another group of customers reported that they decided to consume their alternative fuel and cease gas consumption for economic reasons. Some of the largest-volume end users in the region reported that they suspended or curtailed operations instead of consuming an equivalent amount of alternative fuel to replace their interrupted

supply of gas. Therefore, the total volume of gas interrupted with No. 2 as an alternative fuel may likely be an upper bound when attempting to assess the impact of natural gas interruptions on the distillate market.

Appendix C

**Survey Forms:
Form EIA-903 and Form EIA-904**

Form EIA-903

Natural Gas Service Interruptions in the Northeast During December 1999, and January and February 2000

U.S. DEPARTMENT OF ENERGY
Energy Information Administration
Washington, D.C. 20585

FORM EIA-903
NATURAL GAS SERVICE INTERRUPTIONS IN THE NORTHEAST
DURING DECEMBER 1999, AND JANUARY AND FEBRUARY 2000

I. PURPOSE

The Form EIA-903 "Natural Gas Service Interruptions in the Northeast during December 1999, and January and February 2000" is designed to collect information concerning only those natural gas service arrangements respondent companies have with end users, i.e., those who burn or otherwise use the fuel. Any arrangements for deliveries to other natural gas service providers or distributors should be excluded. This information is being requested on a State basis for the following northeastern States: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. The Energy Information Administration (EIA) is conducting this mandatory survey under the general information gathering provisions provided under the Federal Energy Administration Act of 1974, P.L. 93-275.

II. WHO MUST REPORT

Selected local distribution companies (LDC's) and pipelines that delivered natural gas to consumers during December 1999, and January and February 2000 in the northeastern United States as listed in Part I above.

III. WHEN TO REPORT

Completed Forms EIA-903 "Natural Gas Service Interruptions in the Northeast during December 1999, and January and February 2000" are to be filed with the EIA postmarked on or before May 22, 2000.

IV. WHERE TO REPORT

Each respondent is required to submit the completed form in any of the following formats:

- an Excel spreadsheet,
- a WordPerfect file, or
- paper copy

To: Energy Information Administration: EI-44
Mail Station: BE-064 FORSTL
U.S. Department of Energy
Washington, D.C. 20585-0644
Attn: Form EIA-903

or

Fax completed form to (202) 586-4420
Attn: Form EIA-903

or

E-mail the completed form to either:
mary.carlson@eia.doe.gov or
barbara.marinervolpe@eia.doe.gov

For general information and/or assistance call either Mary Carlson at (202) 586-4749 or Barbara Mariner-Volpe at (202) 586-5878. Ms. Carlson and Ms. Mariner-Volpe can be contacted by e-mail at the addresses listed above.

V. PROVISIONS FOR CONFIDENTIALITY OF INFORMATION

Information supplied in response to this form will be kept confidential by the Energy Information Administration as follows. The Office of Legal Counsel of the Department of Justice concluded on March 20, 1991, that the Federal Energy Administration Act requires the EIA to provide company-specific data to the Department of Justice, or to any other Federal agency when requested for official use, which may include enforcement of Federal law.

The information contained on this form may also be made available, upon request, to another component of the Department of Energy (DOE), to any Committee of Congress, the General Accounting Office or other Congressional agencies authorized by law to receive such information. A court of competent jurisdiction may obtain this information in response to an order.

GENERAL DESCRIPTION OF THE FORM

The Form EIA-903 "Natural Gas Service Interruptions in the Northeast during December 1999, and January and February 2000" is divided into six parts. All selected respondents are required to submit the form and must complete all data items applicable to the company's operations in the report State(s).

INSTRUCTIONS

General Instructions

If final numbers are not available for the information requested, estimated data are acceptable. Indicate with an "E" any estimated data element.

Computer files or other listings may be submitted in lieu of designated parts of the form.

The form may be copied as necessary to cover all rate schedules or contract categories. Computer files or other listings may be submitted in lieu of completing designated items. The form Part number should be written on any computer listing.

Part I. Identification and Certification

Requests the name, address, telephone number, and e-mail address of the person to be contacted with any questions regarding the submission.

The contact should be an individual who is familiar with the service arrangements of the responding company and its customers.

Part I also asks the responding company to indicate the units it will use for reporting, i.e., thousand cubic feet (Mcf) or dekatherms (Dth).

Part II. Interruptible Natural Gas Service Tariffs or Contract Categories

A. Description of Interruptible Natural Gas Service Tariffs or Contract Categories. Requests information on selected characteristics of interruptible service arrangements provided to end-use customers. This category should include any tariff or contract category that allows service to be interrupted at some time during the contract/tariff period. For example, if the annual service agreement is for 330 days of firm service and up to 35 days of a lower level of firm service or interruptible service, that type of service agreement should be categorized as interruptible for purposes of this survey.

Note: Copies of relevant parts of tariff schedules or contract categories are acceptable in lieu of the form.

B. Natural Gas Service Interruptions or Service Restrictions Under Interruptible Tariffs During the Period from December 1, 1999, to February 29, 2000.

Requests information by rate schedule or contract category listed in Part II (A) for any natural gas service that was interrupted during the period from December 1, 1999, to February 29, 2000.

Part III. Customers with Interruptible Natural Gas Service Interrupted during January and February 2000

Requests the names and contact information for customers with interruptible service agreements who were interrupted. Please list a sufficient number of companies to provide at least 75% of the total volume that was interrupted under all schedules up to a total of 50 companies in the report State. If possible, please list customers in order from largest to smallest volumes interrupted.

The customer contact listed should be an individual who is familiar with the service arrangements and the company practices regarding back-up fuel inventories and purchasing practices.

Part IV. Firm Natural Gas Service Tariffs or Contract Categories

Requests baseline monthly and weekly information for those categories of service which were interrupted during December 1999 and January and February 2000. (See definition of firm service.)

Part V. Customers with Firm Natural Gas Service Interrupted during January and February 2000

Requests the names and contact information for customers with firm service agreements who were interrupted. Please list a sufficient number of companies to provide at least 75% of the total volume that was interrupted under all schedules up to a total of 50 companies in the report State. If possible, please list customers in order from largest to smallest volumes interrupted.

The information requested in this form will be kept confidential and not disclosed to the public to the extent that it satisfies the criteria for exemption in the Freedom of Information Act (FOIA), 5 U.S.C. §552, the DOE regulations 10 C.F.R. §1004.11, implementing the FOIA, and the Trade Secrets Act, 18 U.S.C. §1905.

Upon receipt of a request for this information under the FOIA, the DOE shall make a final determination whether the information is exempt from disclosure in accordance with the procedures and criteria provided in the regulations. To assist us in this determination, respondents should demonstrate to the DOE that, for example, their information contains trade secrets or commercial or financial information whose release would be likely to cause substantial harm to their company's competitive position. A letter accompanying the submission that explains (on an element-by-element basis) the reasons why the information would be likely to cause the respondent substantial competitive harm if released to the public would aid in this determination.

VI. SANCTIONS

The timely, comprehensive, and accurate submission of this form by those required to report is mandatory under §13(b) of the Federal Energy Administration Act of 1974 (FEA Act) P.L. 93-275.

VII. DEFINITIONS

Firm Service Tariffs or Contracts: Any tariff, contract, or other type of service arrangement under which the respondent agreed to provide firm continuous service

without any provision for interruptions or a break in service during the contract period.

Interruptible Service Tariffs or Contract Categories: For purposes of this request, interruptible service includes any tariff, contract, or other type of service arrangement under which the responding company agreed to provide service but might discontinue the service upon some agreed upon conditions. This category would include service arrangements such as the following:

- service that is interrupted when the temperature drops to or below a specified level.
- contracts for firm service for much of the year but with a provision for being interrupted under certain conditions or during certain time periods. For example, if the service agreement is for 330 days of firm service and up to 35 days of a lower level of firm service or interruptible service, that type of service agreement should be categorized as interruptible for purposes of this survey.
- service is interrupted on a specific date or schedule.

Maximum Daily Quantity (MDQ): The maximum amount of gas the transporter is obligated to deliver during any single day and for which the customer agrees to pay a fee. An MDQ may be specified in a tariff or contract service agreement. The MDQ is sometimes referred to as maximum daily contract quantity.

Northeastern United States: For the purposes of this survey, includes Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.

The customer contact person should be an individual who is familiar with the service arrangements and the company practices regarding back-up fuel inventories and purchasing practices.

Part VI. Customers that Declined Service during January and February 2000

Requests the names and contact information for customers that declined natural gas service when interruptions were ended and natural gas service was offered/available in the report State. The customer contact should be an individual who is familiar with the service arrangements and company practices regarding back-up fuel inventories and purchasing practices.

U.S. DEPARTMENT OF ENERGY
Energy Information Administration
Washington, D.C. 20585

FORM EIA-903
NATURAL GAS SERVICE INTERRUPTIONS IN THE NORTHEAST
DURING DECEMBER 1999, AND JANUARY AND FEBRUARY 2000

This report is mandatory under the Federal Energy Administration Act of 1974 (Public Law 93-275.) For the provisions concerning the confidentiality of information and sanctions, see Sections V and VI of the Instructions.

PART I. Identification and Certification

1. Company Name:

2. Service in (State):

3. Address (Street, City, State, Zip Code)

4. Contact Person:

5. Title:

6. Telephone Number:

7. E-Mail Address:

8. Fax Number:

9. Signature:

10. Date:

Important: Volumetric data filed on this Form are reported in (check one) : Mcf (thousand cubic feet) Dth (dekatherms)
Heat content: _____ Btu/cf.

Company Name _____
State _____

PART II. Interruptible Natural Gas Service Tariffs or Contract Categories

A. Description of Interruptible Natural Gas Service Tariffs or Contract Categories

Please provide the following information for each tariff schedule that allows service to be interrupted to an end-user. Any tariff or contract that allows service to be interrupted at some time during the contract/tariff period of service should be included. For example, if the annual service agreement is for 330 days of firm service and up to 35 days of a lower level of firm service or interruptible service, that type of service agreement should be categorized as interruptible for purposes of this survey.

Rate Schedule and Name of Interruptible Service _____
Note: For each rate schedule or contract category, your company must file information on Part II (B).

Describe the conditions under which the service is interrupted:
(A copy of the relevant portion of the tariff schedule or contract category may be attached in lieu of completing this Section. The rate schedule or contract category should be noted on the copy.)

Describe any requirements contained in the tariff or contract for fuel back-up arrangements by the customer.
(A copy of the relevant portion of the tariff schedule or contract category may be attached in lieu of completing this Section. The rate schedule or contract category should be noted on the copy.)

Please make additional copies of the form as necessary to cover each rate schedule or contract category.

Company Name _____
 State _____

PART II. Interruptible Natural Gas Service Tariffs or Contract Categories (continued)

B. Natural Gas Service Interruptions or Service Restrictions Under Interruptible Tariffs During the Period from December 1, 1999, to February 29, 2000

Please provide the following information *by tariff schedule or contract category listed in Part II (A) above* for any natural gas service that was interrupted during the period from December 1, 1999, to February 29, 2000. Provide the information for the report State in which your company made deliveries. Indicate with an "E" any information which is estimated.

Rate Schedule and Name of Interrupted Service _____	Monthly Data			Weekly Data								
	Dec 1999	Jan 2000	Feb 2000	1/2-1/8	1/9-1/15	1/16-1/22	1/23-1/29	1/30-2/5	2/6-2/12	2/13-2/19	2/20-2/26	2/27-2/29
Cumulative maximum daily quantity of gas to be provided under these contracts in each period. (e.g., if the maximum daily quantity (MDQ) for each day during February 2000 is 150 units, then the cumulative MDQ for February 2000 is 150 units/day x 29 days = 4,350 units.)												
Total deliveries interrupted in each period. (e.g., if 100 units were interrupted for each of three days, the total interrupted deliveries would be 300 units.)												
Number of days interrupted under these contracts in each period. (If contract was interrupted for less than a day, provide the fractional day equivalent.)												
Number of days of service with flow restrictions to customers in each period. (Service was not interrupted.)												

Please make additional copies of the form as necessary to cover each rate schedule or contract category.

EIA-903

Company Name _____

State _____

PART III. Customers with Interruptible Natural Gas Service Interrupted during January and February 2000

Customer list should account for at least 75 percent of the total volume of interruptible service that was interrupted under all schedules, up to a total of 50 companies in the State specified. If possible, please list customers in order from largest to smallest volumes interrupted. The customer contact should be an individual who is familiar with the service arrangements and the company practices regarding back-up fuel inventories and purchasing practices. You may use the following format or you may attach the information using a computer file or other listing.

Customer Name (company address, if available)	Volume Interrupted (total all schedules)	Types of Alternative Fuel Capability (if known)	Customer Contact Person	Telephone Number (include e-mail address if available)

Please make additional copies of this form as necessary to complete the filing.

Company Name _____
 State _____

Part IV. Firm Natural Gas Service Tariffs or Contract Categories

A. During the period from December 1, 1999 through February 29, 2000, did you curtail, suspend, or restrict service to any customer(s) with firm service tariffs or contracts in the State specified?

Check one: Yes No

B. If the answer to A was "No," please provide the monthly total of the maximum daily quantities of gas to all end-use customers with firm service for the following months (e.g., if the maximum daily quantity (MDQ) for each day during February 2000 is 150 units, then the cumulative MDQ for February 2000 is 150 units/day x 29 days = 4,350 units):

December 1999 _____
 January 2000 _____
 February 2000 _____

C. If the answer to A was "No," please turn to Part VI, and complete as appropriate.

D. If the answer to A was "Yes," provide the following information for the total of all firm natural gas service tariffs or contract categories for the report State in which you had deliveries. Indicate with an "E" any information which is estimated.

	Monthly Data			Weekly Data								
	Dec 1999	Jan 2000	Feb 2000	1/2-1/8	1/9-1/15	1/16-1/22	1/23-1/29	1/30-2/5	2/6-2/12	2/13-2/19	2/20-2/26	2/27-2/29
Cumulative maximum daily quantity of gas to be provided under these contracts in each period. (e.g., if the maximum daily quantity (MDQ) for each day during February 2000 is 150 units, then the cumulative MDQ for February 2000 is 150 units/day x 29 days = 4,350 units.)												
Total deliveries interrupted in each period.												
Number of days interrupted under these contracts in each period. (If contract was interrupted for less than a day, provide the fractional day equivalent.)												
Number of days of service with flow restrictions to customers in each period. (Service was not interrupted.)												

Please make additional copies of the form as necessary to complete the filing.

Company Name _____
State _____

Part V. Customers with Firm Natural Gas Service Interrupted during January and February 2000

Customer list should account for at least 75 percent of the total volume of firm service which was interrupted, up to a total of 50 companies in the State specified. If possible, please list customers in order from largest to smallest volumes interrupted. The customer contact should be an individual who is familiar with the service arrangements and the company practices regarding back-up fuel inventories and purchasing practices. You may use the following format or you may attach the information using a computer file or other listing.

Customer Name (company address, if available)	Volume Interrupted (total all schedules)	Types of Alternative Fuel Capability (if known)	Customer Contact Person	Telephone Number (include e-mail address, if known)

Please make additional copies of the form as necessary to complete the filing.

Company Name _____
State _____

Part VI. Customers that Declined Service during January and February 2000

Please provide a list of the customer name, contact person and telephone number for companies that declined natural gas service when interruptions were ended and natural gas service was offered/available in the State specified. The customer contact should be an individual who is familiar with the service arrangements and the company practices regarding back-up fuel inventories and purchasing practices. You may use the following format or you may attach the information using a computer file or other listing.

Customer Name (company address, if available)	Customer Contact Person	Telephone Number (include e-mail address, if known)

Please make additional copies of the form as necessary to complete the filing.

Form EIA-904

**Customer Survey of Natural Gas Service Interruptions in
the Northeast During January and February 2000**

**CUSTOMER SURVEY OF NATURAL GAS SERVICE
INTERRUPTIONS IN THE NORTHEAST DURING
JANUARY AND FEBRUARY 2000**

LABEL
Company name
Control ID
State

1. The timely, comprehensive, and accurate submission of this form by those required to report is mandatory under §13(b) of the Federal Energy Administration Act of 1974 (FEA Act) P.L. 93-275.
2. Those required to report are selected users of natural gas located in Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont whose supply of natural gas was interrupted during December 1999, or January or February 2000.
3. This completed form should be filed by June 16, 2000.
4. Data may be submitted directly on this form or in any other format, such as:

Excel spreadsheet
Word or WordPerfect file

Whatever format is used to report, ensure that answers are provided for all pertinent questions.

5. For general information and/or assistance call Ms. Dawn Thomas toll free at 1-800-937-8281 extension 2065.
6. Mail the completed form to:

Natural Gas Interruptions
c/o Westat
1650 Research Blvd.
Rockville, MD 20850
or

Fax the completed form to:
301-315-5934
Attn: Natural Gas Interruptions
or

E-mail the completed form to:
thomasd1@westat.com

PROVISIONS FOR CONFIDENTIALITY OF INFORMATION

Information supplied in response to this form will be kept confidential by the Energy Information Administration as follows. The Office of Legal Counsel of the Department of Justice concluded on March 20, 1991, that the Federal Energy Administration Act requires the EIA to provide company-specific data to the Department of Justice, or to any other Federal agency when requested for official use, which may include enforcement of Federal law.

The information contained on this form may also be made available, upon request, to another component of the Department of Energy (DOE), to any Committee of Congress, the General Accounting Office or other Congressional agencies authorized by law to receive such information. A court of competent jurisdiction may obtain this information in response to an order.

The information requested in this form will be kept confidential and not disclosed to the public to the extent that it satisfies the criteria for exemption in the Freedom of Information Act (FOIA), 5 U.S.C. §552, the DOE regulations 10 C.F.R. §1004.11, implementing the FOIA, and the Trade Secrets Act, 18 U.S.C. §1905.

Upon receipt of a request for this information under the FOIA, the DOE shall make a final determination whether the information is exempt from disclosure in accordance with the procedures and criteria provided in the regulations. To assist us in this determination, respondents should demonstrate to the DOE that, for example, their information contains trade secrets or commercial or financial information whose release would be likely to cause substantial harm to their company's competitive position. A letter accompanying the submission that explains (on an element-by-element basis) the reasons why the information would be likely to cause the respondent substantial competitive harm if released to the public would aid in this determination.

Public Reporting Burden for this collection of information is estimated to average 6 hours per response, including the time of reviewing instructions, searching existing data records, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Energy Information Administration, Statistics and Methods Group, EI-70, Washington, DC 20585-0670, and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

All selected respondents are required to submit the form and must complete all data items applicable to the company's operations.

Part I: Identification

Please print. The contact person should be an individual who is familiar with the fuel service arrangements.

1. Name of company if different from front page: _____
2. Address of contact person (Street, city, state, zip code): _____

3. Name of contact person: _____
4. Title: _____
5. Telephone no.: _____ Fax number: _____
6. E-mail address: _____
7. Signature: _____ Date: _____

Part II: General Information

<p>1. Did you experience an interruption in service of natural gas during January or February 2000?</p>	<p><input type="checkbox"/> Yes <input type="checkbox"/> No (No further information is required. Please return the form as instructed on the front page.)</p>
<p>2. When gas supplies were unavailable, did you use alternative fuels in place of natural gas for your operations?</p>	<p><input type="checkbox"/> Yes <input type="checkbox"/> No (No further information is required. Please return the form as instructed on the front page.)</p>
<p>3. Please indicate which of the following fuels were used to substitute for natural gas that was interrupted during January or February 2000. (Check each fuel used.)</p>	<p><input type="checkbox"/> Distillate fuel oil <input type="checkbox"/> Propane (LPG) <input type="checkbox"/> Kerosene & Turbine Fuels <input type="checkbox"/> Residual Fuel Oils <input type="checkbox"/> Electricity <input type="checkbox"/> Natural gas (from alternate supplier) <input type="checkbox"/> Other, please specify:</p>
<p>4. In general, during January and February, what is the maximum percentage of your natural gas needs that can be offset with distillate fuel oil?</p>	<p>_____ %</p>

Only data for selected heating season months for 1998 and 1999 and for selected weeks for 2000 are being requested. If final numbers are not available for the information requested, estimated data are acceptable. Indicate with an "E" any estimated data element.

Part III. Natural Gas Deliveries and other Energy Purchases in Period

Record monthly natural gas deliveries for the 3 months requested. Provide weekly data for the 9 weeks ending on the dates listed. Record any liquid fuel purchases for the same periods.

Report total volumes for the period. Indicate the units used for reporting, e.g., thousand cubic feet (Mcf) or dekatherms (Dth).

Interruptible Contract: For purposes of this request, interruptible service includes any contract, tariff, or other type of service arrangement where the energy supplier agreed to provide service but might discontinue the service upon some agreed upon conditions.

Firm Contract: Any contract, tariff, or other type of service arrangement under which the energy supplier agreed to provide firm continuous service without any provision for interruptions during the contract period.

Part IIIA. Natural Gas Deliveries in Period

	Interruptible Contract		Firm Contract	Other
	Days Interrupted	Volume Interrupted	Volume delivered	Volume delivered
Units used for reporting:		Units:	Units:	Units:
Monthly data				
Dec. 1998				
Jan. 1999				
Dec. 1999				
Year 2000 week ending				
Jan. 8				
Jan.15				
Jan. 22				
Jan. 29				
Feb. 5				
Feb. 12				
Feb. 19				
Feb. 26				
Mar. 4				

Part IIIB. Liquid Fuel Purchases in Period

	Distillate	Propane (LPG)	Kerosene & Turbine Fuels	Residual Fuel Oils
Units used for reporting:	Units:	Units:	Units:	Units:
<i>Monthly data</i>				
Dec. 1998				
Jan. 1999				
Dec. 1999				
<i>Year 2000 week ending</i>				
Jan. 8				
Jan.15				
Jan. 22				
Jan. 29				
Feb. 5				
Feb. 12				
Feb. 19				
Feb. 26				
Mar. 4				

Part IV. Means of Delivery for Purchases of Liquid Fuels

How were deliveries made to the final point of consumption?	<u>Truck</u>	<u>Barge</u>	<u>Pipeline</u>	<u>Other (specify)</u>
Distillate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> _____
Propane (LPG)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> _____
Kerosene & Turbine Fuels	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> _____
Residual Fuel Oils	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> _____

Part V: Distillate Purchases to Offset Natural Gas

Report total volume for the period.

	Units	Weekly Data for Year 2000								
		1/8	1/15	1/22	1/29	2/5	2/12	2/19	2/26	3/4
Distillate										

Part VI: Liquid Fuels Consumed in Period

Report total volume for the period.

	Distillate	Propane (LPG)	Kerosene & Turbine Fuels	Residual Fuel Oils
Units used for reporting:	Units:	Units:	Units:	Units:
Monthly data				
Nov. 1998				
Dec. 1998				
Jan. 1999				
Nov. 1999				
Dec. 1999				
Year 2000 week ending				
Jan. 8				
Jan.15				
Jan. 22				
Jan. 29				
Feb. 5				
Feb. 12				
Feb. 19				
Feb. 26				
Mar. 4				

Part VII: On-Site Fuel Storage Capacity and Inventories

Part VIIA: On-Site Distillate Storage Capacity

Report as of end of period.

	Units	Monthly Data					
		Nov. 1998	Dec. 1998	Jan. 1999	Dec. 1999	Jan. 2000	Feb. 2000
Distillate							

Part VIIB: On-Site Inventories of Liquid Fuels

Report end of period stocks.

	Distillate	Propane (LPG)	Kerosene & Turbine Fuels	Residual Fuel Oils
Units used for reporting:	Units:	Units:	Units:	Units:
<i>Monthly data</i>				
Dec. 1998				
Jan. 1999				
Nov. 1999				
Dec. 1999				
<i>Year 2000 week ending</i>				
Jan. 8				
Jan.15				
Jan. 22				
Jan. 29				
Feb. 5				
Feb. 12				
Feb. 19				
Feb. 26				
Mar. 4				

Thank you for completing this report.

Please return the completed report to:

Natural Gas Interruptions
c/o Westat
1650 Research Boulevard
Rockville, MD 20850

Appendix D

State Heating Oil Studies

Appendix D

State Heating Oil Studies

The New York State Energy Research and Development Authority (NYSERDA), the Rhode Island Department of Attorney General, and the New Jersey Board of Public Utilities have investigated the cause of the distillate fuel price surge and supply shortfall that occurred during January and February 2000.

NYSERDA estimated that peak-shaving electric generation facilities in the State of New York consumed approximately 4.3 million gallons (102,380 barrels) of distillate fuel oil during January 2000, and independent power producers (IPPs) that switched from natural gas to distillate consumed approximately 7.8 million gallons (185,714 barrels). The majority of distillate fuel oil for the month of January 2000 occurred in the last two weeks of the month. For the peak shaving facilities, these estimates include both those facilities that use distillate fuel oil on a regular basis and those facilities that use distillate as a replacement fuel during a natural gas interruption.

As a result of these findings, the New York Public Service Commission passed an order requiring certain interruptible natural gas customers to maintain a minimum inventory of their alternative fuel during the winter heating season. However, some service agreements specify that interruptible gas customers keep an adequate backup supply and maintain the dual-fuel equipment necessary to utilize the fuel. The rule as proposed, requires 10 days storage supply of their alternative fuel, if that fuel is distillate fuel oil or if the customer serves human need end users. In addition, NYSERDA advocates holding a pre-winter meeting between state and federal representatives and petroleum industry representatives. Other initiatives addressed in the NYSERDA report involve the cooperation of state, federal and industry representatives in order to mitigate the effects of a supply disruption or price spike in the distillate fuel oil market.

In contrast to the large volume of incremental demand generated in New York by the electric generation sector, the Rhode Island Department of Attorney General estimated that total fuel oil consumption by all interruptible customers in both the industrial and electric generation sector for the January-February 2000 period was 1.1 million gallons (26,190 barrels) of distillate fuel

oil. Because Rhode Island has a smaller market than New York, the total interruptible end-use consumption during both January and February 2000 was low. The relatively small volume consumed could be a result of changing fuel use by interruptible users. According to the Rhode Island study, it is becoming more common for electric utilities to have access to firm service supplies of natural gas as their alternative during an interruption in service, rather than using distillate fuel oil from storage or purchasing fuel on the spot market. The report found that “Although the interruptions matched the timing of the largest increases in the #2 distillate fuel oil prices, the volumes of fuel oil used by interruptible consumers did not have a major impact on fuel oil suppliers.” [Page 27]

The findings in Rhode Island resulted in different policy recommendations than in New York. The development of a regular publication concerning a distillate (No.2) fuel oil inventory index for consumers and advance information about winter fuel supply is the main focus. Other recommendations include inventory supply standards that would require fuel oil suppliers to demonstrate their ability to meet customers’ demands under forecasted winter demands and have sufficient inventories entering the heating season. Regulatory options requiring minimum inventories for end-users and economic incentives for operators to discourage “just-in-time” inventory practices are also viable options presented in the Rhode Island study.

New Jersey has implemented statewide rules regarding minimum supply of backup fuels for interruptible customers who use No. 2 distillate fuel oil, No. 4 fuel oil, jet fuel, or kerosene, and a noncompliance penalty of 10 times their prevailing tariff rate for interruptible customers who burn gas during the interruption. New Jersey requires a 7-day supply either through onsite storage or through a firm contractual agreement if the customer plans to continue operating during a gas interruption. This order took effect November 1, 2000, the start of the natural gas heating season. Wholesale electric generators, including cogeneration customers with wholesale electric contracts, are exempt. The stated intent of the order is to ensure that interruptible customers comply with system interruption notices so that all firm customers will receive reliable service.