Heating Fuels

Historical Perspective

Before the 1950s, coal was the primary source of heating fuel for the residential, commercial and industrial sectors. This all changed after World War II as wartime demand for oil greatly increased the production and refining capacity of petroleum products. By 1950, petroleum production began to overtake coal as the country's primary heating fuel and the chief source of energy for most of the United States. Post war advancements in technology and a booming transportation infrastructure also helped increase the production of natural gas. Throughout the 1950s and '60s, the 297,000 miles of U.S. pipeline network we have today began to take shape. The nation began a massive expansion of its pipeline network, which led to the rapid growth of natural gas markets in all the major regions of the U.S.

The Northeast Infrastructure & Supply Chain

Heating Oil

Of the 8.1 million households in the United States that use heating oil to heat their homes, 6.3 million households or roughly 78 percent are located in the Northeast region of the country[1]. The infrastructure that brings distillate fuel oil to the Northeast begins with large distribution centers which provide supplies to smaller distribution points that, in turn, supply thousands of retail dealers who deliver heating oil to millions of homes. The large distribution centers play a central role in setting market prices throughout the region. Prices are set at the New York Harbor – the product trading center for distillate fuel oil[2]. Because it is the physical source of much regional supply and an alternative market for companies with product to sell, including area refineries, prices set at the New York Harbor quickly reverberate throughout the region.

In the Northeast, independent marketers provide the gateway for distillate fuel oil supplies in the region. They own and operate oil storage terminals that receive supplies via tanker, barge, or pipeline. They sell to retailers and to large bulk consumers from their terminal "racks."[3] The marketers offer a host of services to their customers, including lines of credit, hedging programs, and bid support. In the 1990s, the wholesale market in the Northeast underwent considerable consolidation. The largest terminals, which form the core of the region's supply network, are still operating but are owned by fewer companies. Moves toward efficiency, as well as increased environmental regulations, resulted in the closure of some smaller dealer-owned storage facilities located closer to consumers.

The Northeast infrastructure provides several alternatives for customers to obtain supplies of distillate fuel oil. Retail dealers normally pick up heating oil from wholesale terminals in trucks. The oil is sometimes transferred to a centrally located bulk plant and from there dispatched in smaller trucks for home delivery. Many retailers, however, dispatch delivery-size trucks to the wholesale terminal, which then proceed directly to deliver the oil to homeowners and other consumers. The delivery system in the Northeast

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[1] The Northeast region includes New Jersey, New York, Pennsylvania, Connecticut, Rhode Island, Maryland, Main, Vermont and New Hampshire.
[2] For the purpose of this report, "distillate fuel oil" and "heating oil" shall have the same meaning.
[3] The superstructure of pipes and manifolds under which trucks are loaded.

has become tighter as competitive pressures have required that market participants store and deliver oil more efficiently. Decades ago, stocks probably would not reach the low levels of today, and there would have been more inventories in smaller terminals backing up the supplies in the major terminals. Although the current system fosters lower prices in the market, it increases the potential for brief periods of price spikes, as seen in the winter of 1999-2000 and more recently the winter of 2005-2006.

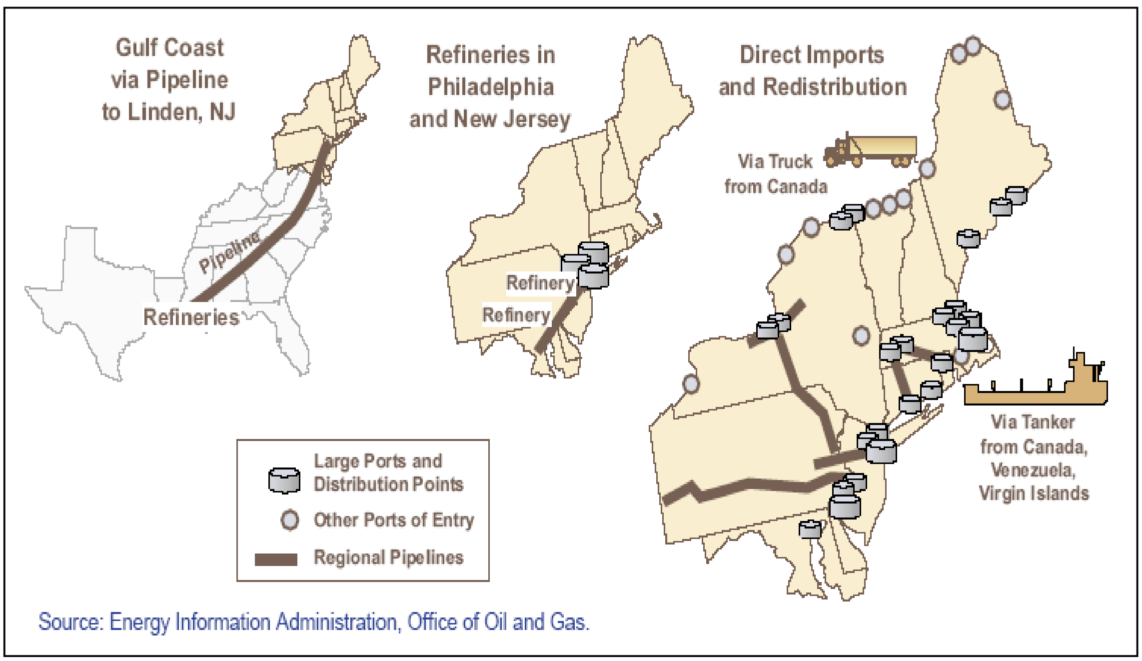
The Northeast gets its supplies of distillate fuel oil from the following sources:

- Shipments from Gulf Coast refineries via pipelines and, to a smaller extent, tankers or barges

- Shipments from Central Atlantic refineries in Delaware, New Jersey and Pennsylvania distributed throughout the region by pipelines and barges

- Imports from offshore and foreign areas—most notably, Canada, Venezuela, and the Virgin Islands —which come either to central distribution centers such as New York Harbor and Boston, from which they are redistributed, or to smaller ports, where they meet local needs.

Figure 1: Northeast Distillate Fuel Oil Supply Sources



More than half, and up to 60 percent in some years, of the supply of low-sulfur (diesel) distillate fuel oil to the East Coast comes from the U.S. Gulf Coast. Supplies of high-sulfur (heating oil) distillate rely about evenly on shipments from other regions, such as the Virgin Islands, and on local refineries. Imports make up a small but significant percentage of supply for both products. Of the net supplies from other regions, pipeline supplies make up the vast majority.

About 80 percent of the diesel supplies and more than 85 percent of the heating oil supplies are shipped via pipeline. Supplies leave the Gulf Coast on the Colonial Pipeline and the Plantation Pipe Line. The two lines follow roughly the same route, with the Plantation's terminus in the Washington, DC, area and Colonial's terminus in Linden, New Jersey.

Other large coastal entry points in the Central Atlantic states include Baltimore, Maryland, and Newark, New Jersey. In addition to the coastal imports, supplies from Canada enter at a variety of pipeline points along the New York, Vermont, New Hampshire, and Maine borders. Among the regular supply sources, pipeline shipments from the Gulf Coast generally have the longest transit time, taking from 14 to 20 days for the run from Texas to New Jersey. Waterborne imports arriving via tanker have shorter transit times, with Venezuela and the Virgin Islands 5 to 7 days away. The shipments are carefully planned in advance so that they arrive at regular intervals. Companies employ a variety of mechanisms to enhance their supply flexibility, such as time exchanges. When the interstate supply system is stretched immediate incremental supplies are available only from local inventories.

The refineries in the Northeast, like U.S. refiners in general, have their peak operations in the warmer months, supplying gasoline and diesel for seasonal consumption and high-sulfur distillate (heating oil) for seasonal stock builds. Refinery production of heating oil increases during the winter months, however, when demand for home heating oil is at its annual peak. The sudden unavailability of steady supply from area refineries was a factor in the price runup of early 2000, and more recently in the winter of 2005 – 2006 when conditions in the Gulf Coast shut down production of some refineries affected by the hurricanes and necessitated the delay of heating oil productions by others.

The infrastructure and supply chain serving New Jersey provides heating oil to consumers and businesses in much the same way that it does to the rest of the Northeast. New Jersey consumers receive supplies through two of the region's primary entry points: the Colonial pipeline system serving the northern part of the state; and the Delaware River refineries[4] serving southern New Jersey, Pennsylvania and Delaware. These two points provide the bulk of New Jersey's supply of domestic fuel oil. During times of peak demand, deliveries to New Jersey are supplemented by offshore imports through area ports such as Newark.

<u>Natural Gas</u>

Gas transportation pipelines entering the Northeast, including domestic lines from the Southwest into the Central Atlantic states and cross-border lines from Canada, have a combined design capacity of approximately 15 billion cubic feet per day (2004 data). Existing pipeline capacity in many parts of the Northeast is adequate to meet current firm-service demand, but is being utilized at high load levels during peak months (Table 1). In New Jersey, the load factor for capacity levels reported in December of 2000 was at 96 percent -- the highest among the Central Atlantic states. In 2004, New Jersey's load factor on the interstate pipelines peaked at 97 percent during the winter months. A very high load factor is an indication that the pipeline is running at full capacity and has little excess to work with. A

[4] New Jersey has a total of six petroleum refineries. Three refineries are clustered along the Delaware River east of Philadelphia, while the others are located in the northern part of the state just south of the New York City area.

pipeline that is fully loaded has the potential of not being able to access underground storage when demand is at its highest. When this happens, service may be interrupted to large volume non-firm customers who must switch to an alternate fuel source[5]. From a reliability standpoint, residential customers are not generally affected by the lack of excess capacity caused by high load factors on the interstate system. The infrastructure of the Local Distribution Companies (LDCs) is designed to accommodate firm service and maintain adequate supplies of local storage to meet seasonal demand from residential customers.

Table 1: Interstate Natural Gas Pipeline Capacity in 2000 (Central Atlantic States)

State	Interstate Pipeline Capacity (MMcf/d)			Peak Month Usage Rate for Net Interstate Pipeline Capacity (%)
	Entering the State	Exiting the State	Net	
Delaware	360	157	203	93 %
Maryland/DC	4,225	3,326	898	90 %
New Jersey	6,148	3,199	2,949	96 %
New York	8,431	3,288	5,143	70 %
Pennsylvania	9,985	11,374	-1,389	50 %
Source: Energy Information Administration, Natural Gas Division October 2001				

To meet heating demand, gas utilities have a number of options such as supplies from underground storage and Liquefied Natural Gas (LNG)[6] storage. Storage supplies are an integral part of meeting consumption needs during the winter, particularly for gas utilities with a substantial residential customer base, which have a highly seasonal demand for gas. By far, the most common forms of storage in the industry are underground reservoirs and aquifers located in various regions of the country. However, during the coldest days of the year, the properties of LNG provide the industry an opportunity to meet the severe transitory requirements of heating load customers. Through regasification, LNG is able to deliver large amounts of natural gas into the distribution system on short-notice during the coldest days of the year, otherwise known as high "deliverability." Most utilities, particularly those in the Midwest and Northeast, utilize a portfolio of supply sources throughout the year that includes peaking supplies from storage and LNG to meet customer needs. For non heating season demand, baseload supplies are received year-round directly through interstate pipelines.

In recent years, interest in LNG imports has been rekindled as a result of higher U.S. natural gas prices and technological advances which have lowered costs for liquefaction, shipping, storing, and regasification. Proposals for more than 20 new import facilities (marine terminals) are currently before regulatory authorities and many more are being planned, although it is unclear how many will actually be built. The opportunity for economic trans-ocean trade has been a driving motivation behind the growth of the LNG industry. As a result, a distinguishing characteristic of the U.S. LNG industry is the need for the construction and operation of marine terminals to handle ocean-going vessels.

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[5] A 2003 FERC analysis of interstate pipeline capacity cited very high load factors in the New England area as a primary reason that may prevent the pipeline system from accessing storage during high demand.

[6] LNG is natural gas (primarily methane) that has been liquefied by reducing its temperature to minus 260 degrees Fahrenheit. It can be compressed, stored and transported over long distances, by ship; and then stored on land in specially designed storage facilities. The liquefied gas can then be reheated, converted to vapor, and injected into a pipeline system for distribution.

Of the 20 proposals, five facilities are proposed for the East Coast including one facility in Logan Township, New Jersey on the Delaware River (also known as BP's Crown Landing facility). The Federal Energy Regulatory Commission (FERC) review process for the Crown Landing facility began in April 2004 and after considering the position from residents, the state of Delaware, local community groups and other interested parties, the project was approved on June 15, 2006[7]. As proposed, the facility is expected to deliver 1.2 billion cubic feet of natural gas per day (Bcf/d), or enough natural gas to supply approximately 5 million homes per day, in the Mid-Atlantic States.

In the Northeast, transported natural gas is the major source of new gas supplies to the region, and new capacity additions to the region is key to maintaining an adequate supply chain. Natural gas pipeline capacity into the Northeast grew throughout the 1990s, mainly through construction of new lines from Canada. The level of import capacity into the region was very small in 1990 and most of the natural gas came from the Southwest. But as natural gas was marketed heavily in New England, less expensive Canadian natural gas supplies were seen as a strong alternative to expanding the natural gas pipeline network into the region from the Southwest. As new gas fields were developed off the eastern coast of Canada in the late 1990's, the expansion of import capacity became an even stronger alternative. At the close of the decade, several major new U.S./Canadian pipeline projects increased import capacity to the region by 2.3 Bcf/d (1999-2000).

Although the current pipeline capacity through the area appears sufficient, growing demand for gas trading and transport capacity will likely require some expansion of existing pipelines. According to the Energy Information Administration (EIA), pipeline projects slated for the New York City metropolitan have experienced significant delays which could impact future demand needs in the region. The Millennium Pipeline project, for example, originally proposed in 1996 for completion in 2000 was delayed in 2003. The project was later divided into two phases with the less environmentally sensitive portion slated for 2006 and the other with an "open-ended" completion date. Since the late 1990s several other major projects have been proposed for the northeast corridor, but delays in the approval process continue to push most of these projects well beyond their expected completion dates.

From 2001- 2004, the U.S. natural gas transmission network as a whole experienced a slowdown in new capacity expansion, both in terms of added transportation capacity and new pipeline mileage. Only about 1,459 miles of natural gas pipeline capacity were added to the national gas transmission grid during 2004 compared with 2,243 miles of capacity in 2003 (Table 2). The amount of incremental capacity in 2004 was the least since 1999.

Table 2: Recent and Proposed Natural Gas Transmission Pipeline Additions and Expansions

Region	Number of Projects					Added Pipeline Mileage				
	Actual		Proposed			Actual		Proposed		
	2003	2004	2005	2006	7007	2003	2004	2005	2006	7007
Northeast	8	8	5	10	8	82	116	22	595	207
U.S. Total	49	41	33	38	36	2,243	1,459	974	1,851	2,237
Source: Energy Information Administration, Office of Oil and Gas, June 2005										

[7] Delaware and New Jersey are currently involved in a U.S. Supreme Court case concerning the right to regulate the terminal site.

While a number of pipeline projects were completed in 2004, there were no major developments along the Northeast corridor into New Jersey. Pipeline expansions in the Northeast region in 2004 served primarily to improve service within the region itself. As of 2006, the only significant pipeline expansion waiting approval by FERC, which proposes an increase in capacity and/or new gas flowing into the New Jersey and New York region, is the Millennium Pipeline Project – Phase I. Millennium is proposing to construct approximately 181.7 miles of 30-inch-diameter pipeline from Corning, New York, to Ramapo, New York. The proposal will add about 250,000 Dth/d of transmission capacity for downstream markets in the New York City, New Jersey, and New England areas.

Propane

Propane, also known as liquefied petroleum gas (LPG), is a by-product of natural gas and crude oil refining. Approximately 88 percent of the propane that we use in the Northeast is produced domestically. Propane accounts for about 2 percent of the residential market in New Jersey (see table 3)[8]. The propane distribution system that serves the Northeast originates in the Mont Belvieu area of Texas. In some ways, the propane market is more complex than those for other petroleum products, due to factors such as the unique by-product nature of production, the many end-use markets served and the different regional characteristics of those markets. The retail price structure for propane also tends to be much more complex than that for other major petroleum products, due primarily to the wide range of volumes purchased. In addition to competing fuels, other factors such as tank storage also contribute to the low penetration rate of 2 percent in New Jersey. Since propane storage tanks tend to be expensive, small volume users such as residential customers may opt for heating oil or natural gas when faced with the choice between competing fuels.

Table 3: New Jersey Home Heating Fuel Characteristics - 2004

Heating Fuel Type	Number of households	Percentage of total households
Natural Gas	2,167,442	69.2%
Heating Oil	546,120	17.4%
Propane (bottled LPG)	71,694	2.3%
Electricity	321,905	10.3%
Wood, Coal & Other	18,046	.58%
Solar	686	.02%
No fuel used	8,588	.27%

Source: U.S. Census Bureau

[8] Since propane use in New Jersey represents only a small percentage (2.3%) of the heating fuels market, the remainder of this report will focus its discussion primarily on heating oil and natural gas.

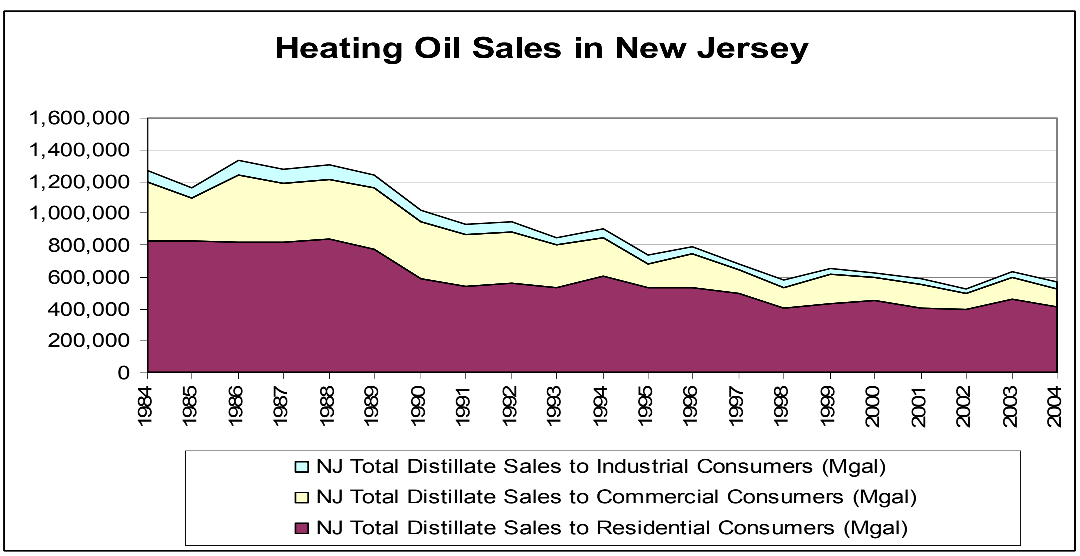
Heating Fuel Consumption in the Northeast and New Jersey

Heating Oil

In most Northeast states, the heating oil share of energy use relative to the natural gas share is higher than the rest of the country, primarily because petroleum products are more competitively priced and natural gas pipeline capacity to the Northeast is smaller than capacity for other urban centers, such as Chicago. Several factors have contributed to this condition. First, the cost of adding new pipeline capacity to the Northeast is relatively high because the region is distant from U.S. gas supply sources and, secondly, the Northeast is readily accessible to ships carrying distillate and less expensive residual fuel.

The Northeast is heavily dependent on distillate fuel oil but its dependency has been steadily declining for the last 20-25 years. The Northeast region (which includes the New England and Central Atlantic States) remains the area with an appreciable share of oil-heated single family homes. In other regions, older homes have seen a greater level of conversion from oil heat to gas heat, and oil no longer has a noticeable share of the new home construction market. Thus, the seasonal increase in inventories and demand (sales of heating oil) is largely confined to the Northeast. In 2005, approximately 303.9 billion barrels of heating oil were sold to consumers in the Northeast representing 77.5 percent of heating oil sales in the U.S. A closer look also shows that the residential sector dominates the heating oil market in the Northeast. Figure 2 below illustrates New Jersey's sales trend over the last 20 years for the residential, commercial and industrial sectors.

Figure 2: Sales of Distillate Fuel Oil in New Jersey (1984 -2004)



Source: Energy Information Administration, Petroleum Consumption/Sales

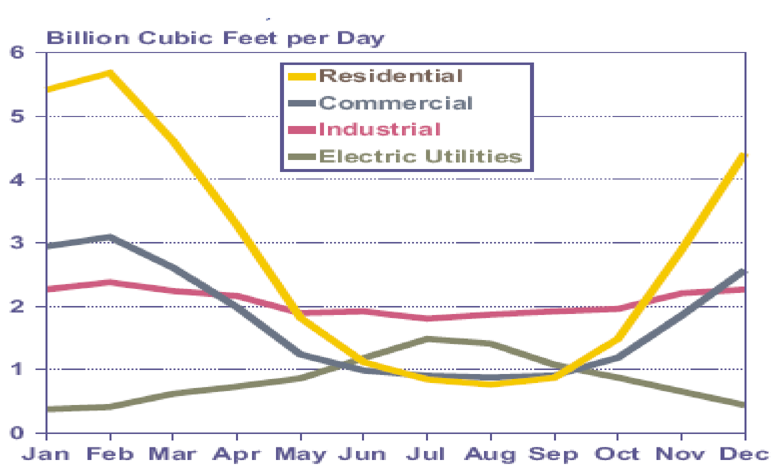
While heating oil sales are often used as a proxy for consumption, we should not assume a direct correlation between a decline in heating oil consumption and a conversion to natural gas. Conversion is not the only factor that has contributed to the steady decline in heating oil consumption. Other factors include efficiency advances in residential oil heat equipment that produce higher flame temperatures and enhanced heat transfer rates, as well as, improvements in building shell efficiency in newly constructed homes. As of 2004, heating oil use for new single-family homes in the Northeast region was at 22 percent. Natural gas maintained a 73 percent share of new single-family homes.

In the commercial and industrial sectors, total heating oil consumption is relatively small when compared to residential use. In 2004, commercial distillate use accounted for 7 percent of total distillate fuel oil sales in New Jersey and industrial use accounted for 2.4 percent of total sales. All 3 sectors are on the decline in terms of annual consumption (see Figure 2 above). According to EIA estimates, approximately 52 percent of distillate fuel oil used by commercial buildings in the Northeast is for space heating purpose with the remainder going for a variety of other building uses. In the industrial sector (manufacturing), the percentage of distillate fuel oil use for space heating is much lower with only 10 percent and the remainder going for boiler use and a variety of other manufacturing uses.

Natural Gas

Although natural gas can be stored in the vicinity of major consumption markets, consumption by end users in U.S. markets generally occurs on a "just-in-time" basis, with most customers drawing supplies from the system as needed. With limited capability for on-site storage at customer locations, the system must meet customer requirements under a wide range of operating conditions. In the Northeast, seasonal patterns of gas consumption vary among the end-use sectors (Figure 3). For the residential and commercial sectors, average daily volumes peak in the months of the heating season and fall to yearly lows in the summer months. Average daily demand in the residential sector during February is more than 4 to 5 times the average during August. For electric utilities the pattern of natural gas demand is reversed, with peak demands during the summer air-conditioning season (when demand for electricity peaks and even the most inefficient turbines are brought into service) and lows during the winter heating season. The seasonal pattern for industrial is relatively flat with minor peaks in the winter months.

Figure 3: Average Annual Gas Consumption by End Use Sector



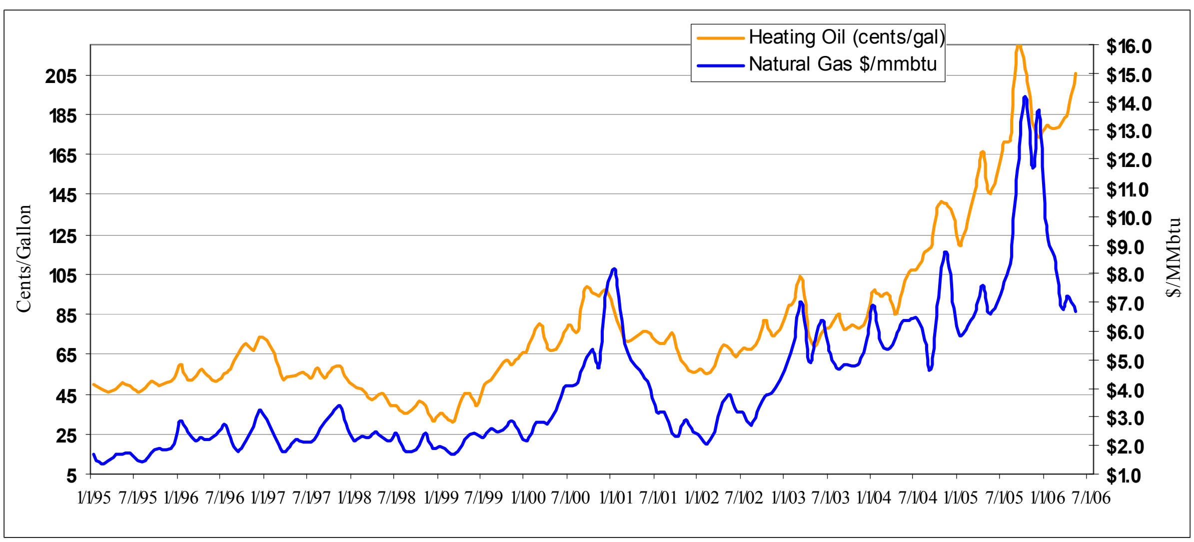
Source: Energy Information Administration (EIA), Oil and Gas Information Retrieval System (OGIRS) (February 2000).

As shown above, demand for natural gas in the Northeast tends to be seasonal, and the infrastructure is designed and operated primarily to meet the need for firm service[9]. The key issue for the LDCs is the ability of the supply system to meet gas demand requirements on winter peak days. At times of peak demand, system operators rely on various methods to manage demand and obtain suitable supplies. Demand is managed by removing some users (large industrial users) from the system, usually under the terms of interruptible service contracts. To ensure delivery to customers who generally pay higher rates for firm service, supplies from the pipeline system may be supplemented with inventories drawn from regional underground storage facilities or with smaller amounts of above ground LNG from storage. On average, net storage withdrawals provide 20 percent or more of total U.S. natural gas consumption during the winter period; however, reliance on storage can be much higher in some peak periods.

Fuel Prices

Distillate fuel oil and natural gas prices are both affected by cold weather. Both fuels are used as a primary fuel source for heating, and increases in demand for either fuel can cause prices to rise during the winter season. Furthermore, there is some interplay between the uses of the two fuels. For example, some large industrial, commercial, and electric utility customers with dual-fuel burning capability use distillate fuel oil as an alternate or peaking fuel. These large customers who normally use natural gas switch to distillate fuel oil either because they have interruptible contracts or because they find distillate fuel oil economically more attractive. The graph below illustrates how closely linked the 2 fuels are over time.

Figure 4: Heating Oil and Natural Gas Historical Wholesale Prices (1995-2006)



Source: Energy Information Administration, Petroleum and Natural Gas Prices

[9] Firm service customers use natural gas mainly for space and water heating in residences and commercial facilities. Natural gas pipeline systems typically are sized to provide the maximum amount of gas that may be required by firm service customers. Pipeline companies must be prepared to provide daily service up to the maximum specified volume or service level under firm contracts or tariffs.

Heating Oil

On a heating value basis, residential oil prices per million Btus in the Northeast were generally lower than gas prices throughout the 1990s. Since 1999, however, residential customers who use heating oil during the winter have spent more to heat their homes than natural gas customers. In the winter of 2005-2006 the EIA estimated that northeast residential customers spent on average $1,121 for natural and $1,412 for heating oil.

The markets for heating oil respond quickly to changes in supply and demand. First, spot prices reflect the outcome of the ongoing "auction" in the marketplace. The routine bid-and-ask process between buyers and sellers quickly reflects the need for more supply or a supply glut. The prices at which once-only transactions are taking place in the big product trading centers such as New York become known quickly via electronic reporting services and print media. Risk management mechanisms, such as hedging and price caps, are used routinely in distillate fuels markets, and retail dealers offer a variety of pricing programs to their customers. Most full-service dealers also offer some type of budget payment plans to their customers. Typically, these plans extend from July to May, allowing customers to make equal payments toward anticipated heating oil bills over the months. Under- and overpayments are settled at the end of the period.

Prices also react to inventory levels and the decision to store oil. High prices indicate that the market needs more oil, and needs it now. A market in which the price for future delivery is lower than the current price discourages storage. Market participants are reluctant to hold inventories or add to them when they are expected to lose value in the future. As the heating oil season approaches, typically in the summer and early autumn, it is common to see a forward price curve that reflects higher prices in December and January than in the following September and October. Using the futures market, a market participant can "lock in" the difference (spread) between the current price and the NYMEX futures price during the heating season, covering the cost of storage and the cost of money for the purchase.

The cause of the 2000 heating oil crisis in the Northeast was largely a result of decisions made concerning storage and inventory drawdown leading up to and during the 1999 – 2000 heating season. As the retail industry consolidated throughout the 1990s dealers began to close underutilized secondary storage depots. The trend was accelerated by more stringent environmental rules and the increased business risk the rules presented in the event of tank failures. With no new storage facilities being constructed, and natural gas buyers making the decision to switch to oil because of cheaper distillate prices leading up to the 1999 – 2000 heating season, inventories were quickly depleted as the height of winter demand approached. As the weather turned colder than expected, demand surged and the supply chain was slow to react because of the bad weather. Prices quickly spiked setting off the heating fuel crisis.

Some energy analysts attributed the large heating oil demand, and subsequent spike in prices, to year 2000 (Y2K) actions (i.e., stockpiling for unexpected contingencies). Most agree, however, that lower than normal inventory levels in December of 1999, coupled with the unexpected cold snap in January and February of 2000, were the main factors contributing to the problem. Historically, distillate fuel oil prices have risen sharply during the high-demand winter months. In each case, including the experience in January and February 2000, cold weather increased demand unexpectedly and hindered the arrival of new supply, as frozen rivers slowed the docking and unloading of barges and tankers. Stocks (inventories) that were already below normal were drawn down rapidly as demand exceeded new supply. Distillate fuel oil stocks approached very low levels in January and February, and wholesale buyers concerned about supply availability rapidly bid up the price of the new supplies as they arrived.

The inventory patterns of large-volume customers also played a role in the 1999-2000 price spikes. Large volume customers do not always carry adequate inventory to cover their needs during unusual circumstances, such as the January/February 2000 cold snap. Some turn to distillate fuel oil at times when their natural gas supplies have been interrupted as part of their service agreements. Others turn from natural gas to distillate fuel oil for economic reasons. The sudden entry of these buyers into the market was a contributing factor in past price spikes.

Natural Gas

End-use prices for natural gas are determined by the costs of the commodity and related supply services (transportation, storage, and local distribution) .They also reflect the type of service provided (firm or interruptible). For residential users, gas commodity price is only about 30 percent of the delivered price, and the remainder reflects the cost of services between the wellhead and the customer on a firm service basis. Because natural gas commodity prices are a small percentage of the delivered price, fluctuations in the gas commodity price result in much smaller relative changes in the delivered price to small-volume customers. Small-volume customers, such as residential and some commercial and industrial consumers, generally receive their gas from LDCs, which typically bill their customers monthly. Monthly billing smoothes out some of the daily price volatility seen in upstream markets, but it also introduces an information lag. Bills arrive after the billing period during which consumption decisions have been made, and the bill is stated in terms of totals or averages for the period. It is difficult at best for consumers to ascertain their marginal costs for timely decisions within the heating season. Thus, if upstream supply prices rise rapidly, small-volume customers are not likely to be aware of the change in prevailing prices until after the billing period.

Large-volume customers vary in their approach to gas acquisition, because the scale of their energy use provides opportunities that generally are unavailable to small-volume customers. Large customers tend to purchase gas "off system" directly from a marketer or producer and contract for delivery separately, rather than purchasing from a LDC. The companies seek the best deals for their requirements, and if energy is particularly important to their operations they may even utilize an energy acquisition unit that specializes in sophisticated market trading. Large-volume customers that cannot switch from natural gas depend on gas-on-gas competition and competition between service providers for advantages in their deals. Those with dual-fuel or switchable capability look for the least expensive fuel, relying on inter fuel competition to yield advantageous transactions. The alternate fuel used by consumers who have natural gas as one option generally is distillate or residual fuel oil. The gas commodity itself, excluding the addition of substantial transportation, delivery, and storage charges, typically is much less expensive than petroleum products on a Btus basis[10]. When natural gas

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[10] Btu or British Thermal Unit is defined as the amount of energy required to increase the temperature of 1 pound of water by 1 degree Fahrenheit.

delivery can be arranged at discounted rates, the combined costs result in an economic advantage generally favoring gas use; however, discounted service usually is available only under interruptible contracts. As a result, large-volume customers with interruptible contracts must seek alternative fuels when heating season demand spikes due to an extended cold snap.

End-use prices are also affected to a large extent by decisions made concerning storage levels and inventory drawdown. Storage allows supplies to be acquired during periods of slow demand and delivered to end users during peak demand periods. In practice, however, storage utilization strategies tend to be more complex. Storage activities are managed to meet a combination of objectives: supplying gas to satisfy peak demand, balancing pipeline loads, and financial arbitrage. For the LDCs, which generally are responsible as the supplier of last resort, the ability to meet peak demand throughout the entire winter is arguably the predominant consideration and their withdrawal strategies often reflect their concerns about being able to meet demand surges in the event of a late season cold snap. An unfortunate consequence of such a strategy is that reduced reliance on natural gas from storage restricts gas supplies to lower levels and may lead to higher prices in the short run. This apparently is what happened in the winter of 1996-1997, when gas was kept in storage during an early cold snap. When the 1996-97 heating season began with even more severe temperatures than in November 1995 and even lower storage inventories than the previous year, many distribution companies preferred to purchase gas on the spot market rather than draw down storage volumes early. This placed significant pressure on gas prices, which were already higher than the previous year in large part because of higher demands in mid-1996 to refill storage stocks which had been depleted in the previous winter.

There are distinct tradeoffs in performance and cost among storage, transportation pipelines, and LDCs. Although there are advantages to storage in managing transportation costs, reliance on storage incurs costs for injection that add directly to the unit costs of delivered gas. Further, in responding to the needs of a growing market, the costs of incremental storage expansion are likely to be higher than the average to date. The number of potential future underground storage sites is limited, and siting of new LNG storage tanks tends to be problematic, encountering local resistance that can increase costs even when it is successfully overcome. Generally, the high deliverability and higher costs make LNG storage most suitable as a source of supply in periods of extreme peak demand.

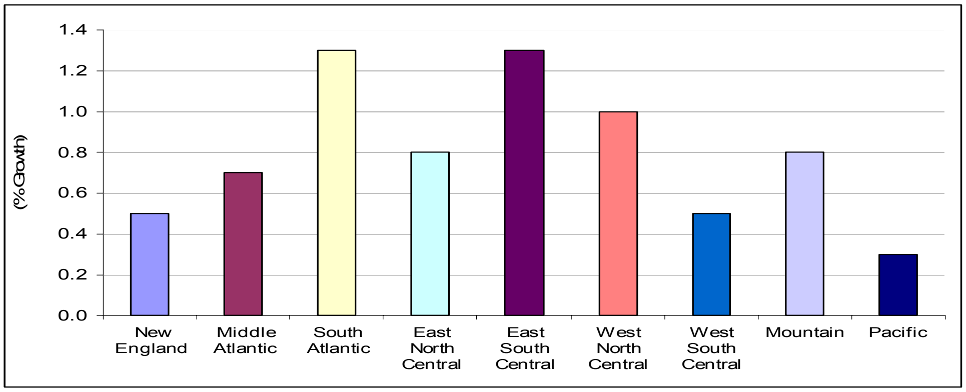
Projections to 2020

National Outlook

With natural gas prices remaining relatively high according to the EIA's 2006 Annul Outlook for the projection period 2004-2030, total U.S. consumption of natural gas is projected to grow slowly in all sectors. Most of the increase is seen before 2017. After 2017, high natural gas prices limit consumption through 2030. Consequently, the natural gas share of total energy consumption drops from 23 percent in 2004 to 21 percent in 2030. From 2004 to 2030, 60 percent of the projected growth occurs east of the Mississippi River (Figure 5). In the Mid Atlantic region (New Jersey, New York and Pennsylvania), consumption grows by 0.7

percent per year. Variation in regional growth rates results from different prospects for population growth, economic activity, and natural-gas-fired electricity generation.

Figure 5: Projected Natural Gas Growth Rate by Region (2004-2030)



Source: Energy Information Administration / Annual Energy Outlook 2006

Distillation capacity at U.S. refineries is expected to expand according to the EIA's 2006 Annual Outlook. Despite the expected expansion in refinery capacity, the EIA is projecting a continued decline in distillate fuel oil consumption. In the residential sector, the use of distillate for home heating is projected to decline as natural gas and LPG are used increasingly as substitutes. Both fuels burn more cleanly than distillate, and natural gas, where available, is more convenient than distillate or LPG. In the industrial and commercial sectors, distillate is primarily used as a fuel for heating purposes and for diesel engines. In the near term, the projected high prices for distillate are likely to lead to fuel switching away from heating oil in both sectors.

New Jersey Fuel Requirements

Residential Sector Growth: With the U.S. population migrating south and west, electricity use for air conditioning has become more important than natural gas and petroleum for space heating. The South and West Census regions, which accounted for 52 percent of the U.S. population in 1980, the population increased to 59 percent in 2004. According to the U.S. Census population is projected to continue to increase to nearly 65 percent in 2030. In the Northeast, 37 percent of households (compared with 27 percent nationally) live in multifamily units, which generally are smaller and use less energy per household than other types of housing. The Northeast, which accounted for 21 percent of the U.S. population in 1980, decreased to 19 percent in 2004 and is projected to fall to 16 percent in 2030 according to U.S. Census estimates. This is one of several factors that contribute to a decline in heating oil use per capita in the residential sector. Other factors such as high crude oil prices and environmental issues are also projected to add to a pattern of decline in the Northeast heating oil market, both in terms of total consumption and the percentage share of households who use heating oil. According to EIA projections, Northeast heating oil consumption in the residential sector is projected to decline by 1.55% annually to 2030.

In order to project residential heating oil use from now until 2020 for the Energy Master Plan (EMP) we have relied on two separate calculations using 10-year historical sales[11] data from

[11] To calculate projected growth, EIA sales data was used as a proxy for consumption/use.

the EIA (1995 - 2004). The first analysis examines the pattern of heating oil sales in New Jersey between 1995 and 2004. Residential oil sales have declined from 538,489 thousand gallons (Mgal) in 1995 to 430,192 Mgal in 2004. Based on the continuation of the 1995 to 2004 trend, heating oil use in 2020 is estimated to be 224,469 Mgal, an annual decrease of 3.98%. In the second analysis, the percentage decrease from 1995 to 2004 was calculated using the same EIA sales data. The percentage was then compounded annually from 2004 to 2020. Under this scenario, the analysis estimates a decrease in heating oil use to 288,793 Mgal by 2020, an annual decrease of 2.46%. We are of the opinion that the actual consumption of heating oil by 2020 will be somewhere between these two estimates. Accordingly, we have used the average of these two estimates to arrive at the final residential heating oil use in 2020. In applying the average of the 2 percentages, we are estimating the 2020 heating oil consumption to be 256,631Mgal, reflecting an annual decline of 3.18%.

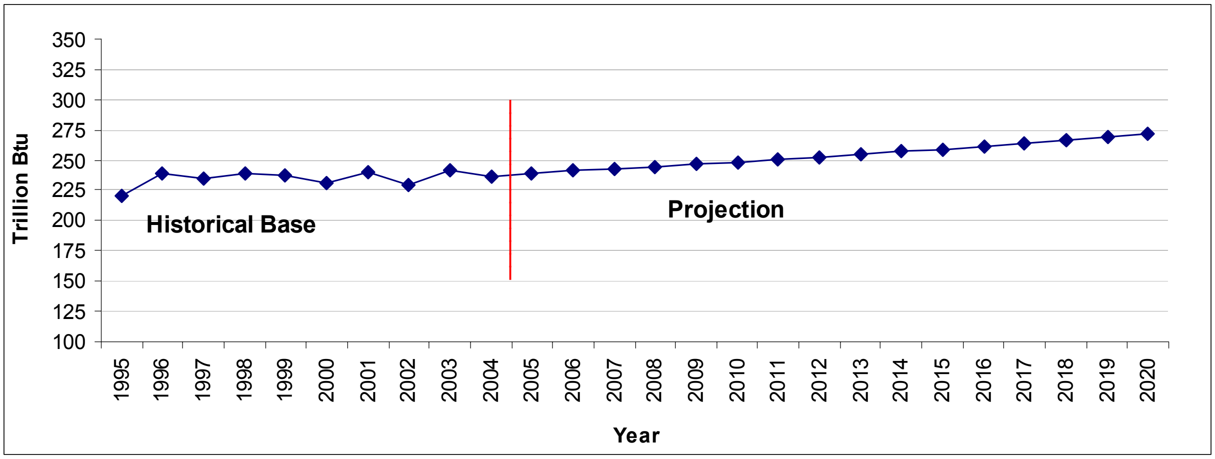
The U.S. per capita natural gas use has remained relatively constant in the residential sector since 1990. In 2004, 56 percent of all households and 63 percent of new single-family households used natural gas for home heating. In the Northeast, the percentage share of new single-family homes with natural gas in 2004 was 73 percent (see Table 3 for New Jersey specific data for existing homes). According to EIA projections, U.S. natural gas consumption per household declines as a growing share of the population lives in warmer climates; but per capita consumption of natural gas does not change significantly, because the average size of new houses increases. Larger houses require more energy to heat, cool, and illuminate, and as housing size continues to grow, energy use per household for these services can be expected to grow, all else being equal. Energy consumption for space heating and water heating per household decreases over time. According to EIA projections, Northeast natural gas consumption in the residential sector is projected to decline by .05% annually to 2030.

In New Jersey, natural gas for residential heating[12] purposes is projected to increase using an analysis similar to the one described above for residential heating oil. Natural gas use increased from 141,448 million cubic feet (MMcf) in 1995 to 172,033 MMcf in 2004 (the historical period). From 2004 to 2020, continuation of the trend line indicates that natural gas use will continue to increase to 214,588 MMcf by 2020, an annual growth rate of 1.39%. In the second analysis, using compound annual growth rate as experienced between 1994 and 2004, we project an increase in natural gas for heating purposes of 243,684 MMcf by 2020, an annual growth rate of 2.20%. Similar to the heating oil analysis, we are of the opinion that the 2020 natural gas consumption will be somewhere between these two projections and accordingly we have averaged the two estimates in arriving at the final consumption number. We are estimating residential natural gas consumption for heating purpose at 229,136 MMcf in 2020, reflecting an annual increase of 1.81%.

Figure 6 below provides the combined heating oil and natural gas use on a Btus basis. On a Btus basis, the 2020 projection for the residential heating requirements is estimated at 271.9 trillion Btus, which equates to an annual growth rate of 0.86%.

[12] For the purpose of this report, heat-only fuel use was extrapolated from total fuel use. The basis for the heat-only use was to remove the non-heat months of July and August from the total annual fuel use for both the residential and commercial sectors.

Figure 6: New Jersey Combined Residential Heat Use Projection in Btus (0.86% Annual Growth Rate)



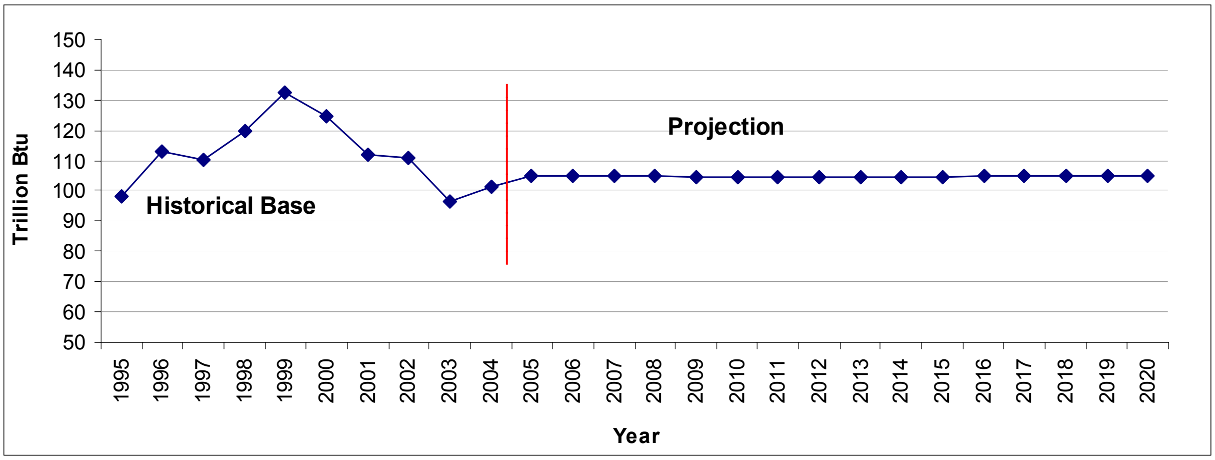
***Commercial Sector Growth*:** The EIA projects that commercial delivered energy use (i.e., energy for heating, cooling, refrigeration, lighting, etc) will grow at about the same rate as commercial floor space, by 1.6 percent per year from 2004 through 2030. Commercial floor space growth and, in turn, commercial energy use are driven by trends in economic and population growth. Growth in disposable income leads to increased demand for services ranging from hotels and restaurants to stores, theaters, etc. the determinants of commercial energy demand include both structural and demographic components. The Nation's continued move to a service economy implies growth in commercial services that use energy intensively, such as health care; however, new construction must meet building codes and efficiency standards, offsetting potential increases in energy intensity (i.e., consumption per square foot of commercial floor space). Energy intensity for the major commercial end uses is projected to decline as more energy-efficient equipment is adopted. Minimum efficiency standards, including those in EPACT2005, contribute to projected efficiency improvements in commercial space heating, space cooling and water heating, moderating the growth in U.S. commercial energy demand. A projected increase in building shell efficiency also contributes to the trend. The expected continuation of high fossil fuel prices also factors into expected efficiency increases for space and water heating equipment. Based on EIA estimates, Northeast heating oil consumption in the commercial sector is projected to decline by 0.51% annually to 2030. Natural gas consumption is projected to grow by 0.36%.

In New Jersey, commercial heating oil use is projected to decline by a much faster rate by 2020. Using the same 10 year sales data from the EIA (1995 – 2004), the trend analysis shows a decrease from 155,197 Mgal in 1995 to 116, 343 Mgal in 2004. From 2004 to 2020, continuation of the trend line estimates a decrease to 12,700 Mgal by 2020, an annual decline of 12.93%. The second analysis using compounded annual growth rate estimates a decrease in commercial heating oil use to 69,716 Mgal by 2020, an annual decline of 3.15%. The results of the two commercial sector calculations were then averaged in the same manner as the residential sector, yielding an estimated 41,208 Mgal by 2020, which equates to an annual decline of 6.28% in commercial heating oil use.

Commercial natural gas use for heating purposes is projected to grow slightly by 2020. The calculation using a trend line analysis shows an increase from 74,428 MMcf in 1995 to 82,802 MMcf in 2004. From 2004 to 2020, continuation of the trend line estimates that natural gas use will increase to 92,736 MMcf by 2020, an annual growth rate of 0.71%. The second analysis, using the compounded annual growth rate, indicates an annual increase to 100,056 MMcf by 2020, an annual growth rate of 1.19%. When averaged together, the two separate analyses yield an estimated increase in commercial natural gas to 96,396 MMcf, which equates to an annual increase of 0.95%.

Figure 7 below provides the combined heating oil and natural gas use on a Btu basis. On a Btu basis the 2020 projection for the commercial heating requirements is estimated at 105.1 trillion Btus, which equates to an annual growth rate of 0.22%.

Figure 7: New Jersey Combined Commercial Heat Use Projection in Btus (0.22% Annual Growth Rate)



Industrial Sector Growth: The U.S. industrial sector is made up of two primary subsectors: manufacturing (steel, glass, paper, food, etc.), and non-manufacturing (agriculture, mining, construction etc.). Manufacturing is more energy-intensive than non-manufacturing, using about 50 percent more energy per dollar of output in 2004. Unlike the residential and commercial sectors where space heating accounts for 55 – 75 percent of natural gas use, and for distillate fuel oil uses it is closer to 90 percent, facility heat use in the industrial sector accounts for a much smaller percentage of the total fuel use. In the Northeast, approximately 66 percent of distillate fuel oil goes for boiler use and process fuel use, with only 10 percent going for facility space heating and air conditioning. Natural gas space heating use in the manufacturing subsector is about the same with only 12 percent going for facility space heating and air conditioning**.** Based on EIA estimates, Northeast heating oil consumption in the industrial sector is projected to decline by 0.81% annually to 2030. Natural gas consumption is projected to grow by 0.77%.

In New Jersey, we are projecting heating oil use for industrial heating purposes to decline by a much faster rate by 2020[13]. Using the same 10-year sales data from the EIA (1995 – 2004), the trend line analysis shows a decrease from 5,292 Mgal in 1995 to 4,188 Mgal in 2004. From 2004 to 2020, continuation of the trend line estimates a decrease to 2,167 Mgal by 2020, an annual decrease of 4.03%. The second analysis using compounded annual growth rate estimates a decrease in industrial heating oil use to 2,766 Mgal by 2020, an annual decrease of

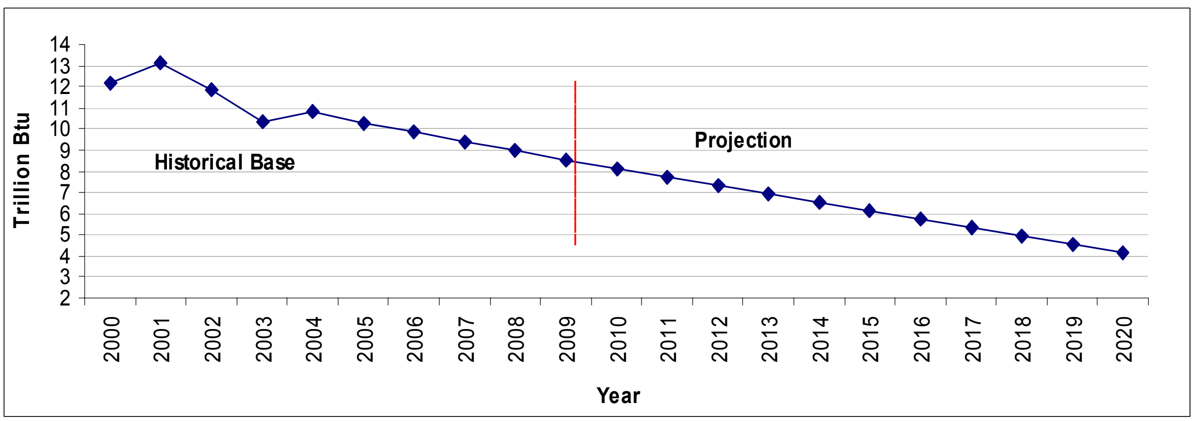
[13] To determine heat-only use, industrial sales numbers from the EIA were multiplied by 10% for heating oil (the space heating percentage) and 12% for natural gas.

2.56%. The results of the two industrial sector calculations were then averaged in the same manner as the residential and commercial sectors, yielding an estimated 2,466 Mgal by 2020, which equates to an annual decrease of 3.26% in industrial heating oil use.

Industrial natural gas use for heating purposes is also projected to decline by 2020. In projecting natural gas use, 5-year sales data was used instead of 10 years (2000 – 2004)[14]. The calculation using trend line analysis shows a decrease from 11,397 MMcf in 2000 to 9,962 MMcf in 2004. From 2004 to 2020, continuation of the trend line estimates that natural gas use will decrease to 914 MMcf by 2020, an annual decrease of 13.86%. The second analysis, using the compounded annual growth, indicates a decrease to 5,814 MMcf by 2020, an annual decrease of 3.31%. When averaged together, the two analyses yield an estimated decrease in industrial natural gas to 3,364 MMcf by 2020, which equates to an annual decrease of 6.56%.

Figure 8 below provides the combined heating oil and natural gas use on a Btu basis. On a Btu basis the 2020 projection for industrial space heating requirements is estimated at 4.18 trillion Btus, which equates to an annual decrease of 5.78%.

Figure 8: New Jersey Combined Industrial Heat Use Projection in Btus (5.78% Annual Decrease)



Propane: The Northeast is the region farthest from the major propane supply centers of the Nation, and has the lowest concentration of residential households using propane as their main heating fuel (2.3% in New Jersey). The Northeast receives more than one-half of its supply of propane, via pipeline, from the U.S. Gulf Coast. The remainder comes from production within the region and from imports. From 1995 to 2004 propane use for all sectors experienced several peaks and valleys with an overall increase from 66,310 Mgal in 1995 to 74,293 Mgal in 2003[15]. In 2004, however, propane use decreased sharply to 54,778 Mgal. As a result of the 2004 decrease, the 10-year trend line analysis going out to 2020 increases only slightly by 1.62% annually. The second analysis using compounded annual growth rate has the reverse affect as a result of the 2004 decrease and shows a projected decline in propane use of 2.1% annually by 2020. The result of the two calculations were then averaged, yielding

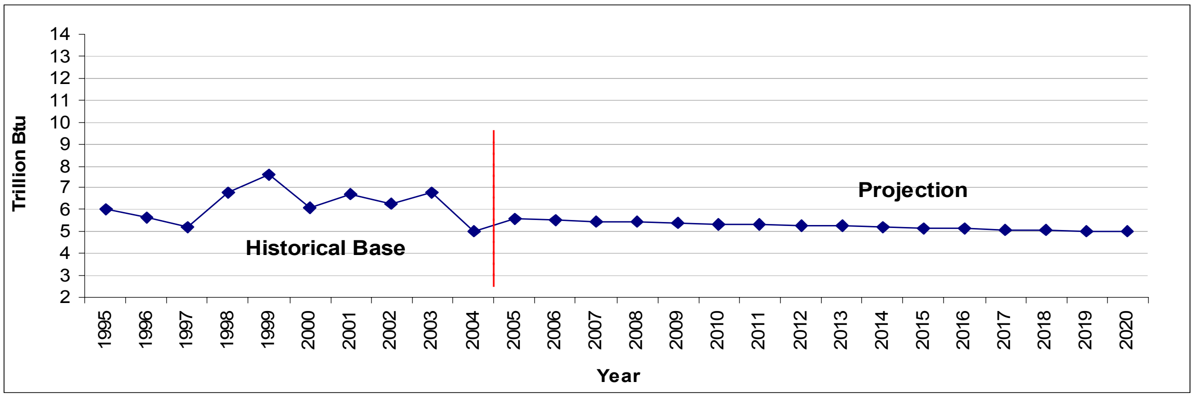
[14] EIA natural gas data does not go back 10 years for the industrial sector.

[15] These numbers represent heat-only use for all sectors (residential, commercial, industrial, transportation and agricultural). To determine heat-only use, the all sectors sales numbers from the EIA were multiplied by the heating portion weighted average use of the 3 primary consuming sectors in New Jersey (residential, commercial and industrial).

an estimated 54,959 Mgal by 2020, which equates to an average annual increase of .020% in propane use for heating purposes in the residential, commercial and industrial sectors.

Figure 9 provides the projected propane use for heating purposes for the combined residential, commercial and industrial sectors on a Btus basis. The 2020 projection for propane space heating requirements is estimated at 5.0 trillion Btus, which equates to an annual increase of .020%.

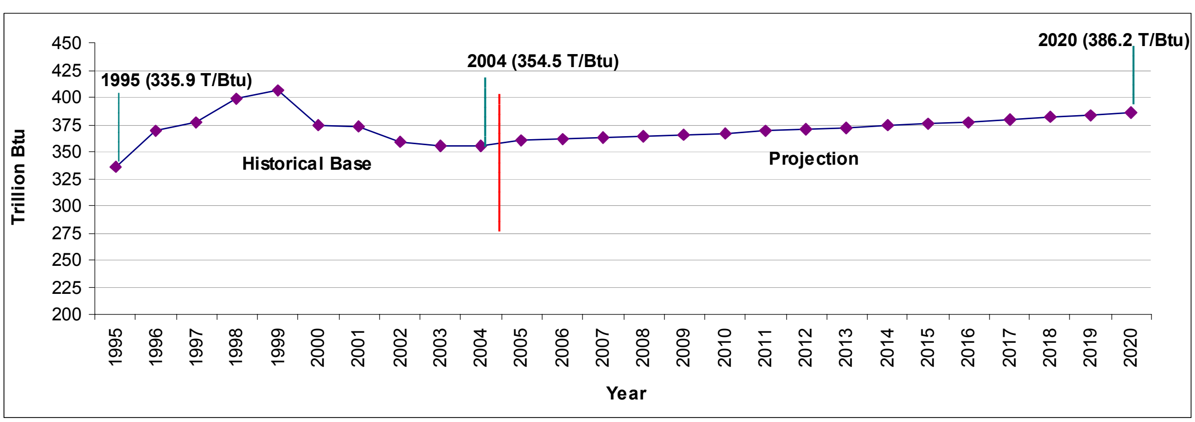
Figure 9: New Jersey Propane Heat Use Projection in Btus (0.020% Annual Increase)



New Jersey Total Heating Requirements

In 2004, non electric heating fuel consumption (heating oil, propane and natural gas) for New Jersey's residential, commercial and industrial sectors was approximately 354.5 trillion Btus. Figure 10 provides the total New Jersey non electric heating requirements projected to 2020. It is based on the summation of the projections of heating oil and natural gas requirements for the residential, commercial and industrial sectors as shown in Figure 6, Figure 7 and Figure 8 respectively, and the propane projections as shown in Figure 9. The total non electric heating requirements for New Jersey are projected to increase to 386.2 trillion Btus by 2020.

Figure 10: New Jersey Total Heating Requirements



In summary,

- Non electric heating usage is projected to increase from 354.5 trillion Btus in 2004 to 386.2 trillion Btus in 2020, without additional energy efficiency efforts. Residential heating use is projected to increase by 34.7 trillion Btus by 2020, which accounts for the bulk of the projected growth. In the commercial sector, consumption is projected to increase by a much smaller amount (3.57 trillion Btus). While the natural gas portion of the commercial sector usage is projected to increase at an annual growth rate of 0.95%, the heating oil usage is projected to decrease sharply by 6.28%. As a result, the 2020 combined commercial sector use increases by a much smaller amount (3.57 trillion Btus) when compared to residential use (34.7 trillion Btus). Industrial heat use is projected to decrease by as much as 5.78% annually, while propane use is expected to remain relatively flat at an annual increase of 0.020%.

- To reduce total projected demand by 20 % by 2020, a reduction in annual usage of 77.2 trillion Btus would be required in 2020 to reach the target of 308.96 trillion Btus.