PETROLEUM INFRASTRUCTURE STUDY

FINAL REPORT

Prepared for:

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LIST OF EXHIBITS

ACRONYMS

Bbl	Barrel
Bbl/d	Barrel per day
Bcf	Billions of cubic feet
Dth	Decatherms
HDD	Heating degree days
GWh	Gigawatt Hour
IRS	Internal Revenue Service
KWh	Kilowatt hour
LDC	Local distribution company
Mcf	Thousand cubic feet
Mbbls	Thousands of barrels
Mb/d	Thousand barrels per day
MMbbls	Millions of barrels
MMb/d	Millions of barrels per day
MMBtu	Million British Thermal Units
MW	Megawatts
MWh	Megawatt hour
NYSERDA	New York State Energy and Research and Development Authority
PADD	Petroleum Administration for Defense Districts; The standard geographic format used for petroleum data. PADD 1 is the East coast, PADD 2 is the Midwest, PADD 3 is the Gulf coast, PADD 4 is the Rockies, and PADD 5 is the West coast.
PSC	Public Service Commission

EXECUTIVE SUMMARY

The New England and the mid-Atlantic regions are unique in their consumption of petroleum fuels for heating. The majority of home heating oil consumed in the United States is used in these two regions. While the use of natural gas by all economic sectors is growing, heating oil and residual fuel oil remain important primary and secondary backup fuels for industry and electricity generation. Historically, the Northeastern United States is subject to severe winter weather, and occasionally very deep cold spells. During these severe periods, the heating fuels supply infrastructure is placed under stress from a combination of spiraling demand, weather-induced supply shortfalls, and delivery problems (i.e., frozen rivers and port facilities). This supply stress is augmented by the incremental demand that appears at precisely the same time that residential heating oil demand reaches a peak. This incremental demand originates from those natural gas users that have interruptible service with natural gas distribution companies.

The residential sector and small volume commercial customers that typically do not have the ability to burn anything other than natural gas need a reliable and firm gas supply. Many larger customers, particularly large multi-family housing units, hospitals, schools, industrial and electric generation customers often have dual-fuel capabilities. These customers have the option of selecting the less expensive gas delivery service known as interruptible service.

The goal of this study is to provide an assessment of the petroleum storage and delivery infrastructure in the New York City, Long Island, and Hudson River regions of New York State (NYS). This information will be used by the Public Service Commission (PSC) as it determines if regulations, utility procedures, and rate schedules (tariffs) that require interruptible gas customers to maintain alternative fuel storage or supply contracts with petroleum fuel suppliers should be revised. The PSC requires natural gas customers that select interruptible service and use petroleum fuels as backup to enter the winter season with seven to ten days worth of fuel supply in storage tanks. Alternatively, customers with insufficient on site storage to cover this requirement must have firm supply arrangements with petroleum fuel distributors to cover the remaining volume requirements. Large contract customers, such as electric generators with interruptible gas contracts, are required to maintain, or have on call, the equivalent of five days of petroleum fuel at the maximum winter burn rate.

The PSC continues to monitor the backup fuel storage regulations in response to the events of the severe cold winter weather of 2002-2003. The Commission has decided to leave the current alternative fuel inventory requirements as they stand but to further examine whether or not there are constraints and bottlenecks in the petroleum infrastructure system that may cause real shortages of petroleum fuels supply that would affect interruptible gas service.

Thus, much of the study is focused on the details of the distribution and storage infrastructure for petroleum fuels, the demands placed on it, and any trends that may have contributed to possible current bottlenecks or inability to provide service during periods of high demand. In thinking about these issues, it is important to keep in mind that New York State and the Northeast in general, are part of the Atlantic Basin petroleum market that determines prices in the region. In addition, New York Harbor is the distribution center for marine transport of petroleum fuels throughout much of the New England and northern mid-Atlantic regions. These realities bring additional pressures to bear on the oil storage and distribution system.

STUDY AREA

For this study, the New York State Energy Research and Development Authority (NYSERDA) and the PSC designated New York City, Long Island, and the Hudson Valley up to Albany, as the areas of interest in the larger northeastern market. Also included in this study area are those counties in New Jersey that abut and service the New York Harbor area.

DATA AVAILABILITY

Natural gas users that select interruptible service may experience interruptions that vary from several hours to as long as several days. While there is a great deal of data available on petroleum fuel supply, demand, and physical movements, the data are presented in monthly, quarterly or annual aggregations. There are estimates of weekly petroleum fuel consumption on the state level from the Department of Energy's (DOE), Energy Information Administration (EIA), but nothing at a smaller, more localized level. Given these constraints, and the fact that many of the interruptions are for no more than a day or two, or even a few hours, the data do not truly reflect the magnitude of the impact of the interruptions. To accommodate these data limitations, the ICF team took two approaches:

- Daily numbers have been estimated from the weekly and monthly data, and
- A survey of heating oil distributors, local distribution companies, and terminals was conducted in the study area.

The ICF team hoped the survey would provide adequate data to allow a quantification of the stress exerted by interruptible service on the petroleum distribution system. However, in many cases respondents refused to participate because of Homeland Security restrictions or business confidentiality concerns. Many heating oil distributors responded and gave the ICF team some useful and interesting data. However, terminal response was limited, so there is data on fuel flows at the retail level but not at the wholesale level. In addition, ICF was unable to acquire data from the State of New Jersey or from New Jersey heating oil trade associations, so for this part of the study area ICF relied totally on public data.

To compensate for the lack of data on wholesale flows the ICF team approached the Internal Revenue Service (IRS) about the availability of aggregate data from their ExSTARS terminal database. The IRS expressed willingness to provide ICF with some data aggregated to the four sub regions of the study area. Unfortunately, they were busy with higher priority work and required ICF to go through the Freedom of Information process resulting in the data not being received in a timely fashion. This lack of wholesale flow data has meant that the modeling was confined to the retail level.

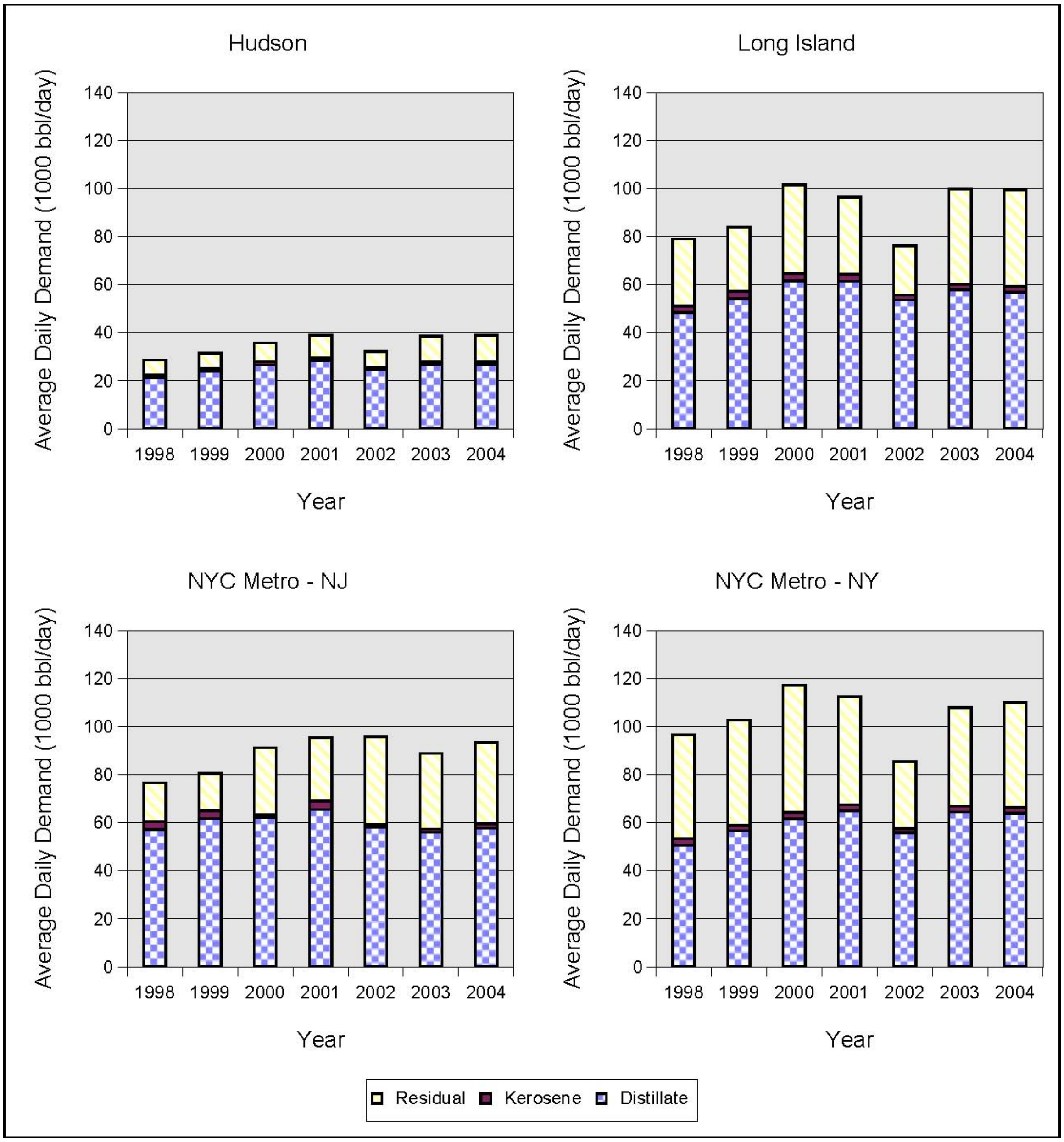
A further problem with the public data is that generally the smallest geographic unit for which it is reported is the state level. There are some data at the county level but all EIA data is at the Petroleum Administration for Defense Districts (PADD), sub-PADD, or state level. Therefore, the ICF team had to make assumptions in order to disaggregate the data to the study area.

DEMAND FOR PETROLEUM

Exhibit ES-1 shows trends in distillate and residual fuel oil consumption in the four regions of the study area. Overall demand for fuel oil in the study area increased between 1997 and 2004. During the economic boom period in the late 1990's, which lasted until 2001, fuel oil demand increased in all regions. However, in 2002 there was a decline in all regions due to the economic recession. Demand started to recover in 2003 and stabilized in 2004.

The major challenge to the use of petroleum fuels in the non-transportation sectors comes from natural gas. The interplay of natural gas and distillate as they compete for market share varies by sector. Heating oil appears to be holding its own in terms of volume in the residential sector but is losing market share as the population grows. Driven by cold winters demand increased between 1999 and 2000, but has been declining since 2001. Natural gas has slowly been gaining market share over the study period. Demand for petroleum in the commercial sector has remained essentially flat. Natural gas has the larger market share, but consumption has trended downward over the last few years. Consumption of both natural gas and petroleum in the industrial sector is small and has fallen steadily, particularly for natural gas.

Exhibit ES-1: Trends in Distillate and Residual Fuel Oil Demand in the Study Region Mbbl/d



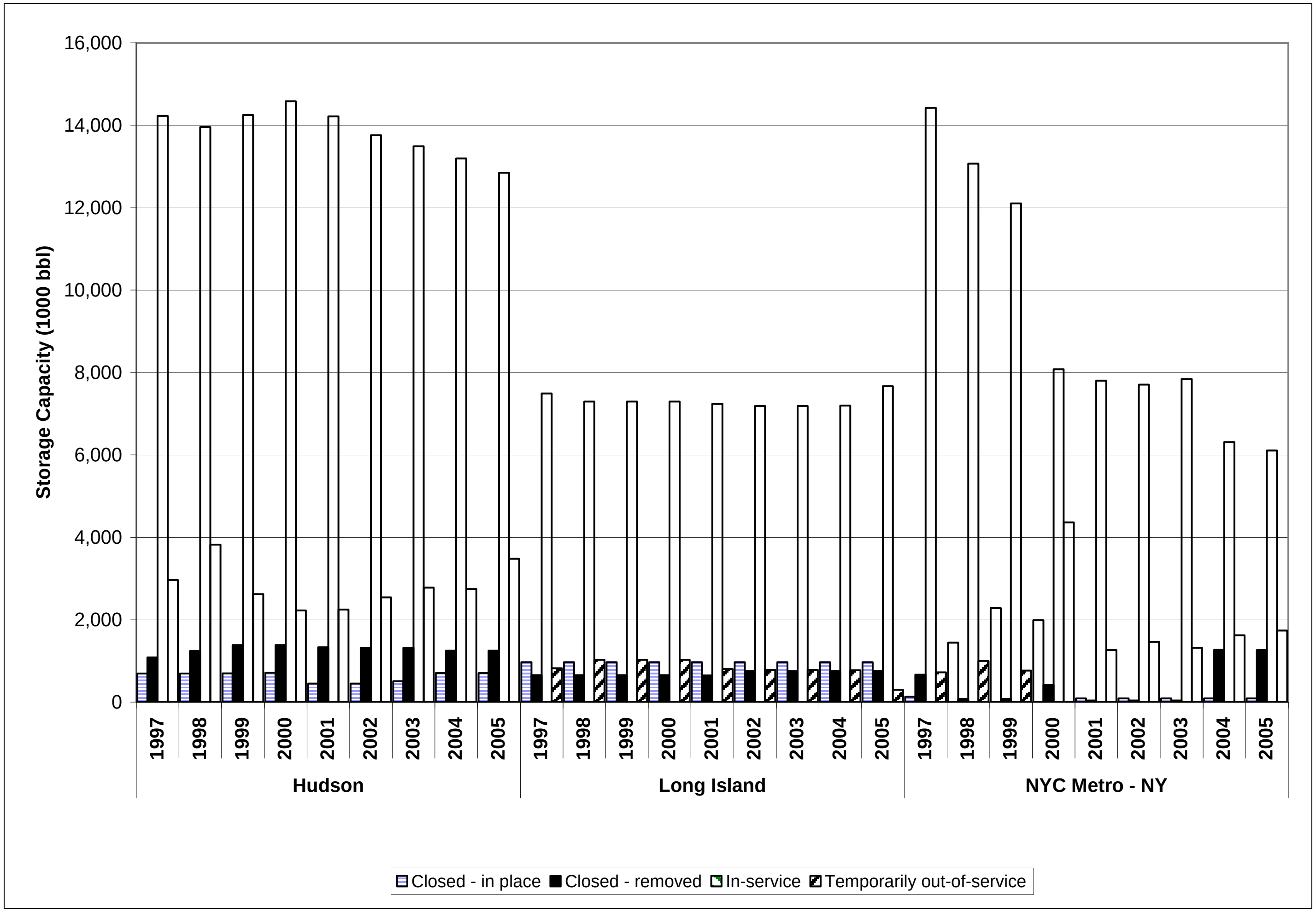
SUPPLY OF PETROLEUM TO THE STUDY AREA

New York State produces a limited amount of crude oil and between three and four percent of its natural gas requirement. The New York portion of the study area has no refineries, although there are two located in the New Jersey portion of the study area. Consequently, the three New York regions are completely dependent on imports, whether domestic or foreign. Petroleum products move into the region by pipeline and marine transport from the U.S. Gulf Coast, the mid-Atlantic refineries, and by marine transport from foreign countries.

Dependence on outside sources and on long supply lines makes the area vulnerable to any disruption of the system, whether caused by human activity or by severe weather. Within the region, products are distributed by barge, tanker, pipeline, rail, and truck, all of which may be subject at times to severe weather delays.

Relying on long supply lines requires adequate storage at the point of demand. However, over the last decade advances in technology and management processes have resulted in much lower inventories – the petroleum industry's version of "just in time" stocks. While these changes have brought efficiency and lower operating costs, they have also brought inflexibility and problems responding to unexpected emergencies and demand surges. Exhibit ES-2 shows the trends in major storage terminal capacity over the last nine years in each of the New York regions.

Exhibit ES-2: Total Petroleum Storage Capacity at Primary Terminals 1997 – 2005



Source: NYSDEC. MOSF Storage Capacity data from NYSDEC database. 1997-2005

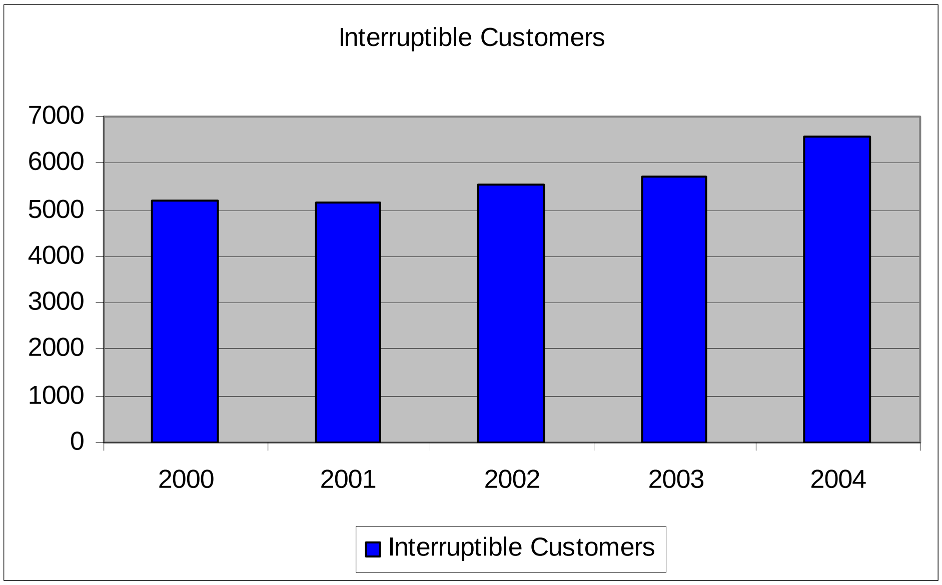
THE ROLE OF NATURAL GAS INTERRUPTIBLE SERVICE CUSTOMERS

The growing inflexibility in the petroleum infrastructure is of particular concern because of the role played by the natural gas interruptible service customers. Each of the natural gas local distribution companies (LDCs) in the study area has interruptible services and contracts. Customers under interruptible sales service agreements[1] are typically large users of gas – at least in comparison to firm residential users, where the average annual consumption per residential customer in 2003 was about 100 MMBtu. Interruptible customers consume gas in the thousands of MMBtu per year and may typically be commercial establishments, large apartment buildings, industrial plants, schools, hospitals, government buildings, and electricity generation facilities. Tariffs under which interruptible customers take service allow LDCs to interrupt gas service when low temperatures lead to high demand by firm service heating customers. Gas is made available to interruptible customers when firm customers do not require it. During high demand periods the gas is needed by the firm customers and there is no excess supply to be made available to interruptible customers. LDCs may also interrupt customers to manage pressures on the system and to maintain system wide deliverability. Such events usually occur during cold weather periods. Some customers who buy gas from a marketer or another third party, or who utilize interruptible pipeline transportation may be interrupted by that party, even if they have firm transportation service from the LDC. These interruptions are outside the control of the LDC.

As shown in Exhibit ES-3, the number of customers served by interruptible service (both sales and transportation) has grown since 2000. There were just over 5,000 interruptible customers estimated for the total study area in 2000; this increased to more than 6,500 by 2004. Well over 90 percent of the interruptible customers are in New York City and Long Island and virtually all of the growth in customers has occurred in this area.

[1] A sales service is when the LDC supplies the gas to the customer. Some large customers procure their own supplies from marketers and contract with LDCs for delivery service. These transportation contracts can also be interruptible when the LDC needs line capacity. Marketers also may be supplying the gas to the customer under an interruptible arrangement where such interruptions are governed not by LDC rules but by the bilateral contract agreement between the parties. Our focus in this study is on LDC interruptible sales services.

Exhibit ES-3: Growth of Interruptible Customers in Study Area



Source: Data received from Local Distribution Companies

FREQUENCY AND DURATION OF INTERRUPTIONS

Interruptions are primarily weather sensitive and thus are highly correlated with price spikes. Based on the data submitted by the LDC study participants[2], there is considerable variety in the frequency and duration of interruptions by LDCs in the study area. Interruptions appear to be strongly related to the physical constraints on the LDC and on interstate pipeline systems. Exhibit ES-4 shows interrupted natural gas demand during the 2001- 2004 time period. Days of interruption may be either full 24 hour days or as little as several hours in a given day.

Exhibit ES-4: Interrupted Gas Demand 2001-2004

Year	Month	Days	Dths	BOE (#2)
2001	Jan	11	932,764	159,665
2002	Dec	17	1,103,161	188,833
2003	Jan	22	4,725,106	808,817
	Feb-Mar	42	6,336,004	1,084,561
	Dec	12	1,448,330	247,917
2004	Jan	27	2,166,135	370,787
	Feb	4	60,725	10,395

BOE= barrels of oil equivalent at 5.842MMBtu/barrel
Dths= Decatherms
Source: ICF Estimate

[2] Consolidated Edison, KeySpan, Orange and Rockland, National Grid, and Central Hudson.

The estimate of gas interrupted would have been replaced largely with heating oil although other distillate fuels or residual fuel could also have been used. The last column of the exhibit converts the volumes of interrupted gas to equivalent barrels of heating oil. As the exhibit indicates, in some months the volumes are quite large. February and March 2003 saw incremental demand for petroleum jump by over one million barrels, or over 45 million gallons. This translates into 800,000 gallons or 18,000 barrels per day. This is equivalent to about 5 percent of the average daily fuel oil consumption of 338,300 barrels per day (bbls/d) in the study area during 2003. For these two months the petroleum infrastructure system was called upon to provide, on average, 3 additional large barge trips per day, or 185 additional large transport truck trips per day. Since these interruptions occurred when the infrastructure was already operating at close to its maximum, the surge in additional demand would have placed great strains on the petroleum distribution system.

BACK-UP FUEL STORAGE CAPACITY OF INTERRUPTIBLE CUSTOMERS

ICF was able to match 2,394, or about 39 percent, of the interruptible gas customers with data in the petroleum tanks database supplied by the New York State Department of Environmental Conservation (NYSDEC). ICF believes that, in light of the difficulty in matching data sets, a 39 percent match provides a robust data set. The resulting analysis provides insight into the number of days of storage capacity of fuel oil that each type of interruptible customer carries. Most of the interruptible customers with distillate fuel oil storage capacity are apartment buildings followed by schools. Customers on Long Island were not categorized because the tank storage database for Nassau and Suffolk counties lacked appropriate information. Long Island had only seven of the gas transportation contract customers that were matched but they accounted for 95 percent of the gas volume used by the 72 interruptible transportation customers, and 33 percent of the gas volume used by all 2,394 matched interruptible customers in October 2004. New York City interruptible customers were mainly gas sales types and consisted primarily of apartment buildings in both the distillate and residual fuels categories.

In the sample of customers that were matched between the two databases, gas sales interruptible customers had distillate fuel oil storage capacity averaging 30 days of usage, based on the average daily consumption of gas in November. Those customers with residual fuel oil as a back up fuel had 42 November-days of fuel oil in storage. Whether in fact these storage tanks are full to capacity at the beginning of the winter is unknown; ICF has assumed they are 100% full. The data for the gas transport customers using residual fuel as back-up suggests that they too have substantial amounts of back-up fuel storage capability on site: 63 days of November average consumption in storage at the beginning of the winter. However, the data for gas transport customers' on Long Island with distillate fuel as back-up shows a very different picture. They appear to have an unusually low 0.4 days worth of storage capacity. ICF questions the accuracy of the data for this class of customers but had no other public source of information. Nevertheless, there is some anecdotal information that does indicate that storage for backup fuels is minimal. That being the case, Long Island has a potential problem in providing timely supplies in severe weather.

Interaction of the Natural Gas and Heating Oil Markets

To analyze the interaction of natural gas and heating oil in the study region, ICF constructed an economic model of the local gas and heating oil markets and tested various ways in which the markets respond.[3] The objective of the modeling process was to understand how the markets operate with and without the incremental demand from interruptible gas customers. ICF modeled gas, distillate heating oil, and residual heating oil markets in the study area at the retail level only. Lack of timely data precluded modeling the wholesale sector. The model examined how the markets operate under winter weather conditions, and shows inventories, inventory draws, and fuel switching. Fuel switching is driven by economics as customers optimize their fuel choices. Gas interruptions were introduced that forced short-term, sharp increases in the demand for oil. The model chose when to interrupt, based on the level of demand relative to supply.

The model focused on the heating season for 2002-2003. This was a cold winter, with a large number of interruptions. Using rules developed for the model by the ICF team, the model interrupted 71 days (versus in reality 76 days), 61 of which occurred on the same days as the historical interruptions actually occurred. The interruptions' effects on oil markets are seen in reductions on inventories and price movements, both of which the model tracks as a consequence of gas interruptions.

Outcome of the Economic Modeling

The model was initially run without the imposition of mandated interruptions. Four demand sectors were examined; residential, commercial, industrial, and electric power generation. The commercial, industrial, and electric power sectors were assumed to all have some customers with the ability to switch between natural gas and the liquid fuels, either distillate or residual fuel oil. Although not explicitly modeled, the electric power system also had the option to purchase power from outside the study area. Also, not explicitly modeled was the fleet of electric generation peaking turbines without dual fuel capability: their only fuel is distillate oil. These units are only used at the coldest points of the winter season, the same time natural gas interruptions occur and traditional residential heating oil demand is at its maximum peak.

A base case was run with the model in which the nonresidential sectors were allowed to switch fuels in a cold winter but no mandatory natural gas interruptions were imposed.

[3] The details of the model can be found in Appendix B.

The model also tracks the number of days that each entity runs out of fuel. In both of the base cases discussed above, no entity ran out of fuel for even a fraction of a day. The sensitivity cases examined, among other things, how more severe conditions might cause consumers to run out.

These other sensitivity cases were examined:

- A once-in-a-century winter where heating season heating degree days (HDD) were 6069 compared to an average 5167
- A delay in supplies due to bad weather. The heating oil distributors' survey told ICF that deliveries are on average reduced by 30 percent in bad weather. This is what was used in the base runs. The reduction was increased to 50 percent for a sensitivity run.

The conclusions from these runs as well as the various base runs are that generally the volume of distillate and residual supplies are sufficient. The model indicates that no one runs out even in the most extreme conditions. Even though the demand for residual, for example, exceeds the supply during 30 days of the once-in-a-century winter, the tertiary inventories indicated by the data can carry the users over until their tanks can be refilled.

CONCLUSIONS

Using the existing data ICF was able to gather from the heating oil distributors and modeling the retail sector, the ICF Team was able to draw some broad conclusions. Namely that current storage capacity of distillate appears to be adequate other than in severe extremes, such as short term periods of intense cold or when there are bottlenecks and constraints in the distribution system. These bottlenecks and constraints may occur during brief, cold periods, even during an otherwise warm winter. The ICF analysis suggests that interruptible customers enter the heating season with storage capacity generally adequate to meet short-term interruptions of gas supply with the possible exception of some Long Island customers. ICF confirmed what percentages of gas interruptible customers rely solely on delivery contracts from fuel oil suppliers. That the number of interruptible customers has been increasing highlights the fact that this appears to be a contestable market; sales of gas to interruptible gas customers are sales not made by fuel oil marketers. Under these conditions, when interruptions of gas supply are implemented, these customers fall back upon their stored fuel oil or enter the fuel oil market or both. This does not appear to cause shortages of fuel oil under normal conditions, even though it may increase the level of business activity just when oil markets are at their tightest.

ICF's modeling shows that even if mandated gas interruptions did not occur there would be considerable fuel switching during the heating season, driven by the relative prices on a BTU basis. There does appear to be a substantial difference in the distillate and residual markets. In an unrestricted market gas users do switch to distillate but at a lower rate than in a market with mandated interruptions. Gas users who can use residual fuel desire to switch irrespectively.

In an unrestricted market price is the main determinant, assuming transaction costs are low. However, changes in the fuels markets may shift the price relationships between the three fuels. World wide demand for distillate is surging and there is intense competition for distillate on the international market. In an area such as the Northeast that relies heavily on imports, users should be aware of international demand and supply considerations that likely will impact price. Changes are also occurring in the residual fuel market, particularly in the bunker fuel sector. Likely changes will require the use of low sulfur bunkers and marine diesels by vessels along the East Coast, and in turn, may drive up the price of residual fuel shifting the relationship between fuels.

The IRS data suggests a different picture at the wholesale terminal level. The data show the estimated number of days that the heating oil inventory held by the New York State terminals at the start of the month can cover the non-bulk deliveries made by them during the same month. Relative inventory in all three New York regions increases by the start of October as terminals prepare for the anticipated cold weather. Between October and February there is a precipitous drop in the inventory cover in all three regions as temperatures drop. The inventory levels on Long Island at the start of February 2004 covered only 5 days worth of deliveries. Gas interruptions took place for four days in New York City and Long Island and for 26 days in the Hudson region starting on January 9th, 2004 . Consumption of heating oil by some of these gas interruptible customers would have increased deliveries from the terminals during this period.

The inventory level is lower in absolute volume as well as in the number of days of non-bulk deliveries that it can cover. The level at which the days covered falls to on Long Island and in New York City, indicates that in a severe winter there might be the real possibility of a crisis. Long Island is of particular concern given the very low oil inventory carried by the natural gas interruptible customers (assuming that the data is correct)

PHYSICAL CONSTRAINTS

Several large primary storage sites, with cumulative volumes of lost storage capacity[4] equaling 6.1 million barrels, have closed between 1998 and 2005. There are small retail tank farms further away from the major wholesale terminals, but many retailers do not have their own tanks. Rather than maintain separate storage facilities, they rely on tank trucks to distribute fuels from the wholesalers.

[4] The lost capacity represents reduction in total 'In-service' and 'Temporarily out-of-service' capacity marked for diesel, distillate fuel oil, residual fuel oil and kerosene. It also includes storage capacity marked as "Empty", i.e. not reserved for any specific fuel.

ICF believes that the bottleneck that exists is the distribution of heating oil to customers, although, in the future, if more terminals close the bottleneck may also be absolute supply volumes. The closure of wholesale facilities has brought a disconnect between the point of supply and the point of demand. According to the data supplied in the survey from the heating oil distributors, snow and ice reduce deliveries of supplies by as much as 30 percent on average. Distributors after all, maintain distribution facilities to deal with average winters, not the extremes. From an economic point of view, it makes no sense to incur costs for an expensive piece of capital equipment, such as storage facilities or surplus transport capacity that will sit idle for much of the time. In addition, anecdotal data from the dealers indicates that part of the problem is the shortage of experienced and qualified drivers. ICF would agree with this comment as we are aware that this is an emerging problem in several industries nation wide that require qualified commercial drivers.

I. INTRODUCTION AND BACKGROUND

The northeastern United States, including New England and the mid-Atlantic States, consumes substantially more petroleum for heating than any other part of the country. Natural gas use is growing but heating oil, and residual fuel oil in the case of industry and electricity generation, remain a major, and in some cases, the major fuel. These states are historically subject to severe weather during winter, and in some years, very deep cold spells. In these severe winter periods, the heating fuel infrastructure is placed under stress from a combination of spiraling demand and weather-induced supply problems (i.e., frozen waterways). This stress is augmented by the incremental demand that appears at precisely the same time heating oil demand is high from those natural gas customers that have interruptible service with natural gas distribution companies.

The residential sector and small volume commercial customers that typically do not have the ability to burn anything other than natural gas need a reliable and firm gas supply. Many larger customers, particularly large multi-family housing units, hospitals, schools, industrial, and electric generation customers often have dual-fuel capabilities. These customers have the option of selecting the less expensive gas delivery service known as interruptible service.

The goal of this study is to provide an assessment of the petroleum storage and delivery infrastructure in the New York City, Long Island, and Hudson River regions of New York State (NYS). This information will be used by the Public Service Commission (PSC) as it determines if regulations, utility procedures, and rate schedules (tariffs) that require interruptible gas customers to maintain alternative fuel storage or supply contracts with petroleum fuel suppliers should be revised. The PSC requires natural gas customers that select interruptible service and use petroleum fuels as backup to enter the winter season with seven to ten days worth of fuel supply in storage tanks. Alternatively, customers with insufficient on site storage to cover this requirement must have firm supply arrangements with petroleum fuel distributors to cover the remaining volume requirements. Large contract customers, such as electric generators with interruptible gas contracts, are required to maintain, or have on call, the equivalent of five days of petroleum fuel at the maximum winter burn rate.

The PSC continues to monitor the backup fuel storage regulations in response to the events of the severe cold winter weather of 2002-2003. The Commission has decided to leave the current alternative fuel inventory requirements as they stand but to further examine whether or not there are constraints and bottlenecks in the petroleum infrastructure system that may cause real shortages of petroleum fuels supply that would affect interruptible gas service.

Interruptible service customers play a critical role affecting reliable gas service to firm customers. When interruptible customers do not switch from gas to alternative fuels, the integrity of the gas system can be compromised and overall costs of service can increase beyond what is optimal for a well functioning gas distribution system. Conversely, if interruptible customers do not maintain sufficient petroleum reserves and do not enter into supply agreements with heating oil distributors, the heating oil industry is then faced with unexpected demand during its peak season. In addition, if interruptible customers enter into firm contracts with heating oil distributors that are not "take or pay" then the distributor is faced with the dilemma of either maintaining enough heating oil to service interruptibles should this materialize, or being left with the inventory should the weather prove to be benign. A further complication is that even if interruptible customers have the full complement of tanks and inventory, the continuous fuel use during interruptions means they may be forced into the market to refill their tanks at the same time peak demand occurs.

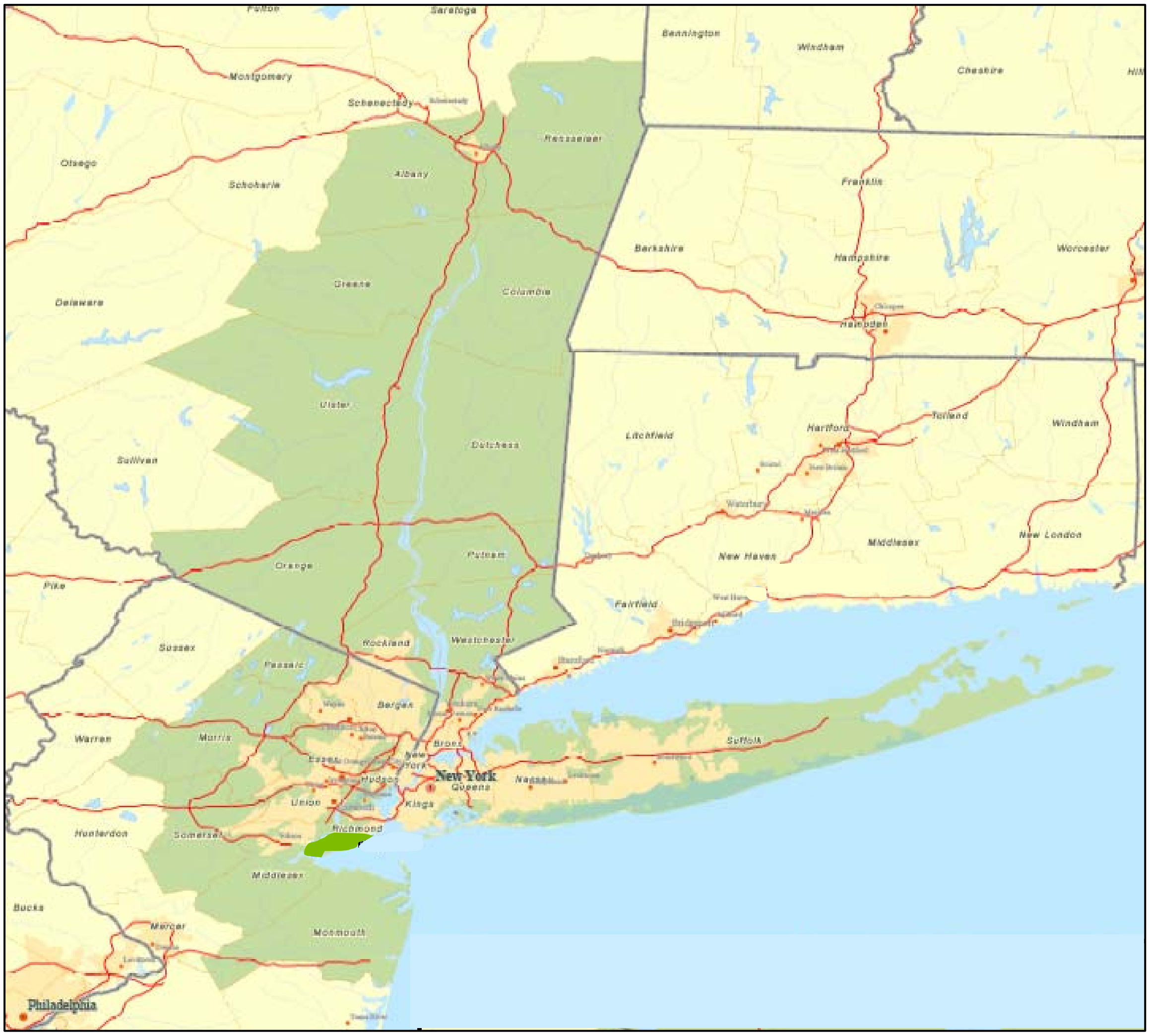
If more stringent back-up requirements were placed on the gas customers, would the petroleum infrastructure have the capacity to deal with increased demand without undue stress? Much of the study is focused on the details of the distribution and storage infrastructure for petroleum fuels, the demands placed on it, and trends that may have contributed to possible current bottlenecks or inability to provide service during periods of high demand.

In thinking about these issues, it is important to keep in mind that New York and the Northeast in general are part of the Atlantic Basin petroleum market that determines prices in the region. In addition, New York Harbor is the distribution center for marine transport of petroleum throughout the New England and northern mid-Atlantic regions. Both circumstances result in additional pressures on the oil storage and distribution system.

STUDY AREA

The study area of interest is New York City, Long Island, and the Hudson Valley as far north as Albany. Also included in this area are those counties in New Jersey that abut onto and service the New York Harbor area. Exhibit 1-1 is a map of the area.

Exhibit I-1: Study Area



DATA AVAILABILITY

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- Daily numbers have been estimated from the weekly and monthly data, and

[5] The term "ICF Team" refers to employees of ICF Consulting LLC and Applied Statistical Associates.

- A survey of heating oil distributors, local distribution companies, and terminals was conducted in the study area.

The ICF team hoped that the survey would provide adequate data to allow a quantification of the stress exerted by interruptible service on the petroleum distribution system. However, in many cases respondents refused to participate because of Homeland Security restrictions or business confidentiality concerns. Many heating oil distributors responded and gave the ICF team some useful and interesting data. However, terminal response was limited, so there is data on fuel flows at the retail level but not at the wholesale level. In addition, ICF was unable to acquire data from the State of New Jersey or from New Jersey heating oil trade associations, so for this part of the study area ICF relied totally on public data.

To compensate for the lack of data on wholesale flows the ICF team approached the Internal Revenue Service (IRS) about the availability of aggregate data from their ExSTARS terminal database. The IRS expressed willingness to provide ICF with some data aggregated to the four sub regions of the study area. Unfortunately, they were busy with higher priority work and required ICF to go through the Freedom of Information process so the data was not received in a timely fashion. This lack of wholesale flow data has meant that the modeling was confined to the retail level. While the IRS data was received late in the process, it did present an illustrative picture of terminal flows for heating oil and gave a somewhat different picture of stock levels in the winter. The data are discussed in an addendum to Chapter V.

A further problem with the public data is that generally the smallest geographic unit for which it is reported is the state level. There are some data at the county level but all EIA data is at the Petroleum Administration for Defense District (PADD), sub-PADD, or state level. Therefore, the ICF team had to make assumptions in order to disaggregate the data to the study area. The details of the calculations for both supply and demand and the sources of the data are specified in Appendix A.

STRUCTURE OF THE REPORT

The original Request for Proposal laid out the substance of the work in three tasks. These tasks have been reorganized and combined in writing the report. This was done to:

- Make the report flow more easily and more logically,
- Organize the large amounts of data in a manageable fashion, and
- Focus on the critical questions of interest to NYSERDA and the PSC.

The report is organized as follows:

I. INTRODUCTION AND BACKGROUND

II. DEMAND FOR HEATING OIL

III. HEATING OIL SUPPLY AND MARKET STRUCTURE

IV. NATURAL GAS SUPPLY AND MARKET STRUCTURE

V. INTERACTION OF THE NATURAL GAS AND HEATING OIL MARKETS

V-A, HEATING OIL INVENTORY DATA FROM IRS

VI. CONCLUSIONS

Five Appendices are attached to the report:

APPENDIX A – DATA SOURCES AND METHODOLOGICAL APPROACH

APPENDIX B – SIMULATION RESULTS

APPENDIX C – WATERBORNE DATA

APPENDIX D – PERMITS AND THE REGULATORY PROCESS

APPENDIX E – SURVEY INSTRUMENTS

II. DEMAND FOR HEATING OIL

The study region for this report covers Long Island, New York City, areas around New York Harbor in the states of New York and New Jersey, and the Hudson River as far north as Albany. Since most energy data are reported at either at the PADD, sub-PADD, or state level, the study region is comprised of complete counties to facilitate disaggregation. While disaggregation still has to be performed using specified assumptions, by focusing on the county geographic area it is possible to gather considerable public data. The study area is divided into four regions – Long Island; part of New York City metropolitan area in the state of New York, henceforth called NYC Metro - NY; part of New York Harbor in New Jersey henceforth called as NYC Metro – NJ; and the counties along the Hudson river north of the NY Metro region and north to Albany, henceforth called Hudson. The counties that comprise each of these regions are shown in Exhibit II-1.

Exhibit II-1: Regions and Counties in the Study Area

Hudson	Long Island	NYC Metro - NY	NJ Metro - NJ
Albany	Nassau	Bronx	Bergen
Columbia	Suffolk	Kings	Essex
Dutchess		New York	Hudson
Greene		Queens	Middlesex
Orange		Richmond	Monmouth
Putnam		Rockland	Morris
Rensselaer		Westchester	Passaic
Ulster			Somerset
			Union

The four regions in the study differ in their demographics and, consequently, so does their demand pattern for petroleum products. Exhibit II-2 presents selected demographic characteristics for the four regions within the study area.

NYC Metro-NY is both a highly urbanized area with a large population and a major commercial and transportation hub, resulting in a large demand for fuels for the residential, commercial, transportation and electricity generation sectors. Long Island is a suburb of New York City and also has a large population with extensive residential properties. The Hudson region is less urban with Albany being the largest metropolitan center. No single sector stands out as being out-of-proportion. NYC Metro-NJ is less populated than New York City but is more highly industrialized. It has the largest number of gasoline stations, but uses much less petroleum in electricity generation.

Exhibit II-2: Key Demographics and Characteristics of the Regions in the Study Area in 2002

Characteristic	Region			
	Hudson	Long Island	NYC Metro- NY	NYC Metro- NJ
Population	7.75%	14.61%	48.62%	29.02%
Residential Homes	8.09%	27.60%	26.18%	38.13%
Commercial Establishments	6.74%	16.67%	47.21%	29.39%
Industrial Establishments	8.90%	21.02%	35.64%	34.45%
Gas Stations	13.15%	22.26%	27.32%	37.27%
Electric Generation				
Electricity Generation from Natural Gas (MWh)	1,441,018	10,380,815	22,817,574	16,912,274
Electricity Generation from Distillate (MWh)	20,971	736,936	228,498	72,336
Electricity Generation from Residual Fuel (MWh)	1,132,797	6,049,749	3,087,967	209,355
Natural Gas Consumed for Electricity Generation	2.58%	19.72%	45.01%	32.69%
Distillate Consumed for Electricity Generation	1.99%	63.96%	23.86%	10.18%
Residual Fuel Consumed for Electricity Generation	10.86%	55.14%	31.40%	2.61%

Sources: U.S. Census Bureau, *Population Estimates. 2002*
U.S. Census Bureau, *American FactFinder. 2002*
U.S. Census Bureau, *Censtat Database. 2002*
Energy Information Administration, E*IA-906 Monthly Power Plant Data. 2002*

DISTRIBUTION OF FUEL OIL DEMAND

Exhibit II-3 shows the sales of distillate and residual fuel oils in 2004 within the four regions of the study. In 2004, the study area consumed 343,800 barrels per day (bbl/d) of fuel oil and kerosene, with NYC Metro-NY consuming 32 percent, NYC Metro-NJ consuming 27 percent, Long Island another 29 percent, and the Hudson region consuming the remaining 12 percent. Distillate fuel oils, consisting of No.1, 2 and 4 fuel oil, diesels, and jet fuel comprise nearly 60 percent of the fuel oil sold. Residual fuel oil, consisting of No.5 and No. 6 oil, comprises another 38 percent, with the remaining 2 percent sold being kerosene.

NYC Metro-NY

This region consumes the largest quantity of fuel oil in the study area and accounts for about 32% of the total. The commercial sector is the largest consumer of petroleum in this region with transportation the next largest. This sector comprises office buildings, businesses, and multi-dwelling apartment buildings and is generally characterized by the use of single- or dual-fired boilers that can operate on either natural gas or oil. The oil could be distillate or residual fuel oil depending on the type of boiler equipment. The total consumption of fuel oil by this sector was about 41,000 bbl/d in 2004, which includes consumption by dual-fired boilers. This can be further defined as 24,200 bbl/d of distillate, 15,800 bbl/d of residual fuel oil, and a small volume of kerosene.

Transportation sector use of distillate fuel is driven by a number of factors. A large number of vehicles are operated for public transport and commercial use in the densely populated New York City region. Also, the New York metropolitan area has a large commercial port and three major airports requiring fuel for vessels and aircraft that are either locally based or visiting the region. In 2004, the transportation sector consumed fuel at a rate of nearly 32,600 barrels of distillate and residual fuel oil per day in the NYC Metro-NY region. The residual fuel used by the transportation sector is primarily used for vessel bunkering[6] at the ports. The distillates used in transportation are mainly diesel and jet fuel.

The residential sector consumed on average 15,600 bbl/d of distillate oil in 2004. Space heating is the major use of distillate oil in this sector. A regression equation was developed between heating degree days and fuel consumption and is presented in Exhibit V-1 below. Application of the equation indicates that residential demand for distillate fuel oil in this region will vary from an average 13,600 bbl/d in the summer months (April to October) to 111,000 bbl/d in the winter (November to March). On average, this winter demand level approaches 4.7 million gallons per day.

The electrical sector consumes about 18,100 bbl/d of residual fuel oil and a very small volume of lighter distillate oil. Fuel oil shares the demand load in this sector with natural gas in facilities where dual-fired steam generators are used. Assuming both natural gas and petroleum fuels are readily available, cost is the determinant of the distribution.

Finally, the industrial sector consumes 2,700 bbl/d in all, a small volume compared to the other sectors. Industrial customers in the New York City area consist of a few large plants, but mostly many small machine shops.

[6] Bunkers and bunkering refers to the petroleum fuels used for marine transportation. The use of the term “bunker” is a relic of the time when ships used coal and the coal was stored in bunkers at ports.

Exhibit II-3: Average Daily Consumption of Distillate and Residual Fuel Oil in 2004 Mb/d

		Sales in 2004 (1000 bbl/d)			
Region	**Sector**	**Distillate**	**Kerosene**	**Residual**	**Total**
Hudson	Commercial	3.4	0.1	2.3	5.8
	Electrical	0.0		6.3	6.3
	Industrial	0.6	0.2	0.7	1.4
	Residential	11.5	0.8		12.3
	Transportation	11.0		2.5	13.5
Hudson Total		26.6	1.1	11.7	39.4
Long Island	Commercial	8.5	0.4	5.6	14.5
	Electrical	1.5		31.8	33.3
	Industrial	0.6	0.2	0.7	1.4
	Residential	27.5	1.9		29.4
	Transportation	18.6		2.2	20.8
Long Island Total		56.8	2.4	40.2	99.5
NYC Metro - NY	Commercial	24.2	1.0	15.8	41.0
	Electrical	0.6		18.1	18.7
	Industrial	1.1	0.3	1.3	2.7
	Residential	15.6	1.1		16.7
	Transportation	22.8		9.8	32.6
NYC Metro - NY Total		64.3	2.4	45.0	111.7
NYC Metro - NJ	Commercial	4.3	0.5	0.6	5.5
	Electrical	0.9		6.9	7.8
	Industrial	1.6	1.3	0.9	3.8
	Residential	7.3	0.1		7.4
	Transportation	43.5		25.3	68.8
NYC Metro - NJ Total		57.6	1.9	33.7	93.3
Grand Total		**205.4**	**7.9**	**130.6**	**343.8**
Study Area Totals	Commercial	40.5	2.1	24.3	66.8
	Electrical	3.0		63.0	66.1
	Industrial	3.9	1.9	3.5	9.3
	Residential	62.0	3.9		65.9
	Transportation	95.9		39.8	135.7
Grand Total		**205.4**	**7.9**	**130.6**	**343.8**

Source: Energy Information Administration. *U.S. Fuel Oil and Kerosene Sales. 2004*

Long Island

In 2004, Long Island consumed about 29 percent of the fuel oil consumed in the study area. Residual fuel oil used for electricity generation constitutes the largest portion of oil consumption in this region. In 2004, a total of 8,900 GWh was generated from residual fuel oil, 7,100 GWh from natural gas, and 500 GWh from distillate fuel oil. The residential, transportation and commercial sectors are the next largest consumers in this highly populated region adjacent to New York City. Heating oil is used for space heating and diesel fuel is needed for vehicle fuel. The residential demand for distillate fuel oil in this region is estimated to vary from an average 5,000 bbl/d in the summer months to 40,500 bbl/d in the winter. The industrial sector, which on a unit of output basis is very small in the downstate region, consumes a very small volume of fuel oil.

NYC Metro-NJ

The New Jersey region is the second largest consumer of petroleum after New York City, contributing to about 31 percent of the total consumption, with the transportation sector by far the largest consumer. The high consumption of residual fuel oil in the transportation sector reflects use in vessel bunkering, whereas distillate fuel oil consumption reflects public transport and freight vehicles.

Residential and commercial consumption of petroleum are about equal, with small amounts used by industry and electricity generation. The residential demand for distillate fuel oil in this region is estimated to vary from an average 4,200 bbl/d in the summer months to 34,200 bbl/d in the winter

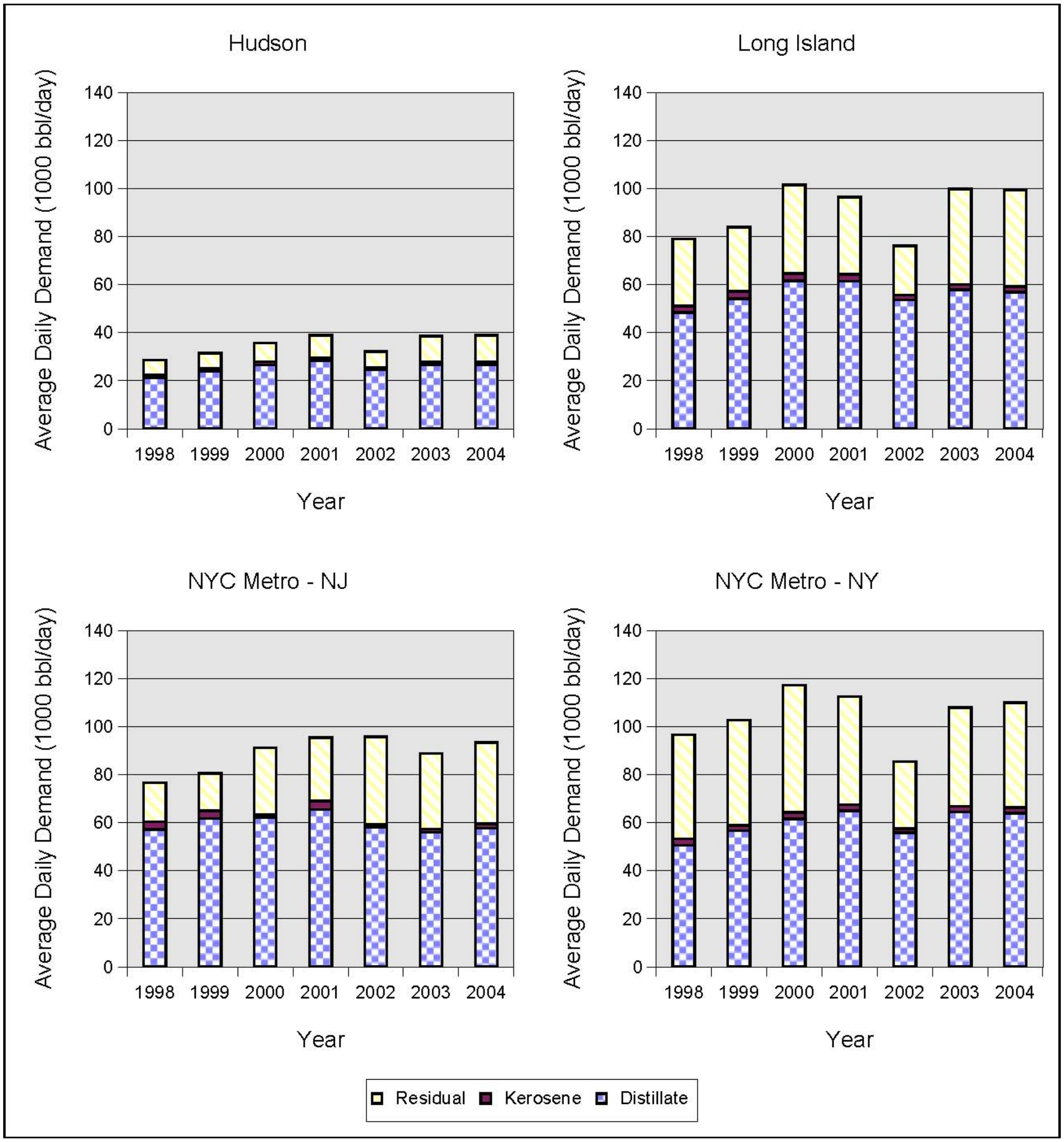
Hudson

As mentioned above, the Hudson region is less densely populated than the other two New York State regions. It consumed 39,400 bbl/d of oil in 2004, about 12 percent of the total study area. The main sources of distillate demand in this region are the transportation, commercial and residential sectors for vehicle fuel and space heating needs, respectively. The residential demand for distillate fuel oil in this region is estimated to vary from an average 2,000 bbl/d in the summer months to 16,000 bbl/d in the winter. Residual fuel oil is used for commercial applications in boilers, by electricity generators, and a small quantity for transportation, most likely for barge operations on the Hudson River which runs the length of this region.

DEMAND TRENDS FOR DISTILLATE AND RESIDUAL FUEL OIL CONSUMPTION IN THE STUDY AREA

Overall demand for distillate oil in the study area increased between 1998 and 2004. During the economic boom period in the late 1990's to 2001, distillate oil demand increased in all regions, as seen in Exhibit II-4. However, there was a decline in all regions due to the economic recession that followed in 2002. Demand started to recover in 2003, and appears to have stabilized in 2004.

Exhibit II-4: Trends in Distillate and Residual Fuel Oil Demand in the Study Region Mb/d



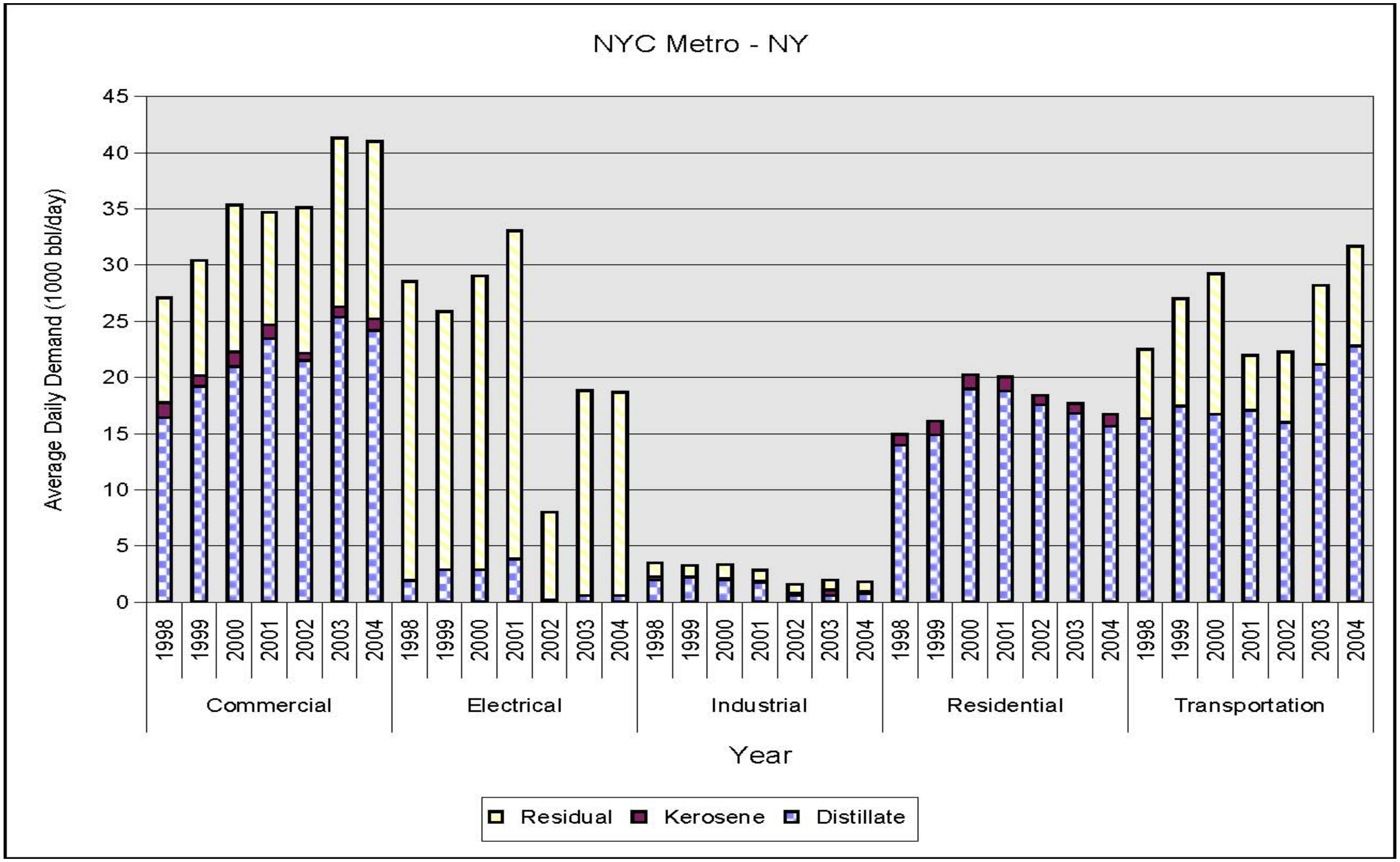
Sources: Energy Information Administration, *US Fuel Oil and Kerosene Sales*. 2001 – 2004: Energy Information Administration, NY *and NJ State Energy Consumption*. 1998 – 2001: ICF assumptions for region level distribution.

Exhibit II-5a, II-5b, II-5c, and II-5d below show the demand trend by sector and region for the study area. The transportation sector, which is also the largest distillate oil consuming sector, grew significantly from 92,000 bbl/d in 1998 to about 135,700 bbl/d in 2004. In the NYC Metro-NJ region, transportation sector use has increased from about 48,500 bbl/d to over 68,800 bbl/d, an increase of over 41 percent in six years. The distillate fuel oil component, which includes on-highway diesel, has increased from 35,000 bbl/d to over 43,000 bbl/d, and the residual fuel oil component has increased from 14,000 bbl/d to 25,000 bbl/d. The increase in the other regions has been less significant. Overall, distillate fuel demand by the transportation sector in the study area has grown by over 27,000 bbl/d, or about 40 percent in six years. Similarly, residual fuel oil demand for the transportation sector has grown by more than 15,000 bbl/d or about 66 percent in six years.

Petroleum demand by the electricity generation sector has shown growth in the Long Island and NYC Metro-NJ regions, but has declined from its high in 2001 in the NYC Metro-NY and Hudson regions. Residual fuel makes up a major portion of the electricity generation sector's demand for oil.

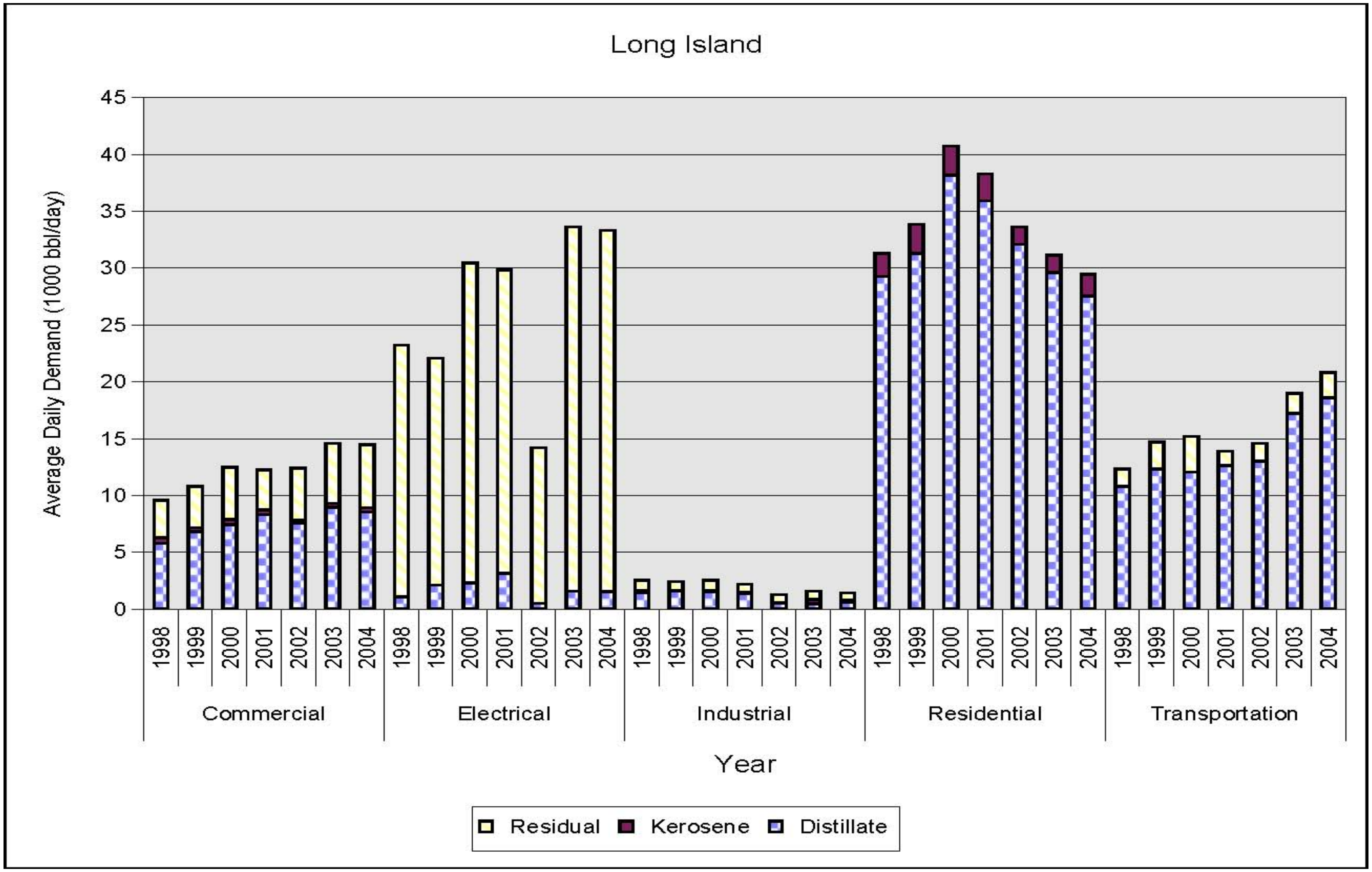
The commercial sector has shown steady growth in all regions other than in 2002, when it held constant during the economic recession. Following the brief recession, demand rebounded in 2003 and resumed the growth trend.

Exhibit II-5a: Sectoral Trend in Consumption of Distillate and Residual Fuel Oil in the NYC Metro – NY Region of the Study Area



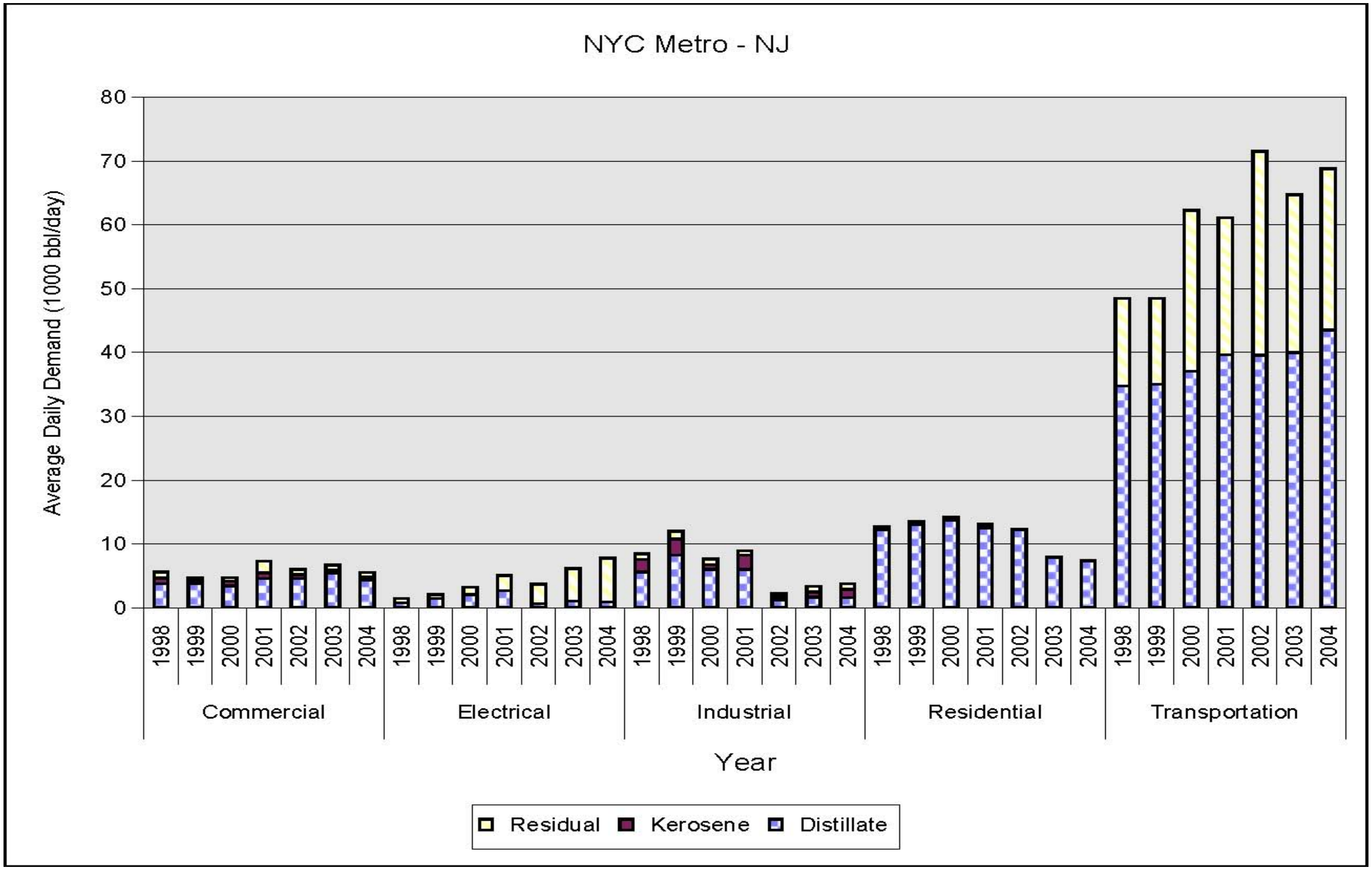
Sources: Energy Information Administration, *U.S. Fuel Oil and Kerosene Sales*. 2001 – 2004
Energy Information Administration, *NY Energy Consumption*. 1998 – 2001
ICF assumptions for region level distribution

Exhibit II-5b: Sectoral Trend in Consumption of Distillate and Residual Fuel Oil in the Long Island Region of the Study Area



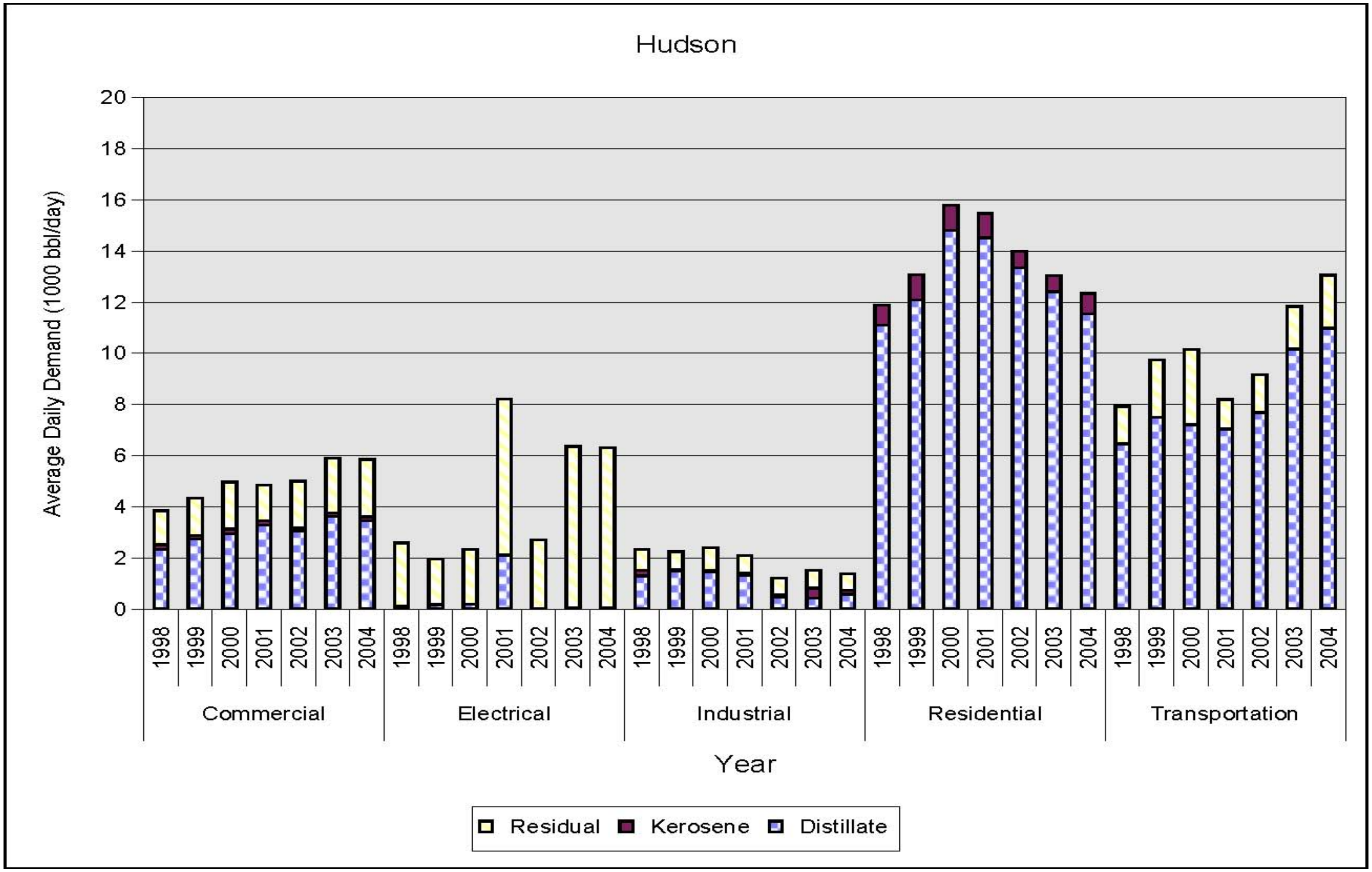
Sources: Energy Information Administration, *U.S. Fuel Oil and Kerosene Sales*. 2001 – 2004
Energy Information Administration, *NY State Energy Consumption*. 1998 – 2001
ICF assumptions for region level distribution

Exhibit II-5c: Sectoral Trend in Consumption of Distillate and Residual Fuel Oil in the NYC Metro – NJ Region of the Study Area



Sources: Energy Information Administration, *U.S. Fuel Oil and Kerosene Sales*. 2001 – 2004
Energy Information Administration, *NJ State Energy Consumption*. 1998 – 2001
ICF assumptions for region level distribution

Exhibit II-5d: Sectoral Trend in Consumption of Distillate and Residual Fuel Oil in the Hudson Region of the Study Area

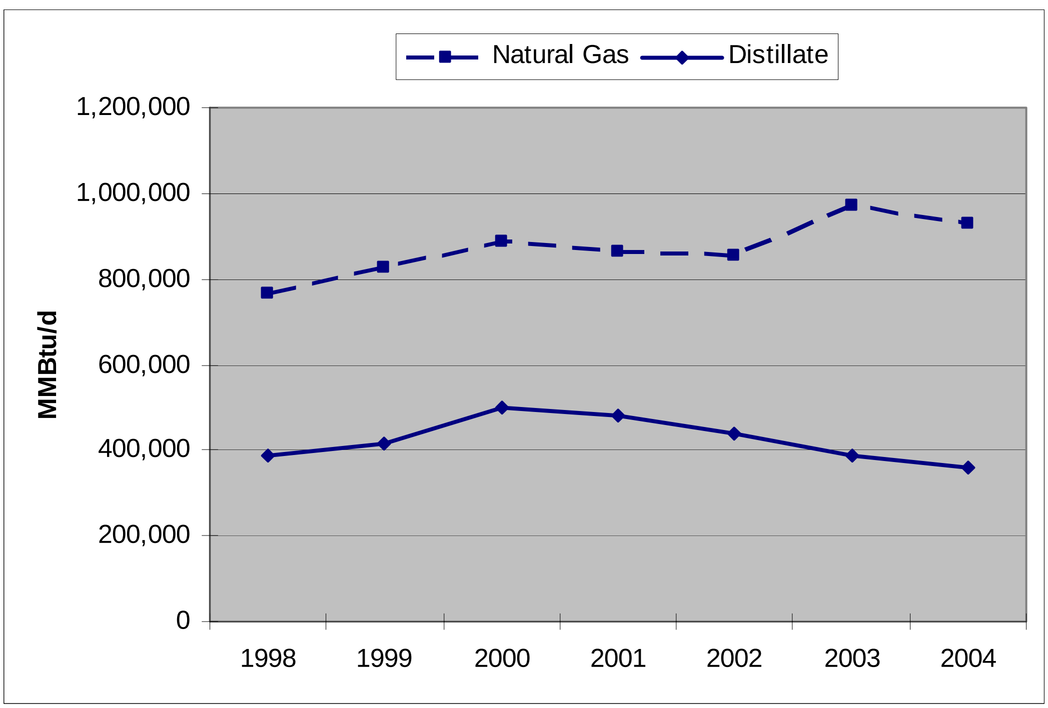


Sources: Energy Information Administration, *U.S. Fuel Oil and Kerosene Sales*. 2001 – 2004
Energy Information Administration, *NY State Energy Consumption*. 1998 – 2001
ICF assumptions for region level distribution

Exhibit II-6a illustrates the consumption of distillate fuel oil and natural gas in the residential sector between 1998 and 2004. The consumption of distillate fuel in the residential sector increased from 1998 to 2000 but has subsequently declined after 2000. Natural gas consumption has increased over the period, regardless of the slight declines in 2001, 2002 and 2004.

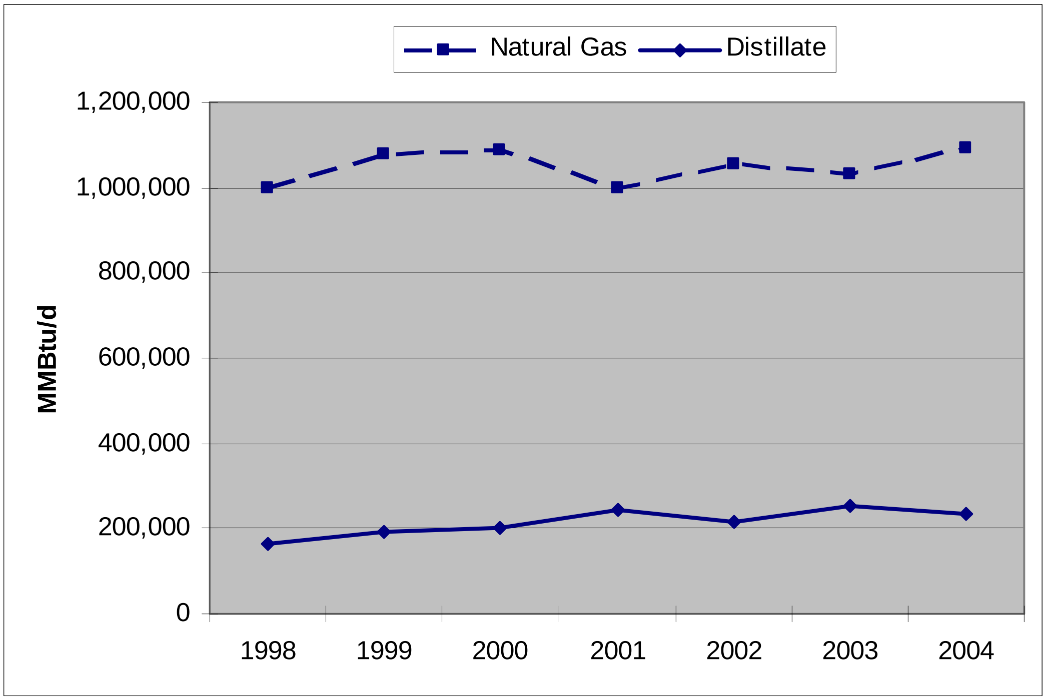
Exhibits II-6b and II-6c show the interplay between distillate and natural gas consumption in the commercial and industrial sectors. In the commercial sector, demand for both fuels has grown slightly. It is interesting that the market share of the two fuels in the commercial sector has shifted only minimally. In the industrial sector, demand for both natural gas and distillate declined during this period with distillate demand being essentially flat from 2001 till 2004. The sharp reduction in natural gas demand in the industrial sector is the result of the EIA reclassifying non-utility generation demand from the industrial sector to the electric power industry sector.

Exhibit II-6a: Trend in Consumption of Distillate Fuel Oil and Natural Gas in the Residential Sector within the Study Area between 1998 and 2004



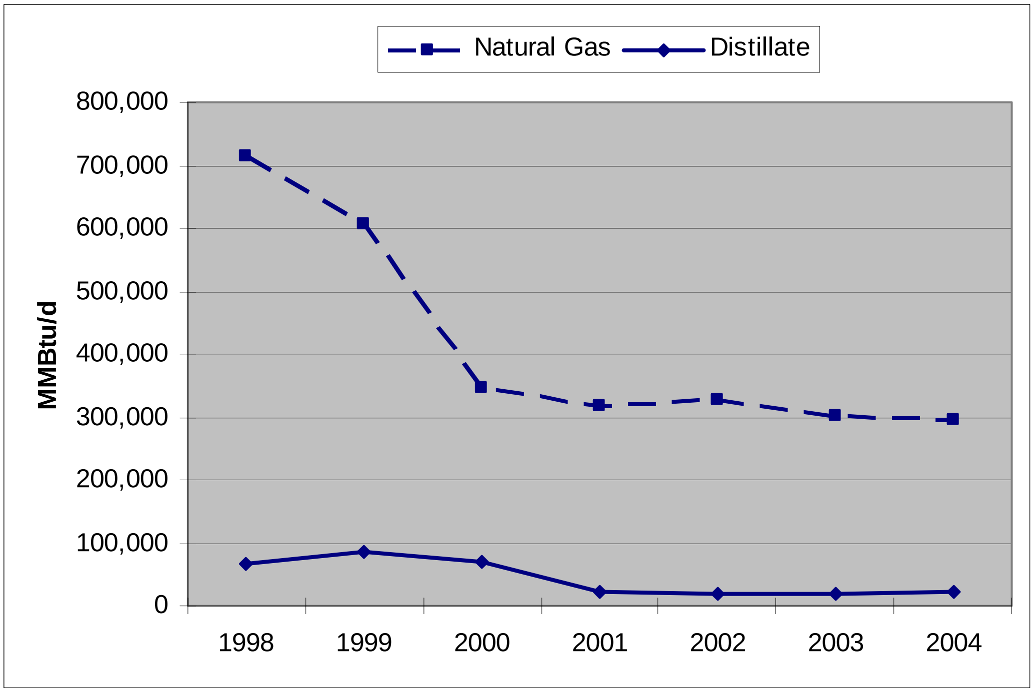
Sources: Energy Information Administration, *U.S. Fuel Oil and Kerosene Sales*. 2001 – 2004; Energy Information Administration, *NJ State Energy Consumption*. 1998 – 2001; Energy Information Administration, *NY State Energy Consumption*. 1998 – 2001; ICF assumptions for region level distribution

Exhibit II-6b: Trend in Consumption of Distillate Fuel Oil and Natural Gas in the Commercial Sector within the Study Area between 1998 and 2004



Sources: Energy Information Administration, *U.S. Fuel Oil and Kerosene Sales*. 2001 – 2004; Energy Information Administration, *NJ State Energy Consumption*. 1998 – 2001; Energy Information Administration, *NY State Energy Consumption*. 1998 – 2001; ICF assumptions for region level distribution

Exhibit II-6c: Trend in Consumption of Distillate Fuel Oil and Natural Gas in the Industrial Sector within the Study Area between 1998 and 2004

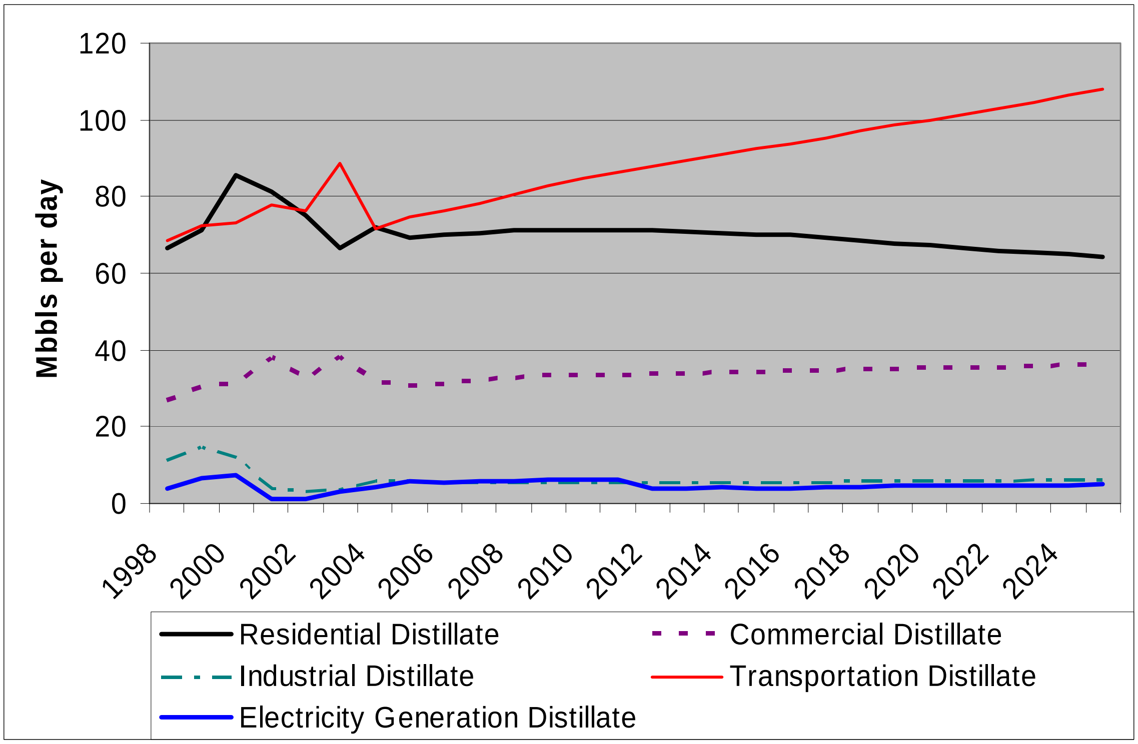


Sources: Energy Information Administration, *U.S. Fuel Oil and Kerosene Sales*. 2001 – 2004; Energy Information Administration, *NJ State Energy Consumption*. 1998 – 2001; Energy Information Administration, *NY State Energy Consumption*. 1998 – 2001; ICF assumptions for region level distribution

DEMAND FORECAST

Exhibit II-7 presents the historical demand for distillate fuel over the last six years and the projected demand out to 2025. The demand projections for the study area have been estimated from EIA's *Annual Energy Outlook 2005* released in March 2005.

Exhibit II-7: Demand Projections for Distillate Fuel in the Study Area through Year 2025



Source: Historical Estimates: Energy Information Administration, *U.S. Fuel Oil and Kerosene Sales* 1998-2004; Projections: Energy Information Administration, *Annual Energy Outlook 2005*. ICF assumptions for region-level distribution.

The primary growth area for distillate fuel is projected to occur in the transportation sector where the demand is, and will be, for low and ultra low sulfur diesel. This projection is consistent with the trend seen in the last few years where demand for distillates in the transportation sector has grown from 68 Mbbls/d in 1998 to 96 Mbbls/d in 2003, an increase of 41 percent. The commercial sector is projected to have a modest growth in demand for distillate fuel oil through 2025. The residential sector is the only sector in which demand for distillates is projected to decline over the forecast horizon. The industrial and electricity generation sectors comprise a small share of the distillate demand and are projected to show relatively minor growth.

The forecast from the EIA *Annual Energy Outlook 2005*, used to project demand from 2005 onwards, is taken from the reference case that assumes a world oil price of $27.73/bbl in 2003 and $25.00/bbl in 2010. If, in fact, the oil prices remain high, as seen in the last few years, ICF would expect continued growth in the transportation sector but no growth or only minimal growth in the other sectors. Also, if LNG imports into the United States increase in the future, downward pressure would be exerted on natural gas prices. This downward natural gas price pressure would further inhibit the growth of oil consumption in the non-transportation sectors.

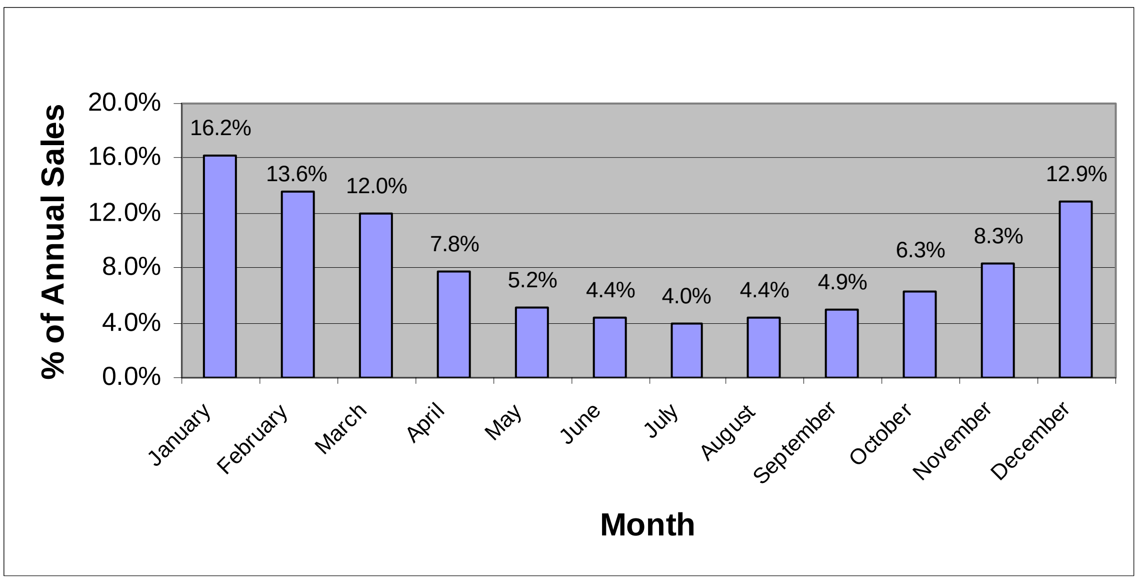
SEASONALITY

The three main fuels, distillate fuel oil, low-sulfur diesel, and residual fuel oil, show a distinct usage pattern during the year driven by the weather and the economic activity of the sectors they supply. The monthly data for seasonality is available only at the state level. To disaggregate it to the four study regions would require numerous assumptions and provide questionable results. Therefore, only state level data is presented.

Distillate Fuel Oil

Exhibit II-8 shows the monthly prime supplier sales pattern for distillate fuel oil in New York State between 1997 and 2004. This fuel is used primarily for space heating in residential homes and commercial establishments, including apartment buildings and office space. As a result, the consumption pattern is highly dependent on the weather and temperature. The study area experiences very cold winters and the months from December to March account for 55 percent of the annual sales. These prime supplier sales represent the sale of fuel for local consumption. Therefore, the data may include purchases made by end-users in the summer months to stock up on fuel oil for the coming winter season. These data are good indicators of demand variations and are the only data available by month.

Exhibit II-8: Average Monthly Sales of No. 2 Fuel Oil in New York State between 1998 and 2004

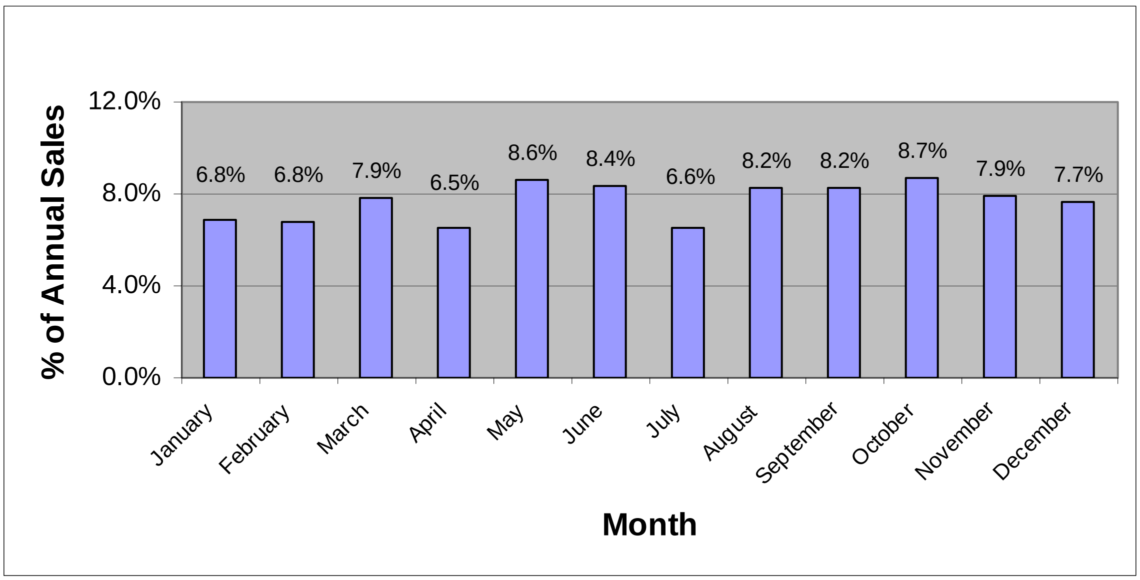


Sources: Energy Information Administration. *US Fuel Oil and Kerosene Sales*. 2001 – 2004. Energy Information Administration. *NY Energy Consumption*. 1998 – 2001

Low Sulfur Diesel

Exhibit II-9 shows the monthly distribution of low-sulfur diesel sales between 1998 and 2004. Low-sulfur diesel is used primarily in diesel engines for on-highway transportation and its sales are consistent throughout the year, with only slightly lower numbers in the winter months compared to the rest of the year. In the United States, on-road diesel is largely used for buses, local trucks, and long haul trucks. Since commerce movements are not affected by weather in the same way as space heating requirements influence heating oil demand, there are less seasonal variations.

Exhibit II-9: Monthly Sales Pattern for Low-Sulfur Diesel in New York State between 1998 and 2004



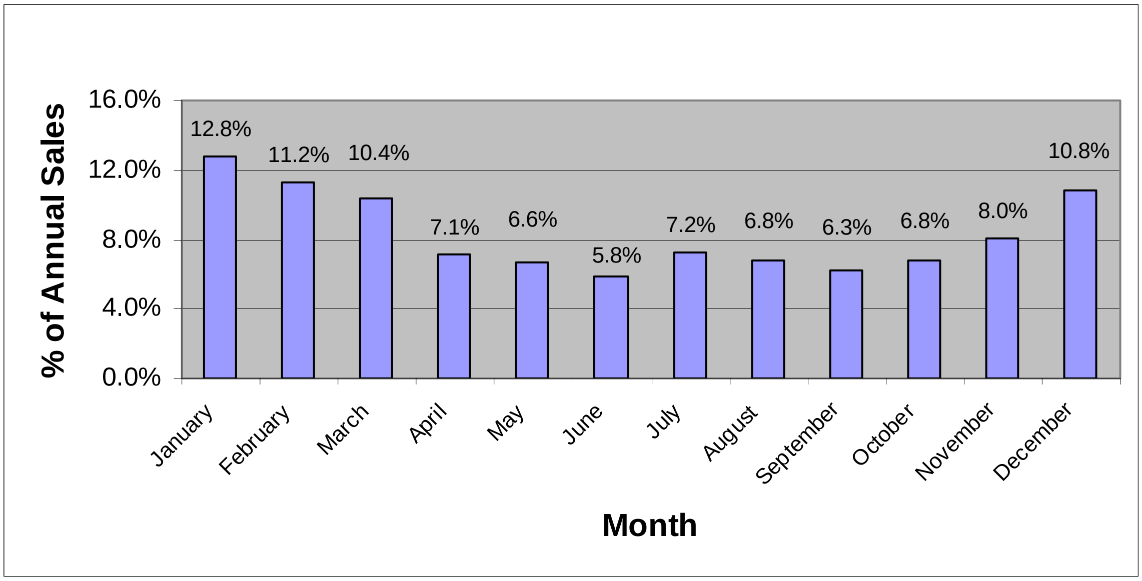
Sources: Energy Information Administration, *U.S. Fuel Oil and Kerosene Sales*. 2001 – 2004
Energy Information Administration. *NY Energy Consumption*. 1998 – 2001

Residual Fuel Oil

Exhibit II-10 shows the monthly distribution of residual fuel oil sales from 1998 to 2004. Residual fuel oil is used in the commercial sector for boilers, electricity generation, and vessel bunkering in the transportation sector. The study area includes the New York Harbor, a major international port that handles large volumes of cargo and liquids. Tankers, barges, and other vessels using this port use residual oil as one of their primary fuels and hence demand from this sector is substantial; over 40,000 bbls/d. The electricity generation sector also uses residual oil. Residual fuel demand tends to increase briefly in the summer months when electricity generation peaks due to air-conditioning use. The winter season shows the highest consumption as space heating in the commercial sector drives demand upward. In 2004, over 63,000 bbl/d of residual oil were consumed by the electric generation sector in the study area.

The New York Metro region is the only area with a sizeable demand for residual oil in the commercial sector, about 16,000 bbl/d in 2004. In this sector the fuel is used in boilers for heating purposes. Sales of residual oil are higher in the winter than the summer. However, due to its multiple end-uses, the residual oil sales do not show as pronounced a seasonal trend as the trend for distillate fuel oil, which is used mostly for heating. In fact, in the peak summer months of July and August, the demand picks up a bit compared to the spring months due to demand from the electric sector.

Exhibit II-10: Monthly Distribution of Sales for Residual Fuel Oil in New York State from 1998-2004

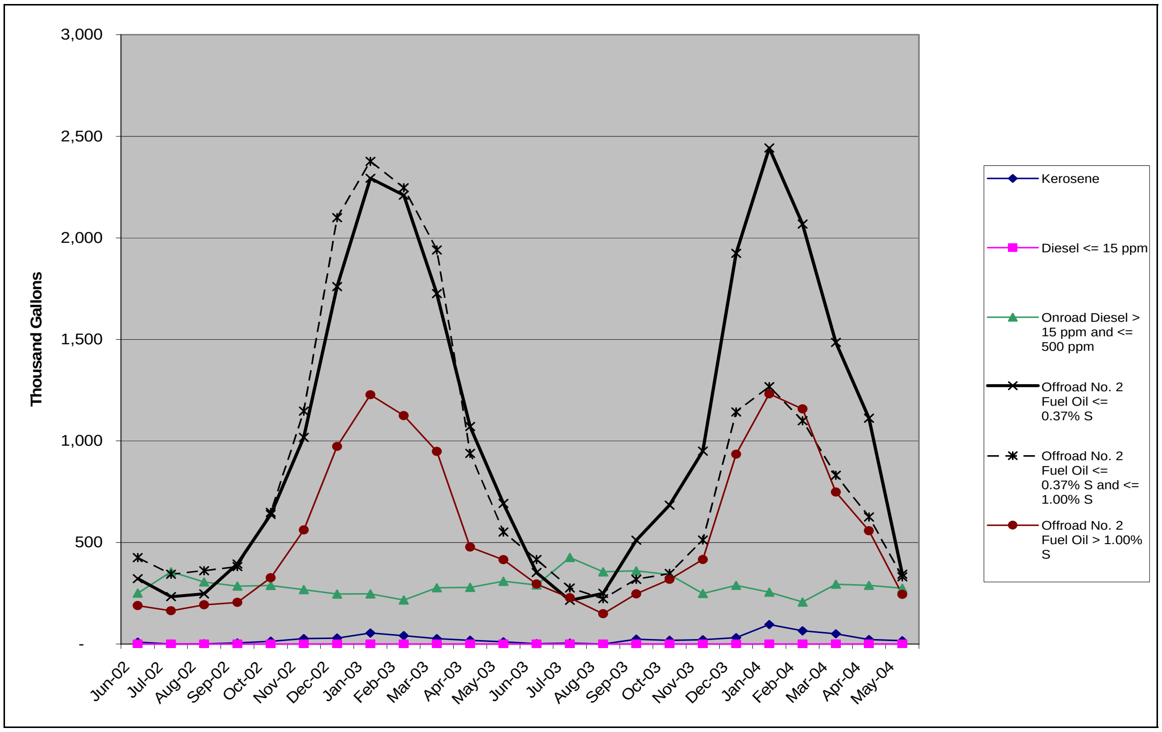


Sources: Energy Information Administration. *U.S. Fuel Oil and Kerosene Sales*. 2001 – 2004; Energy Information Administration. *NY Energy Consumption*. 1998 – 2001

Seasonality at the Regional Level

Although public data are available only at the state level, ICF acquired some disaggregate sales data that show seasonality at the regional level. ICF aggregated data, received from the dealers through a survey, for Long Island and the Hudson regions. Unfortunately, ICF did not receive enough data from dealers in the NYC Metro-NY region to publish it. ICF received no data from dealers in NYC Metro-NJ. Exhibit II-11 shows monthly sales of all distillate fuels for Long Island. Exhibit II-12 shows similar data for the Hudson region. Both graphs emphasize the extreme seasonality of heating oil demand.

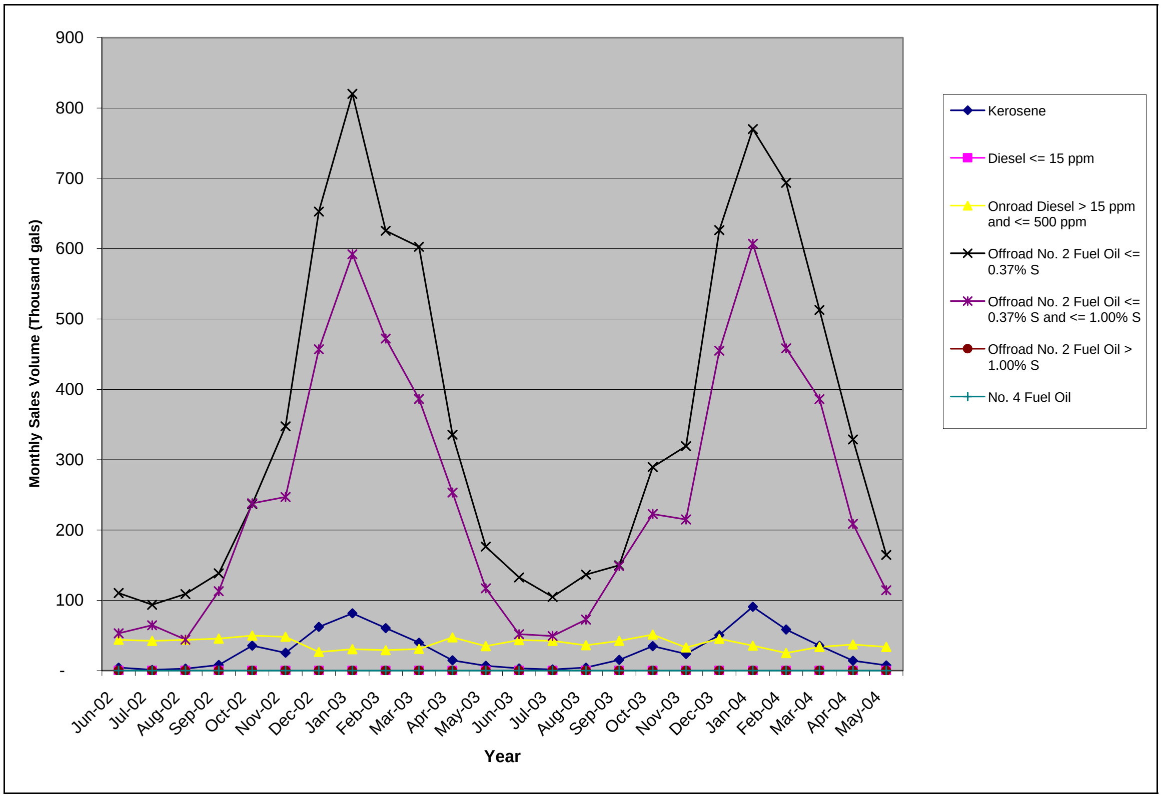
Exhibit II- 11: Monthly Sales of All Distillate Fuels for Long Island: June 2002 – May 2004 Thousands of Gallons



Source: Survey conducted on heating oil distributors 2004-2005

Exhibit II- 12: Monthly Sales of All Distillate Fuels for Hudson Region: June 2002 – May 2004

Thousands of Gallons



Source: Survey conducted on heating oil distributors, 2004-2005

INCREMENTAL DEMAND FROM GAS CUSTOMERS

When natural gas customers are interrupted, they switch to their alternative fuel, which under the interruptible service agreements they are required to have available either in on-site storage or as backup contracts with oil suppliers. Most interruptible customers know when interruptions will occur, either because they are temperature controlled customers whose equipment automatically switches between natural gas and petroleum fuels, or they are the larger customers that are interrupted on notice and are in contact with the Local Distribution Companies (LDC)

ICF sought data from the LDCs with respect to the frequency and duration of interruptions over the last five years. LDC interruption data have come in a variety of formats that make strict comparisons difficult.

For example, one LDC provided a schedule of consumption for the interruptible classes of customers as a function of temperature. This schedule showed the amount of consumption that would occur for each class at a given temperature and heating degree day (HDD), the HDDs at which these customers were interrupted, and temperatures at which interruptions were lifted. This information was especially useful since it provided an estimate of the amounts of gas consumption that needed to be replaced with fuel oil at all temperatures. From these data, ICF was able to match the schedule to actual temperatures for the relevant years to indicate how much interruption should have been expected to occur.

Other LDCs provided information on specific interruption episodes between 2001 and 2004. In some cases, the estimated interrupted volumes of gas were provided. In other cases, the annual sales volumes were provided. Where annual data was provided, ICF estimated the interrupted volumes based on average daily consumption for the winter months in which interruptions occurred.

One LDC provided estimates of the alternative fuels used by interruptible customers. From this information, ICF estimated the total volumes of gas that were interrupted and replaced by fuel oil. These are shown in Exhibit II-13 below.

Exhibit II-13: Interrupted Gas Demand 2001-2004

Year	Month	Days	Dths	BOE (#2)
2001	Jan	11	932,764	159,665
2002	Dec	17	1,103,161	188,833
2003	Jan	22	4,725,106	808,817
	Feb-Mar	42	6,336,004	1,084,561
	Dec	12	1,448,330	247,917
2004	Jan	27	2,166,135	370,787
	Feb	4	60,725	10,395

BOE= barrels of oil equivalent at 5.842MMBtu/barrel
Dths= Decatherms
Source: ICF estimates based on data supplied by LDCs

The estimated quantities of gas interrupted would have been replaced largely with heating oil, although the sulfur content is unknown. The last column of the exhibit converts the volumes of interrupted gas to barrels of oil equivalent (BOE). As the exhibit illustrates, in some months the volumes are quite high. February and March 2003 saw incremental demand for petroleum jump by over one million barrels, or over 45 million gallons. This translates into 800,000 gallons per day, or 18,000 additional bbl/d. This is equivalent to about 5 percent of average daily fuel oil consumption of 338,300 bbls in the study area in 2003. For these two months, the petroleum infrastructure system was required to provide, on average, 3 additional large barge trips per day, or 185 additional truck trips per day, assuming large trucks. Given that this incremental demand occurred when the supply infrastructure was already spread thin, this surge of additional demand would have placed great strains on the fuel oil supply and distribution system.

III. HEATING OIL SUPPLY AND MARKET STRUCTURE

MARKET STRUCTURE

The petroleum market in the study area is complex since New York Harbor is one of the main petroleum distribution nodes in the country. While there are no refineries within New York State, there are two refineries just across the harbor in northern New Jersey. Over time New York Harbor has evolved into both a physical distribution center and a pricing center, not just for New York City but for a large portion of the mid-Atlantic States and New England.

Refined products arrive in and move out to serve both regional and local needs. Distribution into and out of this node is by pipeline, truck, rail, tanker, and barge. New York Harbor is also the center for the water movement of heating oils and residual fuel for electricity generation facilities.

The New York Harbor petroleum supply chain is complex. Distribution of heating oil involves terminals of different sizes, heating oil distributors, and companies that have terminals to store heating oil and then distribute it. Many companies also rent terminal space to third parties.

Just as the larger petroleum industry has been marked by substantial changes over the past decade, so has this segment of the industry. Some of the characteristic changes are:

- Consolidation. The industry is increasingly concentrated as the number of firms declines over time and those surviving become larger.

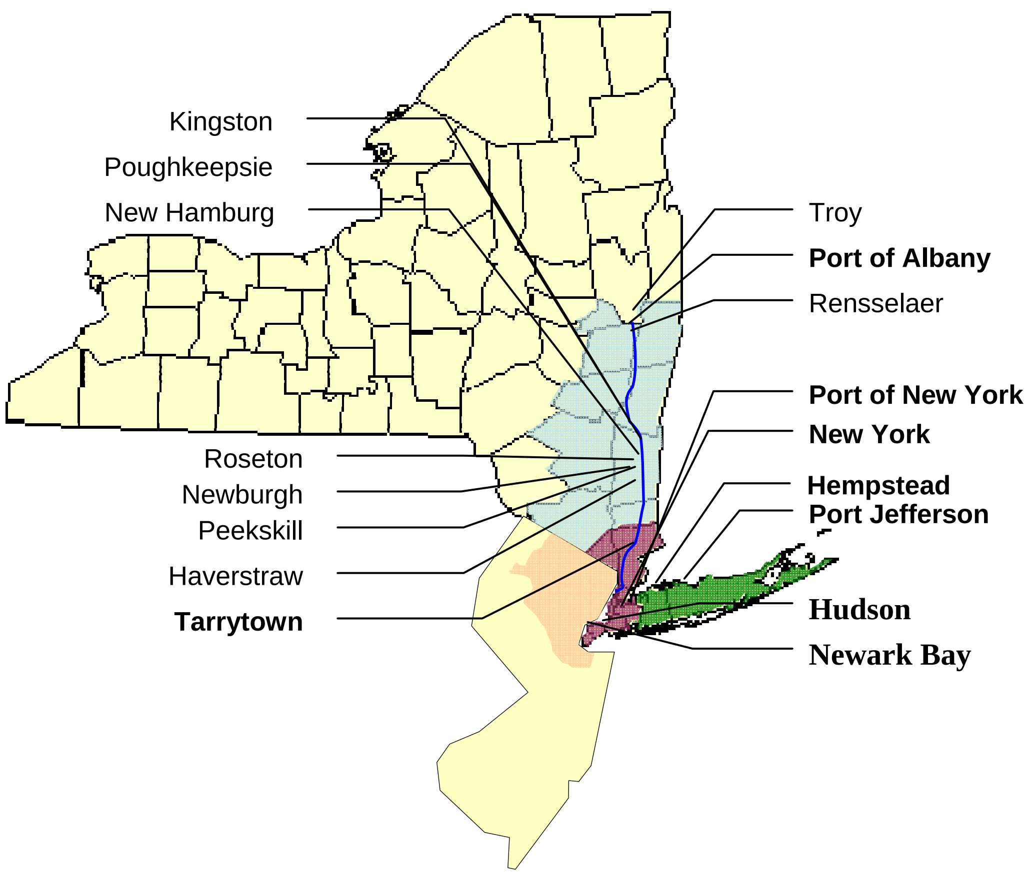
- Increased efficiency and reduction of costs. Advances in software and electronics have allowed inventory to be managed more effectively and efficiently in real time.

- Declining volumes of inventory. This situation exists throughout the country and for all fuel types. In the industry's efforts to minimize costs, managers are reducing inventories. The improved technology of inventory management, as well as the advances in shipping, allows this "just in time" inventory management.

- The influence of the prompt and forward markets of the NYMEX. The futures market for both crude oil and heating oil has become more prominent over the past two decades. Levels of storage both influence the forward prices, and in turn, are influenced by them. A market in backwardation[7] results in retailers stocking only supplies that are necessary to serve fixed clients, and not much more. Conversely, a contango[8] market encourages building up stocks.

Exhibit III-1 shows the four regions of the study area in different shades/colors and lists the major marine ports in **bold**. Smaller ports that can receive distillate fuel oil, residual fuel oil, and kerosene are in regular typeface.

Exhibit III-1: Study Area Regions and Ports



MARKET PLAYERS

The major players in the study area petroleum product distribution supply chain are:

- Refineries: process domestic or imported crude oils and other feedstocks
- Petroleum Bulk Terminals: 50,000 barrels and over in storage capacity

[7] The forward month prices are lower than the prompt month prices.
[8] The forward month prices are higher than the prompt month prices

- Petroleum Bulk Plants: under 50,000 barrels in storage capacity
- Fuel Oil Distributors
- Logistics and Transportation Companies, such as
    - Tankers and Barges
    - Pipelines
    - Railroads
    - Trucks

The distribution of these players in the study area is presented in Exhibit III-2. The transportation system links together the refineries and the various bulk storage facilities.

Exhibit III-2 Distribution of Major Market Players within the Study Area

Player	Hudson	Long Island	NYC Metro - NY	NYC Metro – NJ#
Fuel Refineries	0	0	0	2
Petroleum Bulk Terminals+	25	11	22	42
Petroleum Bulk Plants+,*	10	13	16	3
Fuel Oil Distributor	52	93	89	95
Transportation				
Marine Tankers and Barges	Between 125 and 175			
Inter-regional Pipelines	0	1	1	3
Railroad	N.A.	N.A.	N.A.	N.A.
Trucks	208	372	356	380

*Only bulk plants with storage capacity are included here. This includes plants with capacity between 400,000 gal and 2,100,000 gal. terminals have storage capacities over 2,100,000 gal
#The NYC Metro - NJ data has been gathered from public sources
+Number of Bulk Terminals and Bulk Plants estimated from the NYSDEC Major Oil Storage System Database

One of the major issues in this supply chain is the considerable overlap that exists among the players. Some refineries operate terminals, some terminals may sell fuel directly to end-users, and some fuel distributors have storage capacity that can be leased out to other distributors apart from their primary business of supplying fuel oil to end-users. For this reason, the process of sorting out data and identifying trends is complicated.

SUPPLY

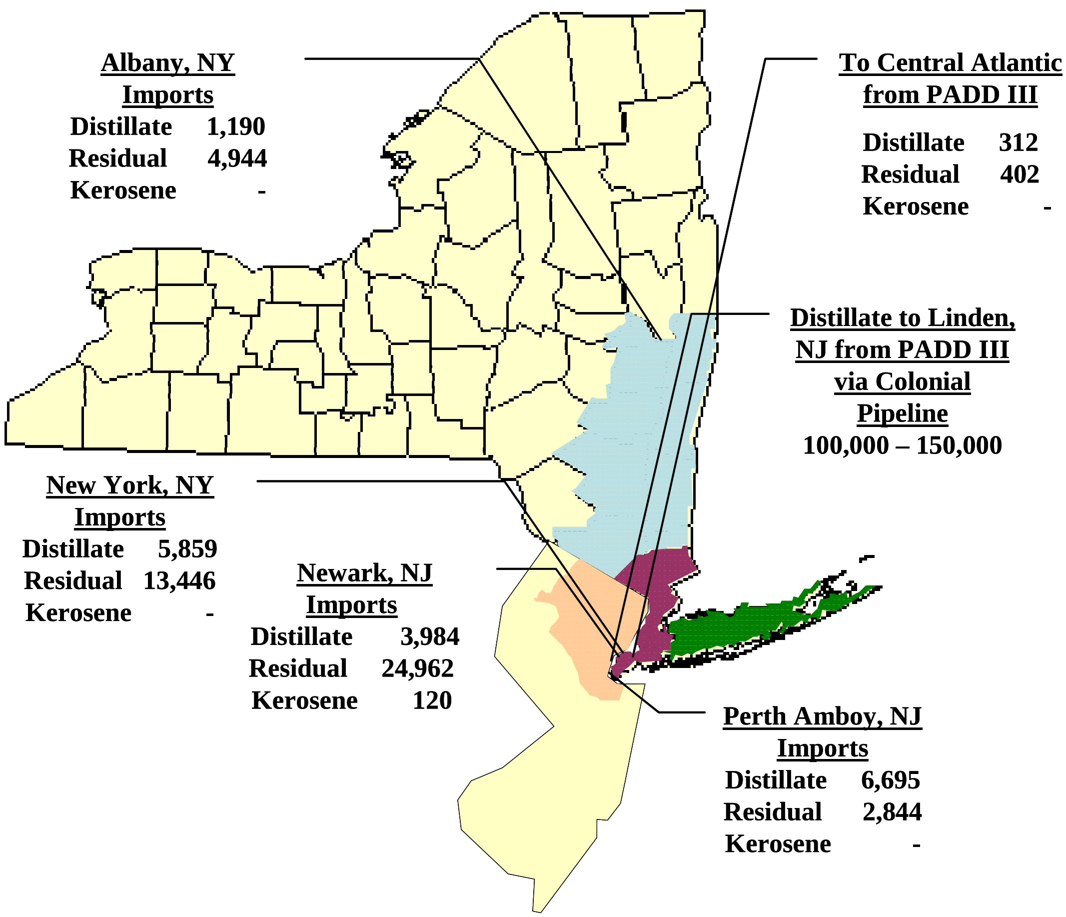
With the exception of refineries, New York has all of the characteristic parts of a petroleum distribution system to bring in supply and meet demand. The nearest refineries are found abutting New York in New Jersey from which they supply the area. The following sections discuss the supplies that enter the study area from these various sources using all modes of transportation.

The study area's primary terminals and distributors are supplied by tankers delivering foreign imports, tankers from Gulf Coast refineries, the Colonial Pipeline moving product from refineries throughout the Gulf Coast, and from refineries in the mid-Atlantic states, several of which are connected to the regional Buckeye pipeline. Product also moves from the mid-Atlantic refineries by water. Once the fuels reach the major ports in the study area, barges and tank trucks distribute the fuels throughout the region.

Foreign Tanker Movements

This section quantifies the volumes moving and examines trends that have been observed. Exhibit III-3 shows the major supply points in or around the study area through which petroleum supplies arrive from various points and by various modes.

Exhibit III-3: 2004 Major Supply Points for Distillate, Residual Fuel, and Kerosene Mbbls



Source: Energy Information Administration *Company Level ImportsData*

Imports play a major role in the supply picture for the study area and the following exhibit, Exhibit III-4, shows the trends in imports of the relevant petroleum products over the past nine years.

Exhibit III-4: Foreign Imports by Tanker into the Study Area: 1996-2005*
Mbbls

	Total Distillate	Distillate <=.05% Sulfur	Distillate >.05% Sulfur	Residual Fuel	Kerosene
1996	18,745	14,458	4,287	35,651	
1997	21,028	13,476	7,552	30,228	
1998	18,170	12,685	5,485	36,136	52
1999	14,514	11,430	3,084	29,537	
2000	19,884	10,046	9,838	47,624	
2001	29,554	8,077	21,477	31,796	543
2002	16,548	2,132	14,416	23,967	741
2003	24,055	6,839	17,216	36,291	1,007
2004	17,728	5,664	12,064	46,196	66
2005*	16,639	7,365	9,274	57,008	1,122

Source: Energy Information Administration, *Company Level Import Data*
*2005 includes data from January to November

Distillate is broken out by sulfur content with the <0.05% sulfur representing mostly on-road diesel and the >0.05% representing mostly home heating oil. Trends show a decline in low sulfur diesel imports, reflecting growing demand in Europe and elsewhere for clean fuels and the competition for fuel supply that has emerged in the Atlantic Basin market. High sulfur distillate (heating oil) imports have increased substantially in the last decade and tend to fluctuate as a function of temperature and weather. The drop in imports in 2005 reflects the relatively mild winter in the northeast, as well as the more severe winter in Europe.

As a result of the lower on-road diesel imports, U.S. diesel demand, which is increasing, must be met by increased domestic diesel production. This rise in domestic production of diesel fuel is occurring at the expense of domestic heating oil production, which has seen a decline as shown in Exhibit III-5.

Exhibit III-5: U.S. Refinery Production of Distillate
Mbbls

	U.S. Total		PADD 3		PADD 1	
	<=0.05%S	>0.05%S	<=0.05%S	>0.05%S	<=0.05%S	>0.05%S
1996	762,633	450,930	346,186	213,657	47,671	92,754
1997	789,287	448,754	348,889	212,796	54,063	100,708
1998	813,970	435,911	354,392	199,315	61,775	99,314
1999	841,998	398,785	374,982	189,745	78,397	79,021
2000	905,064	405,094	407,841	192,218	79,897	88,271
2001	955,247	393,278	438,524	190,804	85,664	84,445
2002	951,087	360,064	438,074	168,769	85,134	81,825
2003	992,571	360,567	467,031	171,575	82,631	81,942
2004	1,042,056	353,981	493,517	178,291	90,630	72,206
2005	1,068,355	382,885	489,465	186,515	103,660	76,285

Source: Energy Information Administration, *Petroleum Supply Annual*, 1996-2005

Exhibit III-6: Breakdown of Foreign Distillate Imports by Tanker by Sulfur Content: 2004-2005*
Mbbls

	<0.0015% S	>0.0015%<0.05%	>0.05%<0.2%	>0.2%
2004	1,295	4,369	11,311	753
2005*	0	7,365	8,321	953

Source: Energy Information Administration, *Company Level Import Data*
*Note 2005 data includes January to November

Starting in 2004, data for distillates are reported with an additional sulfur level, presented in Exhibit III-6, as the country prepares to meet the requirements for on-road ultra low sulfur diesel in the summer of 2006. Through 2012, when both the on-road and off-road ultra low sulfur regulations will be in effect, these multiple categories of distillate fuels will each require separate tankage. This further stratification of distillate storage capacity over an expanded number of fuels results in a lower amount of storage capacity for each fuel. The advent of very low sulfur products will also bring problems to the pipeline delivery system because of product sulfur contamination. The movement of higher sulfur fuels, such as heating oil and jet fuel, through pipelines leaves traces of sulfur that may contaminate the ultra-low sulfur fuels.

Exhibit III-7: Breakdown of Foreign Residual Fuel Imports By Tanker: 1996-2005* Mbbls

	<.31%S	.31-1.00%S	>1.00%S	Total
1996	13,654	13,106	8,891	35,651
1997	13,190	6,019	11,019	30,228
1998	14,886	11,722	9,528	36,136
1999	11,098	7,578	10,861	29,537
2000	23,068	9,047	15,509	47,624
2001	8,552	11,208	12,036	31,796
2002	3,900	4,098	15,969	23,967
2003	10,936	14,271	23,491	48,968
2004	15,825	15,461	14,910	46,196
2005*	18,904	16,710	21,394	57,008

Source: Energy Information Administration, *Company Level Import Data*
*Note 2005 data includes January to November

Residual fuel oil imports are also being reported by sulfur content as environmental regulations become more stringent. Low-sulfur residual imports, presented in Exhibit III-7, are slowly increasing. A further complication in terms of tankage may be the possible requirement for low sulfur marine bunkers[9] as Annex VI of MARPOL[10] goes into effect in May 2005.

Domestic Tanker Movements from the Gulf Coast

As shown in Exhibit III-8, distillate fuel normally moves from the Gulf Coast up the East Coast by pipeline, and in the case of New York State, by the Colonial Pipeline. Domestic tanker movements from the Gulf Coast region represent the marginal barrel. In other words, tanker movements from the Gulf Coast only occur when demand is high on the East Coast and the pipelines are full. The requirement that coastwise shipping be Jones Act vessels[11] also makes water transportation of domestic imports into the region somewhat more expensive than foreign imports.

Tanker-delivered distillate from the Gulf Coast is an important source of fuel. However, winter driven surges in demand occur very rapidly and tanker shipments of distillate from the Gulf Coast area take anywhere from 10 to 12 days to reach New York Harbor, often arriving after the crisis has passed.

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9 Bunkers are the generic name for all marine fuels. The name is a relic from the past when ships were propelled by coal and the coal was stored in ports in bunkers.
10 MARPOL, the Convention and its Annexes set international marine pollution controls for the International Maritime Organization. Annex VI covers reductions in SOx and NOx emissions from vessels.
11 Merchant Marine Acts of 1920, 41 Stat. 988, as amended, and 1936, 19 Stat. 1985. Under these acts the United States reserves its coastal shipping to vessels built and documented in the United States, and manned by U.S. citizens.

Exhibit III-8: Domestic Movements of Kerosene and Distillate by Tanker and Barge between PADD III and mid-Atlantic: 1995-2005*

Mbbls

	Kerosene	Distillate		
		Total	< .05% Sulfur and under	> .05% Sulfur
1995	-	3,133	505	2,628
1996	133	4,324	1,628	2,696
1997	638	4,065	1,798	2,267
1998	-	2,182	1,312	870
1999	-	288	55	233
2000	-	684	684	-
2001	50	2,480	600	1,880
2002	42	52	52	-
2003	-	1,579	358	1,221
2004	-	312	47	265
2005*	-	733	285	448

Source: Energy Information Administration, *Petroleum Supply Annual*, various issues
*Note 2005 data includes January to November

Exhibit III-9 shows movements of residual fuel from the Gulf Coast to the mid-Atlantic region. Residual fuel oil moves from the Gulf Coast and from the mid-Atlantic refiners by tanker and barge. The fuel is too viscous to move by pipeline and therefore, bulk deliveries must travel by water.

Exhibit III-9: Domestic Movements of Residual Fuel by Tanker and Barge between PADD III and mid-Atlantic: 1995-2004

Mbbls

	Residual Fuel			
	Total	< .31% Sulfur	.31 to 1.00% Sulfur	> 1.00% Sulfur
1995	855	740	0	115
1996	1,430	0	0	1,430
1997	1,399	0	0	1,399
1998	552	0	0	552
1999	240	0	0	240
2000	243	0	0	243
2001	365	0	0	365
2002	56	0	7	49
2003	319	204	115	0
2004	402	122	150	130
2005*	73	0	0	73

Source: Energy Information Administration, *Petroleum Supply Annual*, various issues
*Note 2005 data includes January to November

The decrease in residual fuel movements reflects both declining use in the region and declining supply in the Gulf Coast area. Many Gulf Coast refiners are upgrade their refinery processing capacity to produce more valuable light products, such as gasoline and distillate fuels, at the expense of heavier residual fuel grades.

Domestic Pipeline Movements

Apart from local lines connecting terminals, and in some cases large customers, the study area is served by three major pipelines, of which the largest is the Colonial Pipeline. The Buckeye and Sun are the other two pipelines. Unfortunately, pipeline managers were unwilling to divulge the volumes of products delivered to the study area, so the ICF team made assumptions and estimates of the throughput.

The Colonial Pipeline originates in Houston, Texas, and extends northward up the east coast to its northernmost terminal in Port Mobil, Staten Island. The Colonial Pipeline system moves approximately 900 million barrels (MMbbls) annually of petroleum products from Houston. At Greensboro, North Carolina the volume moved on the line falls to just over 365 MMbbls annually. This volume is moved to its northern terminus in the Linden-Newark-Bayonne-Port Mobil area. This capacity is the nominal annual light product flow. ICF assumes this line is at or near capacity all year and that anywhere from 30 to 40 percent, or approximately 100MMbbls to 150MMbbls, of this total capacity is utilized for distillate fuels. The remaining 60-70 percent of the line is used for shipping gasoline, jet fuels and other light products to the region.

The Sun Pipeline services the northern New Jersey area by bringing products north from three terminals in the Philadelphia area along the Delaware River. These three terminals are: the Marcus Hook Tank Farm, the Fort Mifflin Terminal Complex, and the Eagle Point Terminal Complex. In northern New Jersey, the Sun Pipeline first connects to the Linden Terminal, and then to the northern most terminus, the Newark Terminal. There are two pipelines that service the northern New Jersey terminals, and they have capacities of 140 thousand barrels per day (Mbbl/d) and 180 Mbbl/d. ICF assumes that 30 to 40 percent of these pipelines' capacities are utilized for distillate products. Therefore, anywhere from 35,000 to 45,000 Mbbls of distillate can be shipped on these two pipelines to the study area every year.

The Buckeye Pipeline serves major population centers in Pennsylvania, New York, and New Jersey. Refined petroleum products are received at Linden, New Jersey from approximately 17 major source points, including two refineries, six connecting pipelines, and nine storage and terminalling facilities. Products received at Linden can be transported through one line to Newark and through two additional lines to JFK and La Guardia airports, and further to commercial refined product terminals at Long Island City and Inwood, New York. JFK is connected to the Inwood Terminal from which the airport gets all its aviation fuel. La Guardia is connected to the Long Island City terminal.

Refineries

There are two fuels refineries located in the study region, both in New Jersey near New York Harbor. One is owned by ConocoPhillips and the other by Amerada Hess. Representatives of these refineries were unwilling to reveal the volumes of distillate and residual fuel oil they sell in the study areas. ICF made estimates of the products shipped from both refineries. This information is included in Exhibit III-10, shown below.

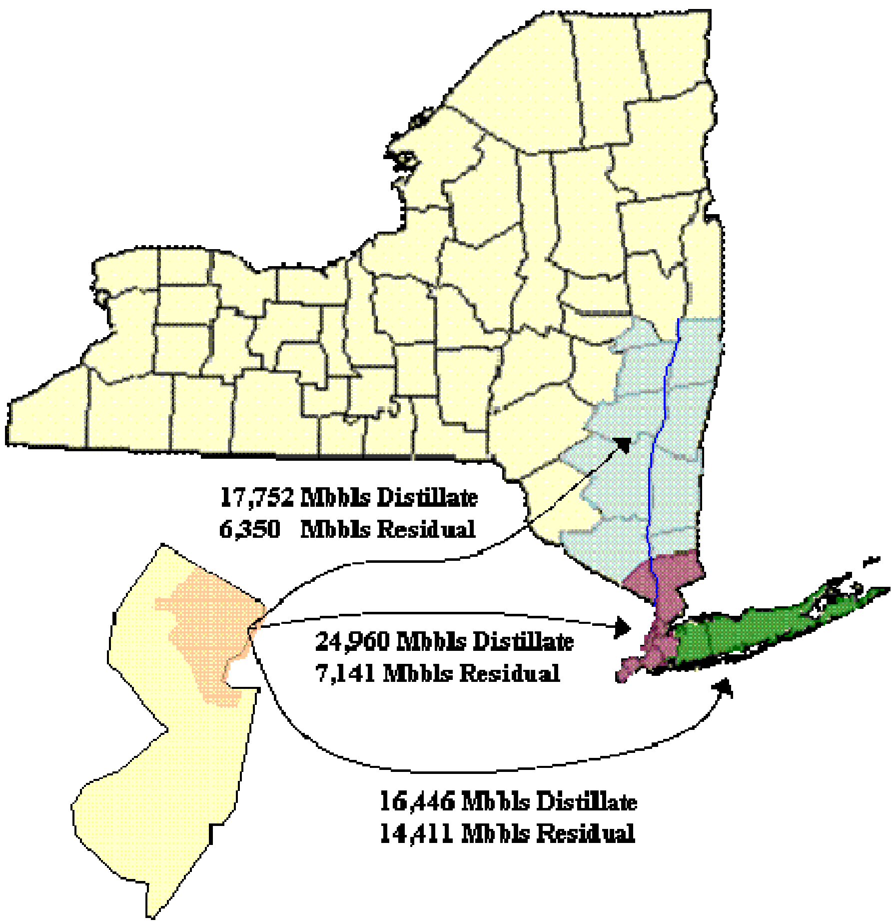
ConocoPhillips, Bayway Refinery in Linden, N.J.
The Bayway refinery, located on the New York Harbor in Linden, N.J., has a crude oil processing capacity of 250 Mb/d[12]. The refinery has 100 Mb/d of capacity to produce distillate products. Its refined products are distributed to East Coast customers and New York Harbor through pipelines, barges, rail cars and trucks. The refinery is complex, with a Nelson complexity factor of 10[13], and focuses on clean products production. During 2004, its clean product yield was 88 percent on average. Gasoline production is higher during the summer, while in winter, the refinery adjusts operations to increase heating oil production to meet local market demand.

[12] ConocoPhillips website
[13] The Nelson Complexity Factor is an industry measurement of a refinery's secondary conversion capacity and capability to produce higher value products such as clean fuels. A Nelson Complexity Factor of 10 represents a complex refinery.

Amerada Hess, Port Reading, N.J.

Amerada Hess operates a fluid catalytic cracking (FCC) unit in Port Reading, New Jersey, ten miles from New York City. The FCC unit can produce up to 62 Mb/d of high quality gasolines and other high value products[14]. The refinery serves the needs of Hess retail outlets, as well as industrial and residential customers, in the metropolitan area. The refinery gets its feedstocks, intermediate products, and blend stocks, primarily from the Hovensa Refinery in the U.S. Virgin Islands through a joint venture owned by Amerada Hess and Petroleos De Venezuela S.A. (PDVSA), the Venezuelan state oil company.

Exhibit III-10: 2003 Movements of Distillates and Residual Fuels from New Jersey to the New York Portion of the Study Area



Source: Energy Information Administration *Company Level ImportsData*

[14] http://www.hess.com/rm/energy_marketing.htm

After receiving shipments to the region at the bulk terminals from foreign imports, domestic Gulf Coast imports, the two local refineries, and the various pipelines, products are shipped to local markets via small tankers and barges, tanker trucks, and railcars. The following sections describe heating oil distribution companies and their roles in the marketing of petroleum fuels in the study area.

FUEL OIL DISTRIBUTION

Petroleum marketers can be categorized into three types of business:

- Large Oil Companies
    - These companies deal mostly with larger transactions. They include companies such as Shell, ExxonMobil, ConocoPhillips, and own large bulk terminals and sell petroleum products to both large and small independent fuel oil distributors. Additionally, they supply large consumers like industrial plants and power plants.
- Large Independent Fuel Oil Distributors
    - These businesses are increasingly aggregating small independents into larger distributors, e.g., Heating Oil Partners, PETRO, and STAR Power. The companies own bulk stations and sell product to end-users via trucks they own and operate while sometimes leasing tankage to smaller independent fuel oil distributors.
- Small Independent Fuel Oil Distributors
    - Have limited or no bulk station storage, but deliver fuels via trucks that they own and operate.

According to various sources and the work performed on the survey, there are 234 Fuel Oil distributors in the New York study area. The Hudson region has 52, there are 93 on Long Island, and 89 in the New York Metro area. Ninety-five Fuel Oil distributors have been identified in the New Jersey Metro portion of the study area.

Fuel oil distributors in the mid-Atlantic states sell approximately 75 percent of their heating oil to private homes, 18 percent to industrial end-users, 10 percent to commercial businesses, and 2.5 percent to apartment complexes.[15] For the purposes of the study, ICF assumed that the 2.5 percentage distribution for apartment complexes would be higher in the New York City region.

Bulk Terminals (Primary Distribution)

As shown in Exhibit III-11, the New York State Department of Environmental Conservation (NYSDEC) database for the Major Oil Storage Facilities (MOSF) and Petroleum Bulk Storage (PBS) programs

[15] *Fuel Oil News Industry Survey 2005*, December 2004

allowed detailed representation of storage capacity for the NYC Metro-NY, Hudson, and Long Island regions. Similar data were not available for New Jersey so only publicly available data were used.

The products moving into the study area usually arrive first at a bulk terminal. There are 58 bulk terminals with oil storage capacity of more than 50 Mbbls in the New York portion of the study region and another 42 in the New Jersey portion.

Exhibit III-11: Summary of Petroleum Storage Terminals in the Study Area

	Study Area Sub Region				
	Hudson	Long Island	NYC Metro- NY	NYC Metro- NJ	Total
Total Terminal Capacity (1000 bbl)	16,325	7,970	7,848	71,054	103,197
Average Terminal Size (1000 bbl)	653	725	357	1,692	1,032
Share of Capacity in Study Area	15.8%	7.7%	7.6%	68.9%	100.0%
Number of Facilities	25	11	22	42	100
Facilities with Vessel/Barge Access	23	10	19	42	94
Facilities with Pipeline Connnection	4	6	8	NA	18
Facilities with Truck Racks	24	10	18	NA	52
Facilities with Railroad Access	3	0	0	NA	3

Source: NY data is based on NYSDEC MOSF database for 2005. NJ data is taken from Army Corps of Engineers, *U.S. Waterway Data CD, 2003*

The study area is characterized by two large marine features; New York Harbor with terminals having access to domestic and international oil supplies, and the Hudson River as far north as Albany. Approximately 90 percent of the bulk terminals in the New York portion of the study area and all terminals in the New Jersey portion have access to vessels or barges. Barges and small tankers can travel up the Hudson from the New York Harbor with fuel supplies and small tankers can move as far as Albany.
The only major inter-regional pipelines are the Colonial pipeline that moves products from the Gulf Coast and ends in Linden, NJ, and then at Port Mobil, Staten Island in the NY Metro area, the Buckeye Pipeline, and the Sun pipeline. Linden is a large junction where the Colonial pipeline connects with other intra-regional pipelines which connect, in turn, to several terminals and refineries. There is a web of small intra-regional pipelines in the NYC Metro-NY and Long Island regions that connect terminals to ports, and terminals to the Linden junction. Therefore, several facilities in these regions have pipeline access. None of the major terminals in these two regions have access to railroads, suggesting that terminals in this region must supply secondary marketers situated at long-distance by marine transportation.

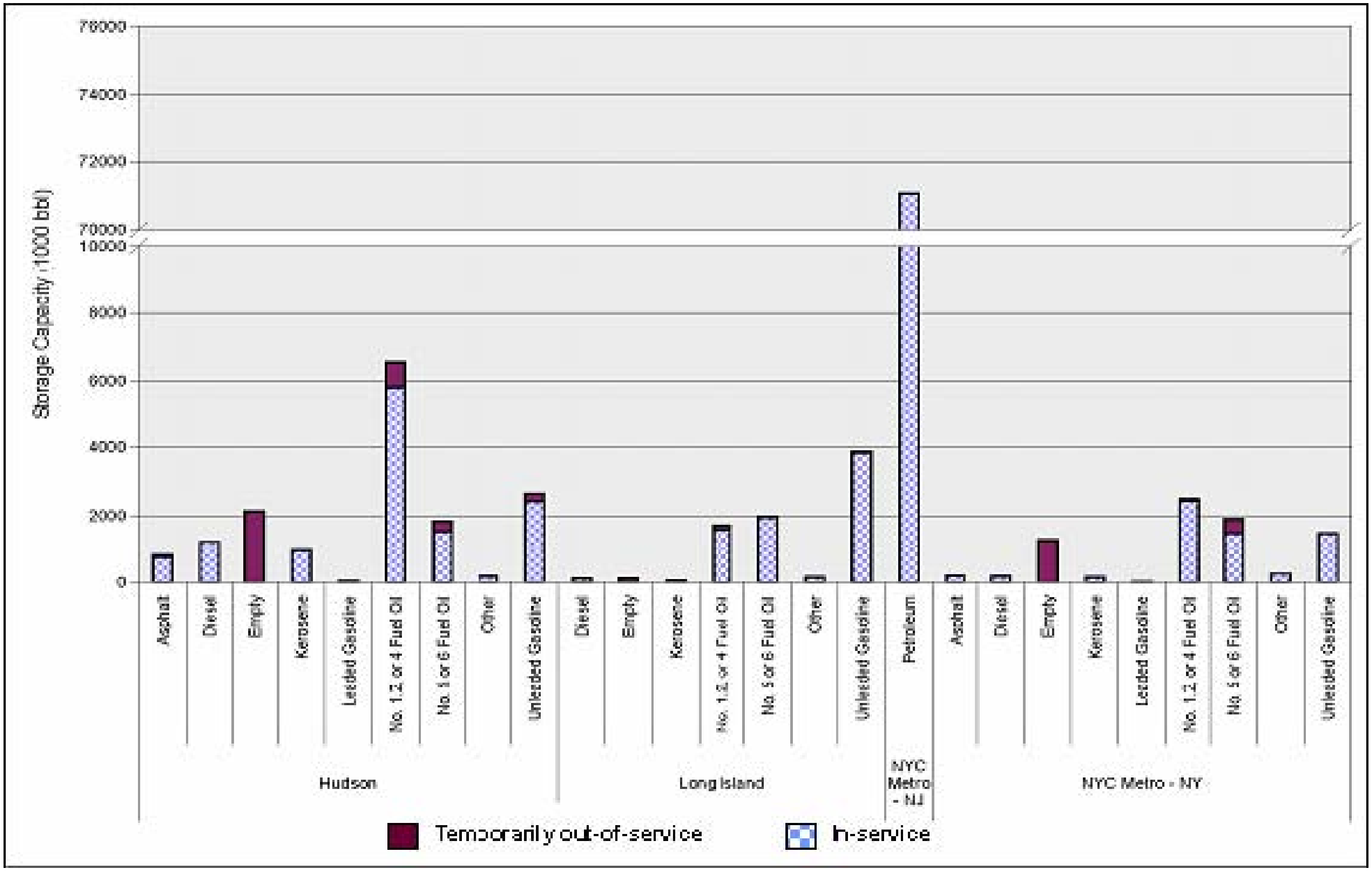
In the Hudson region, three terminals in Renssaelaer County have access to pipelines and one in Orange County along the Hudson River also has access. These pipelines are local pipelines connecting different terminals and the marine facilities.

There are no terminals on the New York side of the harbor that have access to railroads. The only railroad access is for a few terminals in the Albany metropolitan region which are used to supply oil to markets in upstate New York, Vermont and Western Massachusetts.

Exhibits III-12 and III-13 show total storage capacity at the major terminals by product and location. More specifically, they show storage capacity for residual and the distillates. The storage capacity shown in these exhibits is divided into two categories, in-service and temporarily out-of-service. The in-service category represents capacity in tanks that are actually used currently, whereas the temporarily out-of-service category represents capacity in tanks that conforms to all permits and regulations but is currently not used. Therefore, the latter capacity can be considered as usable capacity.

Interestingly enough, the Hudson region has the most capacity for distillates within the New York portion of the study area, with Long Island and NYC Metro-NY following. Most of the Hudson capacity is centered in Albany which is a distribution center for eastern New York State and western New England as small tankers and barges can navigate the Hudson river. However, the New Jersey terminal storage capacity is more than double that of all three New York regions combined. This is due to the substantial industrial development in the New Jersey region, including major pipeline terminals, ports and two refineries. The overall petroleum storage capacity for NY Metro-NJ is estimated, however details about the fuel type were not available and therefore, not shown in the following analyses.

Exhibit III-12: Primary Bulk Terminal Storage Capacity by Product Type and Region within the Study Area



Source: NYSDEC. MOSF Storage Capacity from NYSDEC database. 2005. New Jersey data from Army Corps of Engineers, *Port Series Data, 1999*

Exhibit III-13: Storage Capacity of Distillate and Residual Fuel Oils in the Study Region (Mbbls)

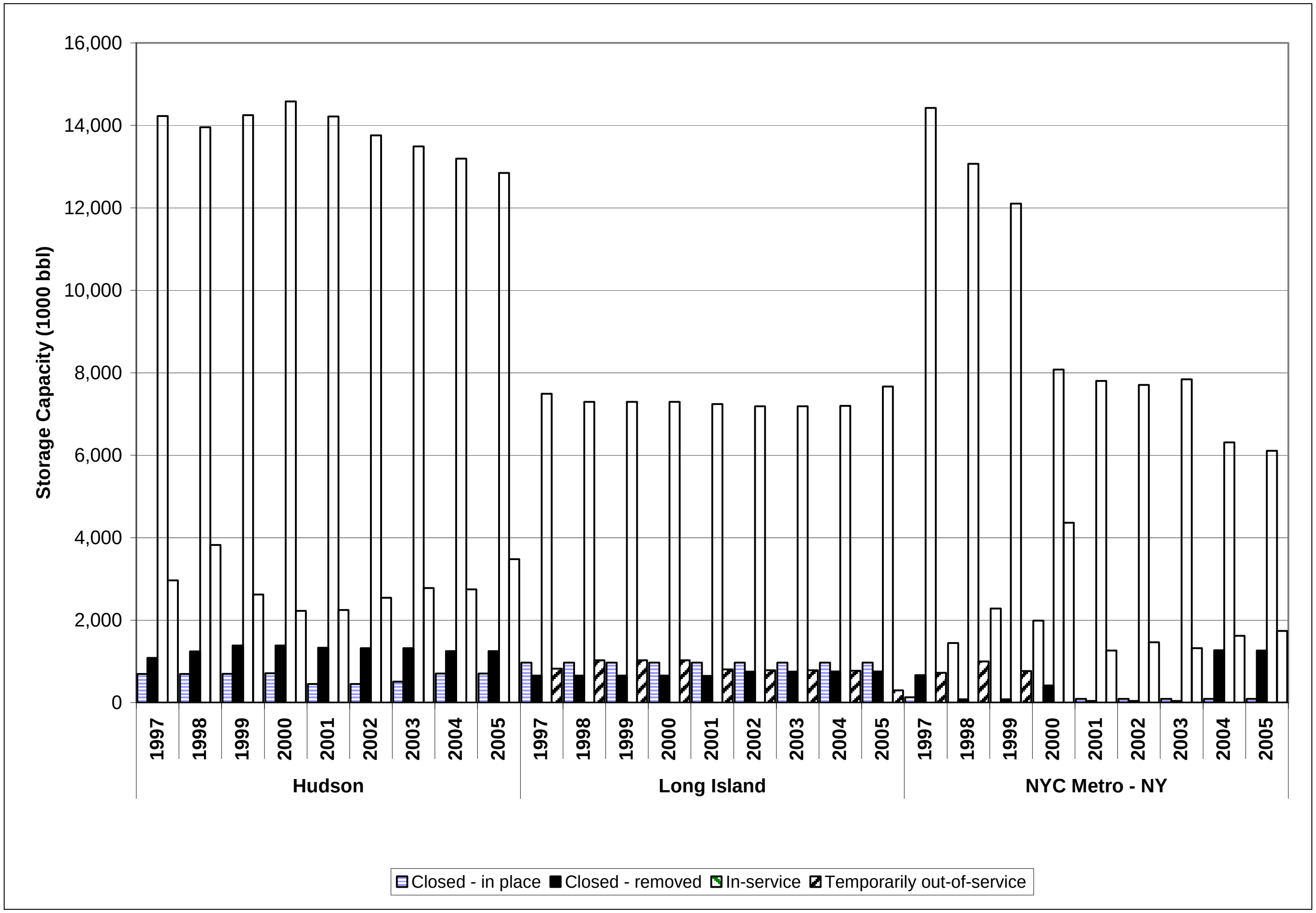
Region	Product Name	In-service (1000 bbl)	Temporarily out-of-service (1000 bbl)	Total (1000 bbl)
Hudson	Asphalt	734	76	810
	Diesel	1,226		1,226
	Empty	3	2,121	2,124
	Kerosene	937	12	949
	Leaded Gasoline	31		31
	No. 1, 2, or 4 Fuel Oil	5,814	730	6,544
	No. 5 or 6 Fuel Oil	1,527	300	1,827
	Other	168	0	168
	Unleaded Gasoline	2,406	241	2,647
Hudson Total		12,845	3,480	16,325
Long Island	Diesel	96	19	115
	Empty	0	105	106
	Kerosene	53		53
	No. 1, 2, or 4 Fuel Oil	1,591	119	1,710
	No. 5 or 6 Fuel Oil	1,944		1,944
	Other	148	1	148
	Unleaded Gasoline	3,835	59	3,893
Long Island Total		7,668	302	7,970
NYC Metro - NJ	Petroleum	71,054		71,054
NYC Metro - NY	Asphalt	187		187
	Diesel	163	4	167
	Empty	0	1,268	1,268
	Kerosene	146		146
	Leaded Gasoline	8		8
	No. 1, 2, or 4 Fuel Oil	2,431	45	2,476
	No. 5 or 6 Fuel Oil	1,469	423	1,891
	Other	238		238
	Unleaded Gasoline	1,466		1,466
NYC Metro - NY Total		6,109	1,739	7,848
Total (1000 bbl)		97,676	5,521	103,197

Source: NY Data - NYSDEC MOSF Database 2005. NJ Data - Army Corps of Engineers, *Port Series Data, 1999*

Trends in Petroleum Bulk Terminal Product Storage Capacity

Exhibit III-14 shows trends in total capacity at petroleum storage facilities in the study area. Over the period examined, Long Island in-service petroleum product storage capacity held relatively steady. The Hudson region has been showing a gradual but steady decline since 2000. However, the NYC Metro-NY region has been showing a significant decline in petroleum storage capacity since 1997. These capacity declines are discussed below.

Exhibit III - 14: Total Petroleum Storage Capacity at Primary Terminals 1997 – 2005



Source: NYSDEC. MOSF Storage Capacity data from NYSDEC database. 1997-2005

Exhibits III-15a, III-15b and III-15c show the same trends as in Exhibit III-14 broken out by fuel type. The overall in-service storage capacity on Long Island (Exhibit III-15b) has stayed relatively level from 1997 to 2005, but this overall trend masks a 17 percent decrease between 1997 and 2003 and then a 37 percent increase from 2003 to 2005.[16] In-service storage capacity for distillate fuel oil in the Hudson Region (Exhibit III-15a) shows a decline since 2001of about 15 percent.

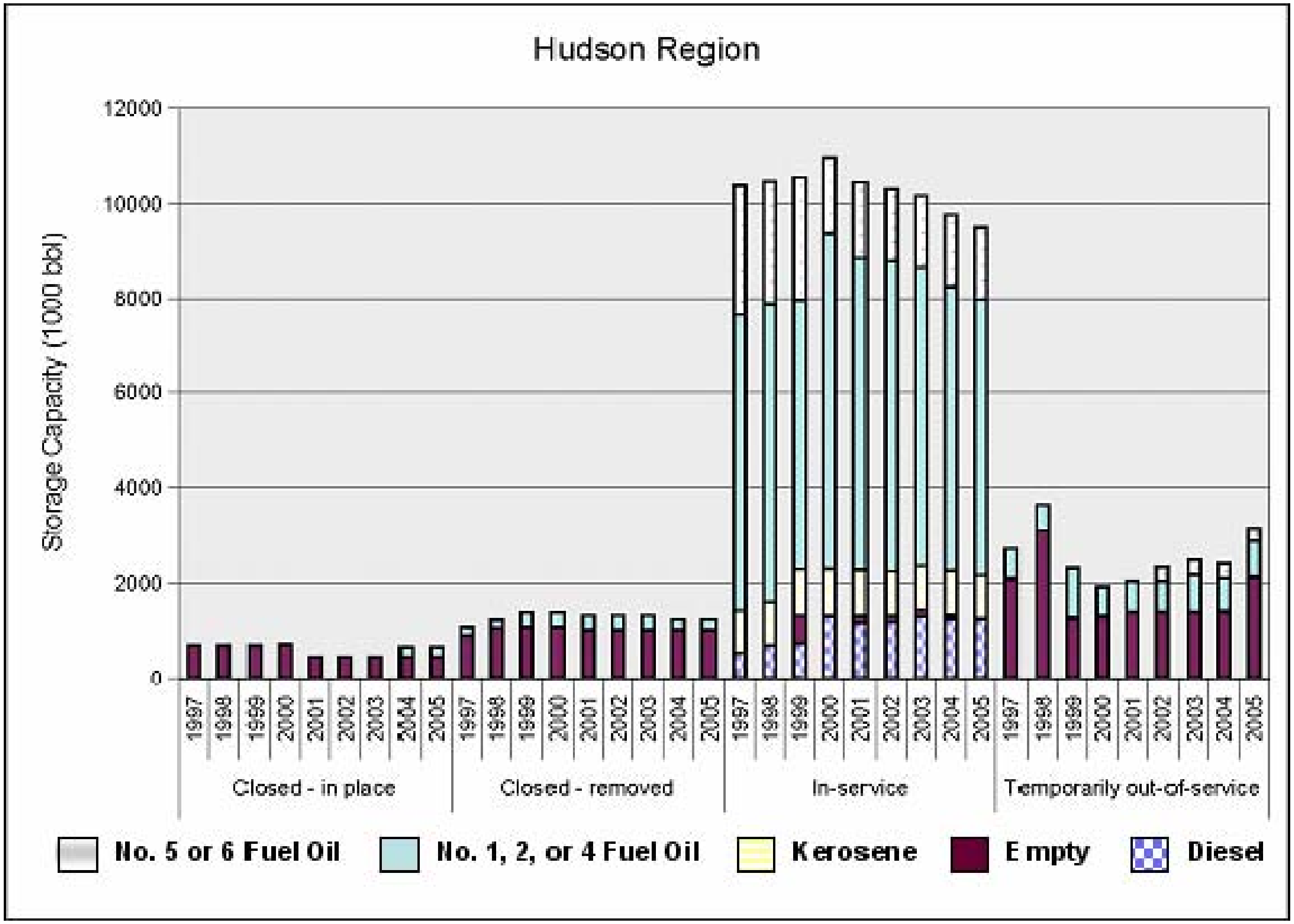
In-service storage capacity in the NYC Metro - NY region (Exhibit III-15c) has declined significantly since 1997. The decline from 1997 to 1999 was 17 percent, 34 percent in 2000, and then a further decrease of 27 percent from 2000 to the present. This decline has been primarily in aboveground storage tanks. Residual fuel oil has been affected the most by this decline.

In both the NYC Metro-NY and the Hudson regions, the volume of capacity listed as temporarily out-of-service (a volume that conforms to all regulations and can be used for active storage if required) has increased steadily in the period from 1997 to 2005. Long Island's temporarily out-of-service capacity has dropped steadily in the same period potentially indicating a market signal to terminal operators to increase storage capacity.

Exhibits III-16a and III-16b show the underlying data for the graphs in Exhibits III-15a, III-15b, and III-15c.

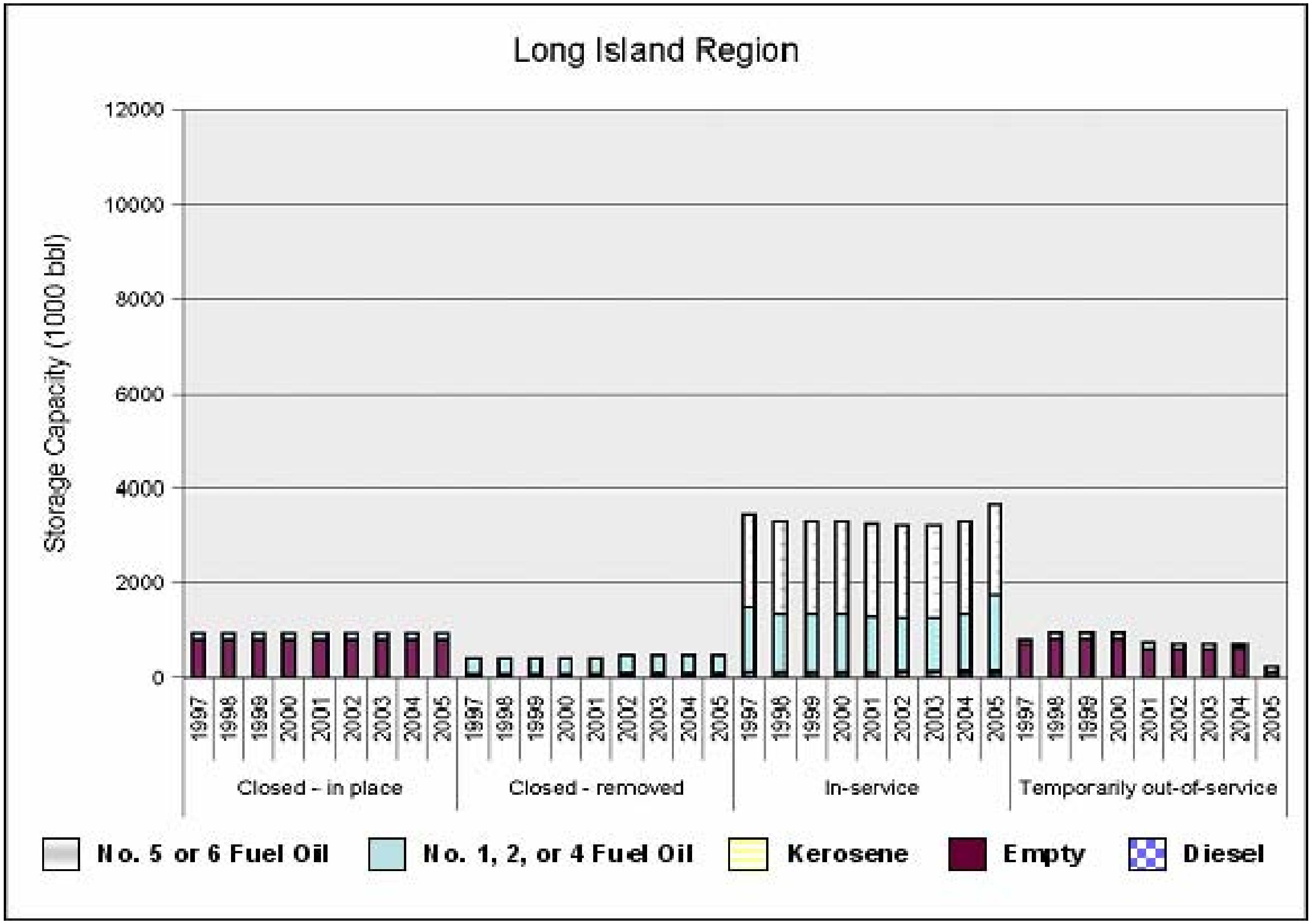
[16] Data for the first two months of 2005. One terminal (Northville) moved capacity from temporarily out of service in 2004 to in-service in 2005.

Exhibit III – 15a: Trend in Primary Petroleum Storage Capacity by Fuel Type in the Hudson Region of the Study Area



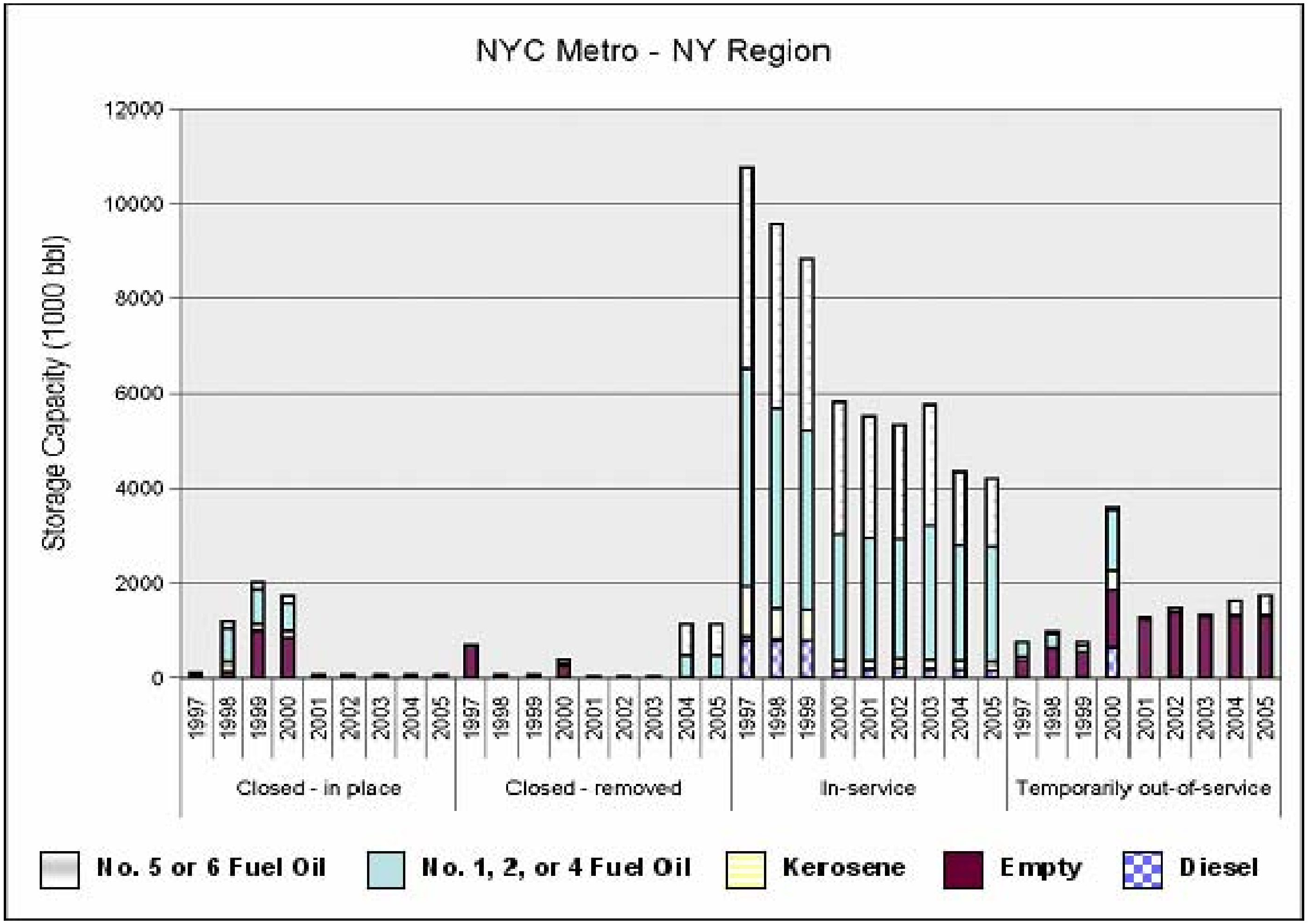
Source: NYSDEC. MOSF Storage Capacity data from NYSDEC database. 1997-2005

Exhibit III – 15b: Trend in Primary Petroleum Storage Capacity by Fuel Type in the Long Island Region of the Study Area



Source: NYSDEC. MOSF Storage Capacity data from NYSDEC database. 1997-2005

Exhibit III – 15c: Trend in Primary Petroleum Storage Capacity by Fuel Type in the NYC Metro – NY Region of the Study Area



Source: NYSDEC. MOSF Storage Capacity data from NYSDEC database. 1997-2005

Exhibit III – 16a: Trend in Primary Petroleum Storage Capacity by Fuel Type and Region Study Area: Closed-in place and Close-removed Storage (Mbbls)

Status: Closed- in place					
Hudson					
	Diesel	Empty	Kerosene	No. 1,2, or 4 Fuel Oil	No. 5 or 6 Fuel Oil
1997	0	677	0	0	0
1998	0	677	0	0	0
1999	0	677	0	3	0
2000	0	689	0	3	0
2001	0	436	0	0	0
2002	0	436	0	0	0
2003	0	436	0	0	0
2004	0	436	0	200	0
2005	0	436	0	200	0
Long Island					
	Diesel	Empty	Kerosene	No. 1,2, or 4 Fuel Oil	No. 5 or 6 Fuel Oil
1997	0	816	0	148	0
1998	0	816	0	148	0
1999	0	816	0	148	0
2000	0	816	0	148	0
2001	0	816	0	148	0
2002	0	816	0	148	0
2003	0	816	0	148	0
2004	0	816	0	148	0
2005	0	816	0	148	0
NYC Metro- NY					
	Diesel	Empty	Kerosene	No. 1,2, or 4 Fuel Oil	No. 5 or 6 Fuel Oil
1997	0	13	0	62	46
1998	0	145	160	722	152
1999	1	970	160	732	152
2000	1	812	160	595	158
2001	1	13	0	10	56
2002	1	13	0	10	56
2003	1	13	0	10	56
2004	1	13	0	10	56
2005	1	13	0	10	56
Study Area Total					
	Diesel	Empty	Kerosene	No. 1,2, or 4 Fuel Oil	No. 5 or 6 Fuel Oil
1997	1	1,505	0	210	47
1998	1	1,638	160	870	153
1999	1	2,463	160	883	153
2000	1	2,317	160	746	158
2001	1	1,265	0	158	56
2002	1	1,265	0	158	56
2003	1	1,265	0	158	56
2004	1	1,265	0	358	56
2005	1	1,265	0	358	56

Status: Closed- removed					
Hudson					
	Diesel	Empty	Kerosene	No. 1,2, or 4 Fuel Oil	No. 5 or 6 Fuel Oil
1997	1	865	12	169	0
1998	1	1,025	12	169	0
1999	1	1,042	12	295	0
2000	1	1,042	12	295	0
2001	1	981	17	297	0
2002	1	981	15	292	0
2003	1	981	15	292	0
2004	1	981	15	221	0
2005	1	981	15	221	0
Long Island					
	Diesel	Empty	Kerosene	No. 1,2, or 4 Fuel Oil	No. 5 or 6 Fuel Oil
1997	19	43	24	324	0
1998	19	43	24	324	0
1999	19	43	24	324	0
2000	19	43	24	324	0
2001	19	43	24	324	0
2002	19	43	34	386	0
2003	19	43	34	386	0
2004	19	49	34	386	0
2005	19	49	34	386	0
NYC Metro- NY					
	Diesel	Empty	Kerosene	No. 1,2, or 4 Fuel Oil	No. 5 or 6 Fuel Oil
1997	0	665	0	3	1
1998	0	76	1	3	0
1999	0	76	1	3	0
2000	30	234	1	95	0
2001	0	29	0	3	5
2002	0	29	0	3	5
2003	0	29	0	3	5
2004	0	29	0	414	672
2005	0	29	0	412	672
Study Area Total					
	Diesel	Empty	Kerosene	No. 1,2, or 4 Fuel Oil	No. 5 or 6 Fuel Oil
1997	19	1,574	37	496	1
1998	20	1,145	37	496	1
1999	20	1,161	37	621	1
2000	49	1,319	37	713	1
2001	20	1,053	41	624	6
2002	20	1,053	49	681	6
2003	20	1,053	49	681	6
2004	20	1,058	49	1,021	672
2005	20	1,058	49	1,019	672

Source: NYSDEC. MOSF Storage Capacity data from NYSDEC database. 1997-2005

Exhibit III – 16b: Trend in Primary Petroleum Storage Capacity by Fuel Type and Region Study Area: In-service and Temporarily Out-of-Service Storage (Mbbls)

Status: In-service					
Hudson					
	Diesel	Empty	Kerosene	No. 1,2, or 4 Fuel Oil	No. 5 or 6 Fuel Oil
1997	510	1	878	6,238	2,741
1998	675	0	950	6,268	2,559
1999	713	579	987	5,694	2,559
2000	1,278	4	1,011	7,043	1,591
2001	1,150	136	985	6,570	1,591
2002	1,152	136	955	6,534	1,527
2003	1,274	136	955	6,277	1,527
2004	1,226	75	955	5,988	1,527
2005	1,226	3	937	5,814	1,527
Long Island					
	Diesel	Empty	Kerosene	No. 1,2, or 4 Fuel Oil	No. 5 or 6 Fuel Oil
1997	101	1	25	1,400	1,944
1998	96	1	25	1,248	1,944
1999	96	1	25	1,248	1,944
2000	90	7	25	1,248	1,944
2001	90	1	30	1,198	1,944
2002	107	1	24	1,160	1,944
2003	106	0	24	1,160	1,944
2004	97	0	53	1,221	1,944
2005	96	0	53	1,591	1,944
NYC Metro- NY					
	Diesel	Empty	Kerosene	No. 1,2, or 4 Fuel Oil	No. 5 or 6 Fuel Oil
1997	749	109	1,073	4,607	4,251
1998	746	50	664	4,219	3,880
1999	763	1	662	3,778	3,659
2000	179	1	145	2,681	2,814
2001	186	1	145	2,589	2,588
2002	221	1	145	2,538	2,415
2003	192	0	157	2,845	2,558
2004	177	0	146	2,445	1,590
2005	163	0	146	2,431	1,469
Study Area Total					
	Diesel	Empty	Kerosene	No. 1,2, or 4 Fuel Oil	No. 5 or 6 Fuel Oil
1997	1,360	111	1,976	12,245	8,936
1998	1,517	51	1,640	11,735	8,384
1999	1,573	581	1,674	10,720	8,162
2000	1,547	12	1,181	10,972	6,350
2001	1,426	138	1,159	10,357	6,123
2002	1,480	138	1,124	10,233	5,886
2003	1,573	136	1,136	10,281	6,029
2004	1,500	75	1,155	9,654	5,061
2005	1,486	4	1,137	9,836	4,939

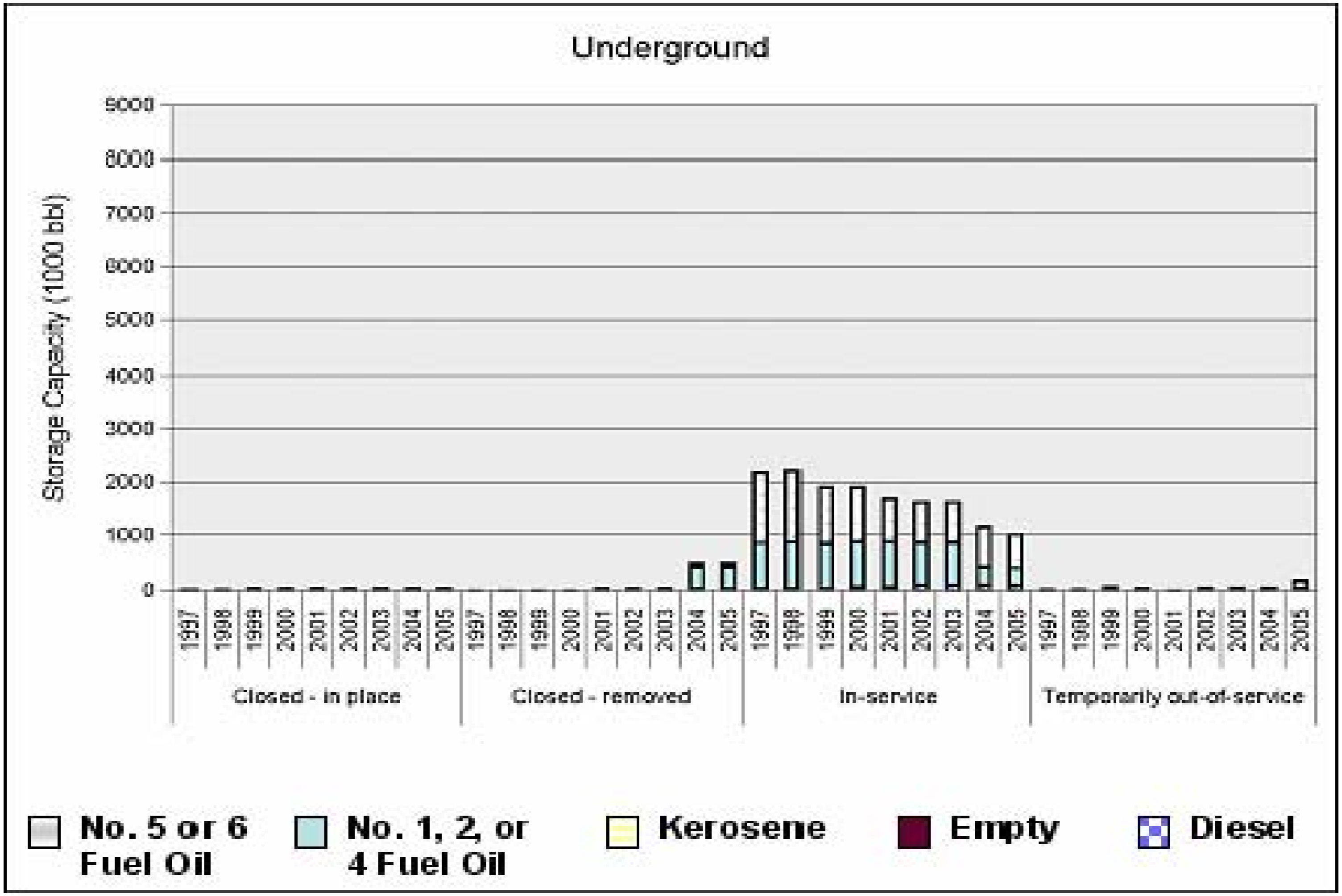
Status: Temporarily out-of-service					
Hudson					
	Diesel	Empty	Kerosene	No. 1,2, or 4 Fuel Oil	No. 5 or 6 Fuel Oil
1997	0	2,065	45	595	0
1998	0	3,076	45	528	0
1999	0	1,213	45	1,056	0
2000	0	1,254	27	643	0
2001	0	1,359	12	671	0
2002	0	1,353	12	671	300
2003	0	1,353	12	809	300
2004	0	1,364	12	730	300
2005	0	2,121	12	730	300
Long Island					
	Diesel	Empty	Kerosene	No. 1,2, or 4 Fuel Oil	No. 5 or 6 Fuel Oil
1997	0	721	0	95	0
1998	5	826	0	142	0
1999	5	826	0	142	0
2000	5	826	0	142	0
2001	5	605	0	142	0
2002	5	605	0	118	0
2003	6	606	0	118	0
2004	19	623	0	71	0
2005	19	105	0	119	0
NYC Metro- NY					
	Diesel	Empty	Kerosene	No. 1,2, or 4 Fuel Oil	No. 5 or 6 Fuel Oil
1997	17	320	80	303	0
1998	17	583	0	303	50
1999	16	494	0	135	80
2000	617	1,236	422	1,255	51
2001	4	1,216	0	45	0
2002	20	1,363	0	81	0
2003	4	1,272	0	45	0
2004	4	1,272	0	45	301
2005	4	1,268	0	45	423
Study Area Total					
	Diesel	Empty	Kerosene	No. 1,2, or 4 Fuel Oil	No. 5 or 6 Fuel Oil
1997	17	3,107	125	993	0
1998	22	4,484	45	973	50
1999	21	2,532	45	1,332	80
2000	622	3,316	448	2,040	51
2001	9	3,180	12	857	0
2002	25	3,321	12	869	300
2003	10	3,231	12	971	300
2004	22	3,259	12	847	602
2005	22	3,494	12	894	723

Source: NYSDEC. MOSF Storage Capacity data from NYSDEC database. 1997-2005

Exhibit III-17a and Exhibit III-17b show the NYC Metro-NY area data in more detail. The underground storage capacity at major petroleum terminals is mainly used for distillate and residual fuel oils. This capacity has been steadily declining since 2000 because of increasing liability for leaks and because of increasing land values. The aboveground storage capacity has sharply declined since 1997 with a major drop in the year 2000. Several terminals have closed in the region, however the large drop between 1999 and 2000, is mainly a result of the closing of the GATX terminal on Staten Island.

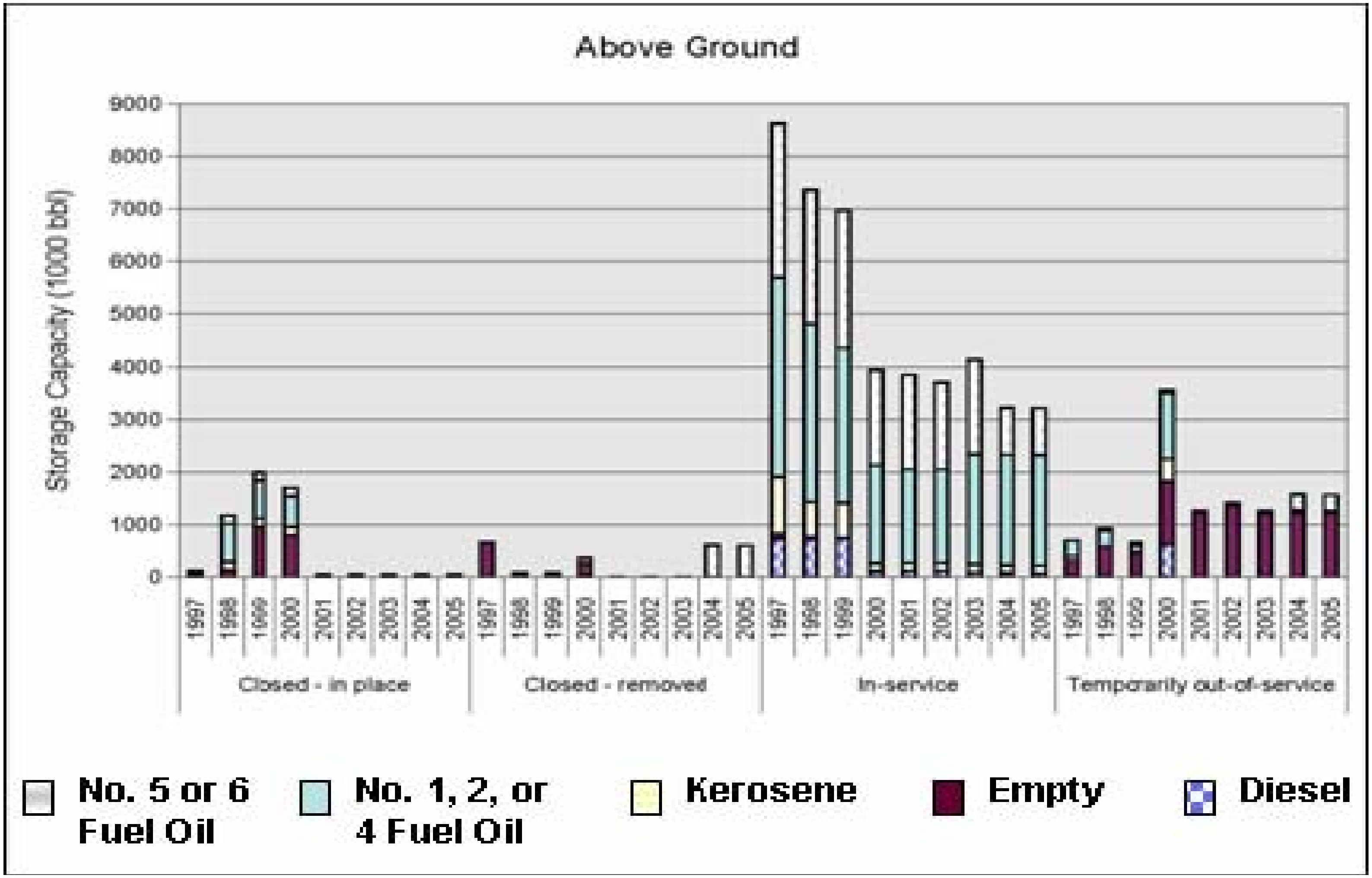
In 1999, the GATX terminal on Staten Island was decommissioned resulting in the loss of a large portion of the NYC Metro – NY storage capacity. After decommissioning, all 82 active tanks at the site were temporarily closed in 2000 before removal in 2001. The GATX Corporation had a number of reasons for closing the terminal. In part, it was a rationalization of its assets, including the sale of GATX Terminals, and in part, it was the after tax gain from selling the largest privately held property in the New York City area. The closure of this terminal accounts for a storage capacity loss of nearly three million barrels within the region. Exhibit III-18 shows the status of storage capacity at the GATX terminal over several years.

Exhibit III-17a: Trend in Underground Active Tank Storage Capacity over the Years in NYC Metro – NY



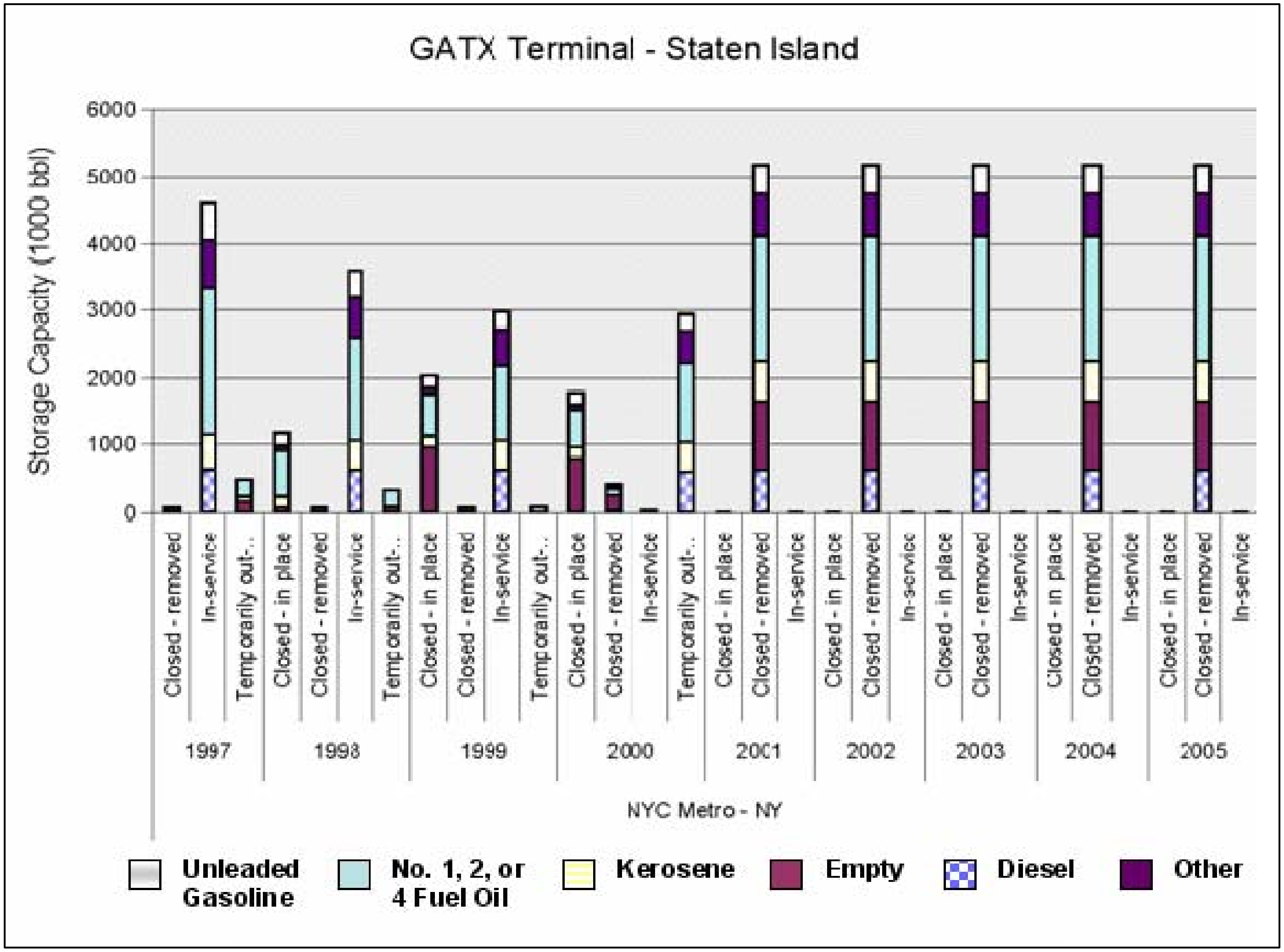
Source: NYSDEC. MOSF Storage Capacity data from NYSDEC database. 1997-2005

Exhibit III-17b: Trend in Aboveground Active Tank Storage Capacity over the Years in NYC Metro-NY



Source: NYSDEC. MOSF Storage Capacity data from NYSDEC database. 1997-2005

Exhibit III-18: GATX Terminal Closing in NYC Metro – NY

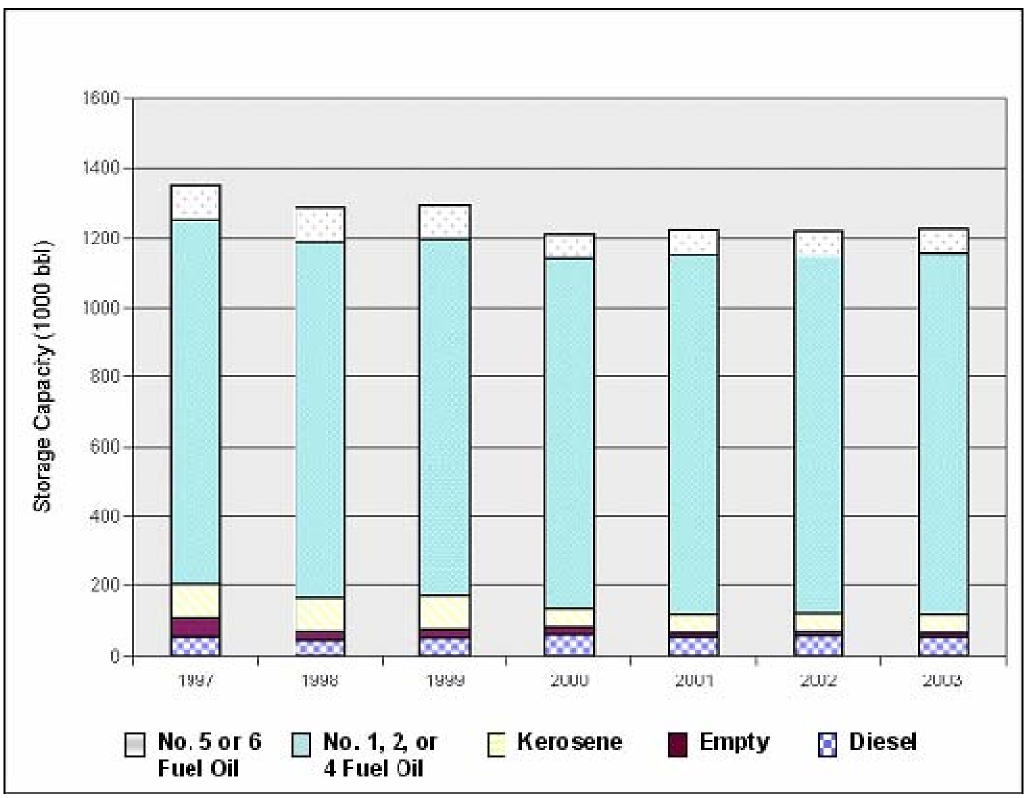


Source: NYSDEC. MOSF Storage Capacity data from NYSDEC database. 1997-2005

Petroleum Bulk Plants

The bulk petroleum terminals discussed above are the primary storage segment in the petroleum distribution supply chain. The secondary storage segment consists of the petroleum bulk plants. These are storage facilities that are less than 50,000 barrels in storage capacity and are not owned by an end-user. Bulk plants are typically owned by fuel oil distributors who receive their product supply from fuel oil terminals and then distribute the products directly via trucks to customers and end-users. Fuel oil distributors who do not have their own storage facilities may also load their distribution trucks or tank wagons at these bulk stations for deliveries to their customers. Exhibit III-19a shows the trend in total storage capacity for the entire New York portion of the study area. The data for Nassau, Suffolk, Westchester and Rockland counties exclude facilities with capacities less than 9,500 barrels[17]. The graphic shows a slight decline in the storage capacity at bulk stations between 1997 and 2003. Similar data were not available for New Jersey.

Exhibit III-19a: Trends in Petroleum Storage Capacity in the Smaller Bulk Plants in the New York Portion of the Study Area

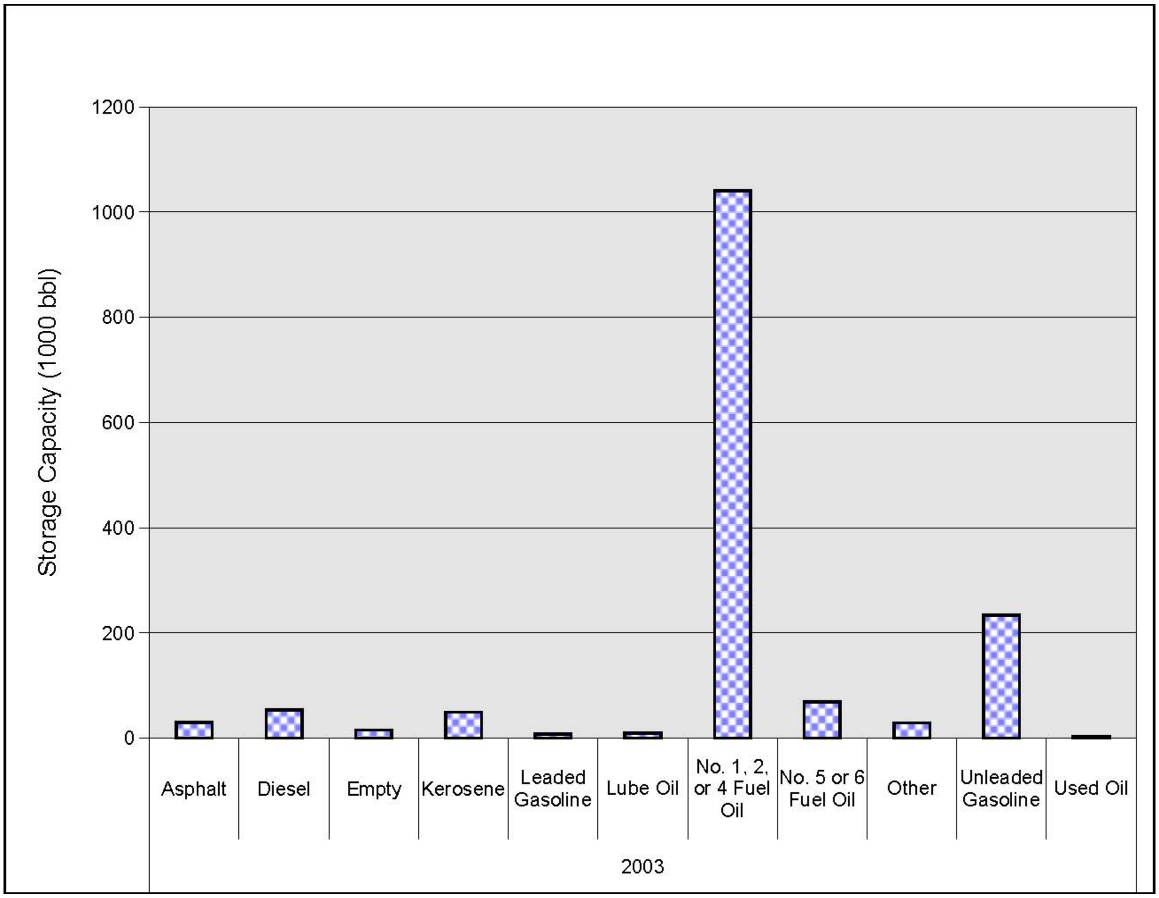


Source: New York State Department of Environmental Conservation, MOSF and PBS program
Note: Partial data for Nassau, Suffolk, Rockland and Westchester counties.

[17] The PBS program is administered individually by Nassau, Suffolk, Rockland and Westchester counties. The data received for these counties overlapped with data received from NYSDEC and could not be distinguished sufficiently for a clear analysis.

Exhibit III-19b illustrates bulk storage capacity in the year 2003 by fuel type for the entire New York portion of the study area. Distillates, including No.1, 2 and 4 fuel oil, dominate the storage capacity with 1.04 million barrels out of a total of 1.54 million barrels. There is 234,000 barrels of storage capacity for unleaded gasoline while the other products share the remaining 269,000 barrels of storage capacity.

Exhibit III-19b: Petroleum Storage Capacity in the Smaller Bulk Plants by Fuel Type in the New York Portion of the Study Area for the Year 2003



Note: Partial data for Nassau, Suffolk, Rockland and Westchester counties.
Source: New York State Department of Environmental Conservation, MOSF and PBS program

The predominance of distillate is logical as bulk plants are typically owned by fuel oil distributors. Exhibit III-19c shows the trend and distribution of storage capacity for distillates in the three New York regions within the study area. The NYC Metro-NY region has the largest distillate storage capacity, followed by the Hudson and Long Island regions. This storage capacity has held steady between 1997 and 2003.

Exhibit III-19c: Storage Capacity for No. 1, 2 and 4 Fuel Oil at Bulk Plants in the New York Portion of the Study Area (Mbbls)

NYS Sub Region	1997	1998	1999	2000	2001	2002	2003
Hudson	378	375	384	379	381	377	383
Long Island	254	260	265	251	240	240	245
NYC Metro- NY	418	391	379	376	413	411	412
Grand Total	**1,050**	**1,026**	**1,028**	**1,006**	**1,034**	**1,028**	**1,040**

Note: Partial data for Nassau, Suffolk, Rockland and Westchester counties.
Source: New York State Department of Environmental Conservation, MOSF and PBS program

End-User Storage Capacity

Most end-users of petroleum products have some storage capacity at their own sites. Residential consumers have the option of using heating oil, kerosene, propane or natural gas as their heating fuel, but in most cases, it is either heating oil or natural gas. Homeowners using heating oil tend to have small storage tanks, with 275 gallons to 550 gallons being common sizes. Assuming that residential customers consume approximately 0.125 gallons per HDD[18] and assuming the average HDD during the winter months of year 2003, a 275 gallon tank would hold approximately 60 days of fuel, and a 550 gallon tank approximately 121 days of fuel.

The commercial sector, including offices and apartment buildings, would have larger on-site storage capacity since their daily consumption is higher. Some of these customers burn distillate fuel exclusively and some operate dual-fired boilers that can burn natural gas or one of the distillate oils.

The electricity generation sector consumes residual and distillate fuel oil in addition to natural gas. Some electricity generators use fuel oil exclusively or switch between natural gas, supplied under interruptible natural gas service, and fuel oil. Residual fuel oil is more commonly used than distillate fuel oil since it has a lower price. However, distillate is more commonly used in peaking units of 80 megawatts (MW) or less. Electricity generators need to store a large amount of oil on site because of their high burn rate.[19] The example given in the footnote shows the impact, in demand for distillate, from one plant during a natural gas interruption, i.e. a two-day disruption results in a demand for 20 Mbbls of distillate. Cumulatively over the study area, this amounts to a large volume of fuel from one sector alone.

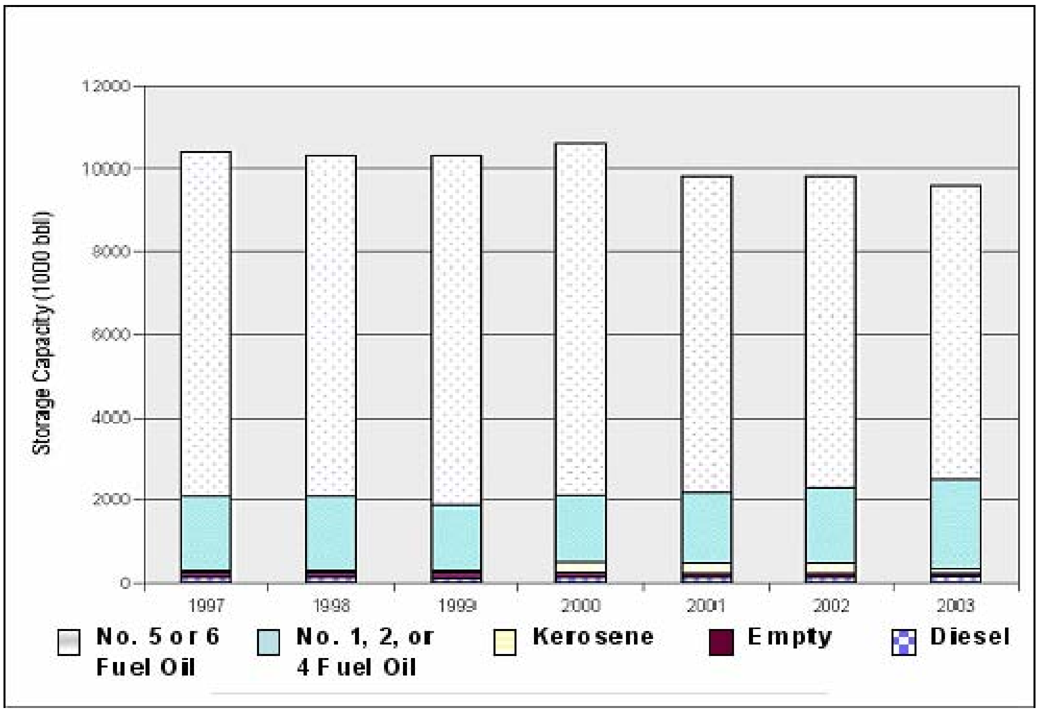
Exhibit III-20a illustrates the trend of end-user storage capacity for petroleum products between 1997 and 2003. The overall storage capacity has decreased slightly since year 2000 while the share of distillate fuel oil has grown at the expense of residual fuel oil and kerosene. Exhibit III-20b shows the distribution of end-

[18] Energy Information Administration, *The Northeast Heating Fuel Market: Assessment and Options*, May 2000
[19] For example: Consider a generation plant with a winter capacity of 300 MW with cogeneration facilities and a combined cycle total fuel rate of 8000. Natural gas is the primary fuel, with distillate as the backup. This converts to a fuel use of 2393.6 mmBtu/hour in the winter which then converts to 17,259 gallons of distillate an hour. For a gas interruption of two days, this plant would require 828,432 gallons of distillate or 19,725 barrels of fuel.

user storage capacity by fuel type. Residual fuel oil has the largest storage capacity at end-users. This is because there are many electricity generation facilities in the study area that consume residual fuel oil. These facilities have large storage tanks located in the port area and can receive direct shipment from barges and other marine vessels. Most electricity generators get their residual oil supply directly from suppliers or from petroleum terminals. Bulk plants are usually not involved in the transactions because of the large volumes and hence, they do not maintain much capacity for residual fuel oil.

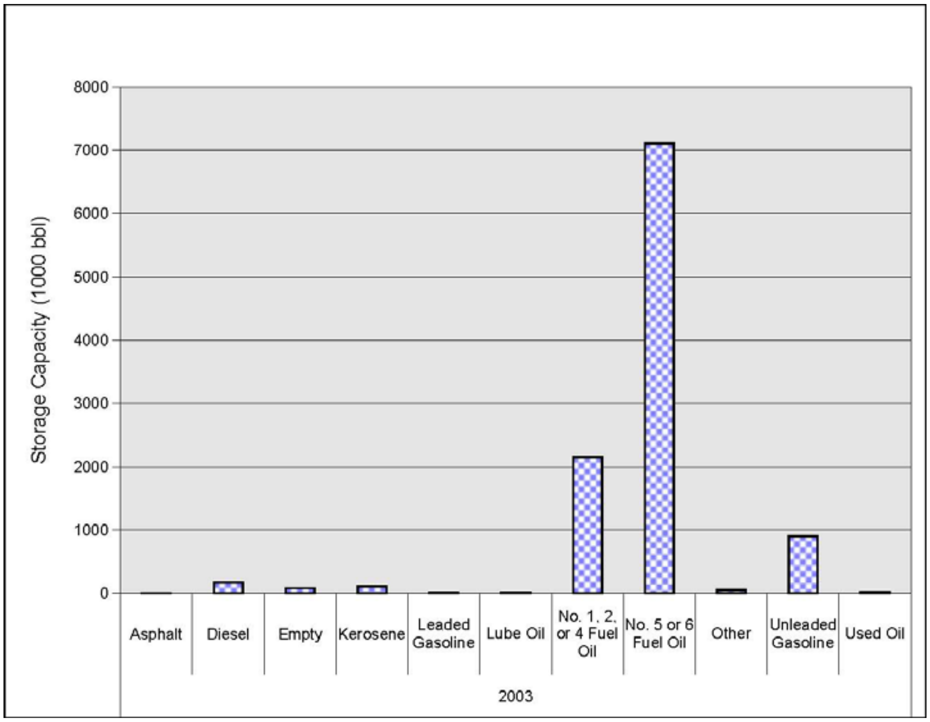
The distillate fuel oil storage capacity of end-users is maintained primarily by residential and commercial customers. This capacity is characterized by a large number of customers, each having a small storage capacity, especially when compared with the electricity generation sector. These customers get their distillate fuel oil supply from heating oil/fuel oil distributors.

Exhibit III-20a: Trends in Fuel Oil and Kerosene Storage Capacity at End-users in the New York Portion of the Study Region from 1997 to 2003



Source: New York State Department of Environmental Conservation, MOSF and PBS program
Note: Partial data for Nassau, Suffolk, Rockland and Westchester counties.

Exhibit III-20b: Petroleum Storage Capacity at End-Users by Fuel Type in the New York Portion of the Study Region in 2003



Source: New York State Department of Environmental Conservation, MOSF and PBS program
Note: Partial data for Nassau, Suffolk, Rockland and Westchester counties.

COSTS OF TANKAGE

Exhibits III-21 shows the average cost of building new fuel tanks of various sizes for siting at petroleum terminals. Costs include labor and materials for the tank and auxiliary equipment and services such as pipeing, and environmental compliance requirements. Other costs may include land acquisition, permitting, and legal support. If the permitting process is protracted, as is often the case when aggressive public opposition exists lost time translates into significant costs..

Exhibit III-21: Average Cost of Building a New Fuel Oil Tank in the Study Area

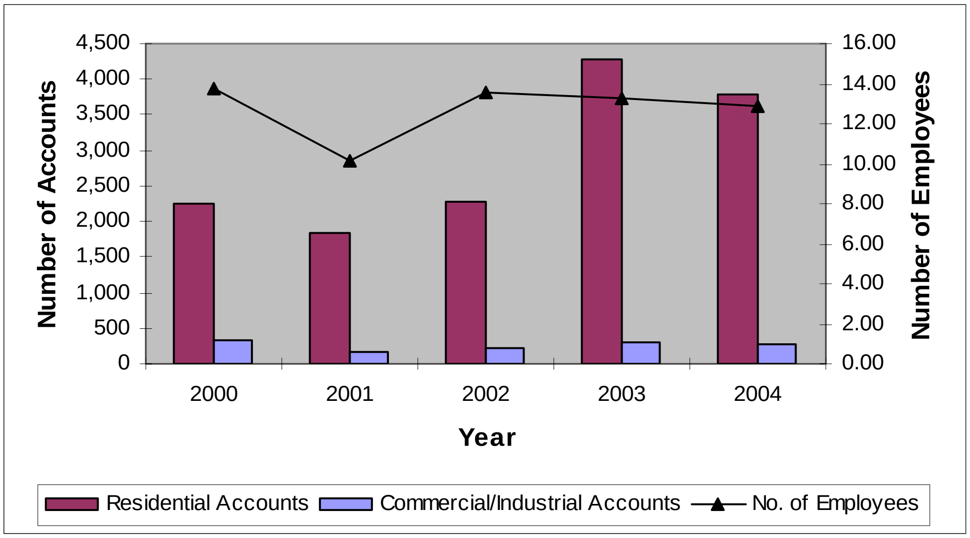
Fuel Oil Tank Costs				
	New York Metro Area		Albany/Hudson Area	
Capacity (bbls)	Cost ($)	Cost per Barrel ($/bbl)	Cost ($)	Cost per Barrel ($/bbl)
500	191,028	382	170,504	341
2,000	232,641	116	207,646	104
5,000	141,439	28	126,243	25
12,000	464,909	39	414,960	35
20,000	599,701	30	535,271	27
24,000	644,364	27	575,135	24
36,000	871,327	24	777,713	22
45,000	1,049,993	23	937,184	21
56,000	1,244,070	22	1,110,410	20
64,000	1,369,493	21	1,222,357	19
80,000	1,666,610	21	1,487,553	19
88,000	1,712,558	19	1,528,564	17
110,000	1,836,010	17	1,638,753	15
143,000	2,190,100	15	1,954,800	14
180,000	2,742,035	15	2,447,437	14
224,000	3,460,802	15	3,088,980	14
Source: *RS Means 2004 Environmental Remediation: Assemblies Cost Book*				
Costs includes all labor, materials and equipment. Adjusted to NY Metro and Albany/Hudson based on localization factors published in the source.				
Assumed safety level "C" on a scale of "A to E". Reflects the reduced productivity of labor and equipment that result from safety level requirements. (E is highest productivity)				

Heating Oil Distributors

Every December *Fuel Oil News* conducts a random sample survey of fuel oil distributors across the nation. The report provides a considerable amount of data and the data for the mid-Atlantic region was used by the ICF team as a backdrop for the study area. However, this is a random sample, so there are anomalies in the data which cannot be explained and probably reflect peculiarities of the sample. Nevertheless, the following three exhibits provide relevant information against which the study area distributors can be measured.

Exhibit III-22 shows the average number of accounts and the number of employees in the mid-Atlantic region. Serving residential home heating needs is the predominant form of business with commercial and industrial accounts lagging far behind. For distributors in the mid-Atlantic region, the number of accounts increased between 2001 and 2003 before recording a slight fall in 2004. Other than in 2001, the average number of employees has remained remarkably consistent, fluctuating between 12 and 13.

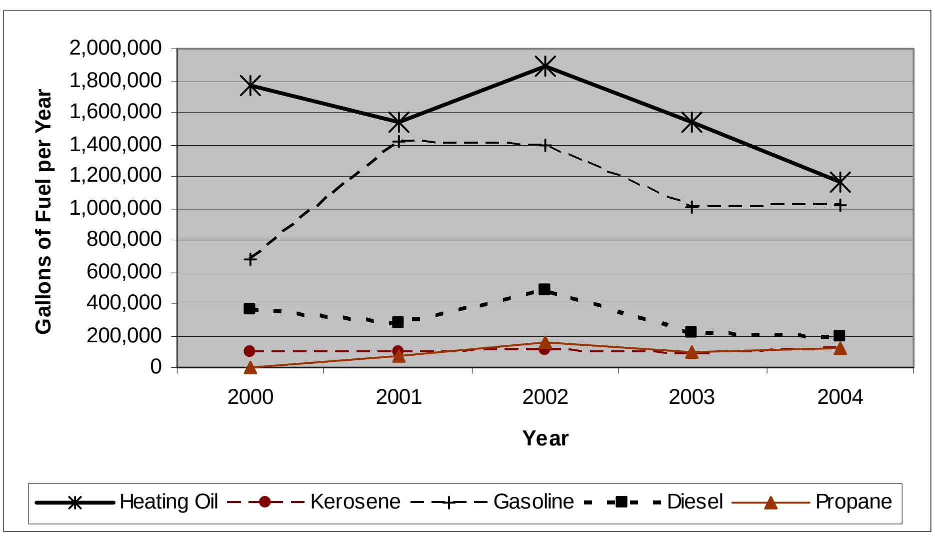
Exhibit III-22: Average Size of the Business in the mid-Atlantic in Number of Accounts and Number of Employees 2000-2004



Source: *Fuel Oil News*, various December issues

Exhibit III-23 shows the volumes and types of fuels sold in the mid-Atlantic region by fuel oil distributors in the survey. Sales of all fuels peaked in 2002, an extremely cold winter, and then declined. Volumes increased slightly between 2003 and 2004, but not enough to show clearly on the graph. The winter of 2004-2005 began late, with the most severe weather occurring in early 2005. One would expect to see an increase in the December 2005 data in the next survey.

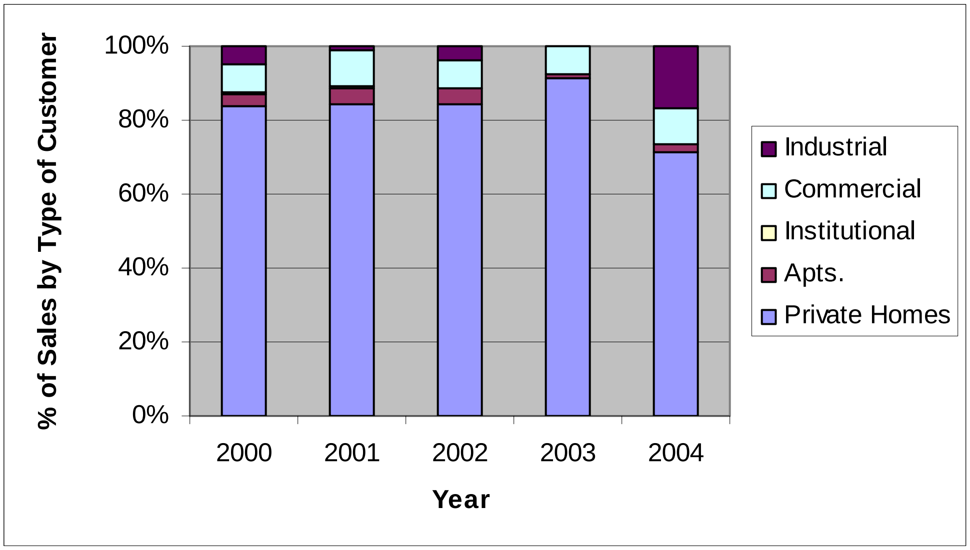
Exhibit III-23: Annual Average Volume of Fuels Sold in the mid-Atlantic by Fuel Type 2000-2004



Source: *Fuel Oil News*, various December issues

Exhibit III-24 shows the distribution of sales by customer sector in the mid-Atlantic region. As expected, the largest sector is the residential. The decline in 2004 is most likely due to the distribution of winter weather discussed above.

Exhibit III-24: Percentage of Sales by Type of Customer 2000-2004



Source*: Fuel Oil News*, various December issues. Note that industrial sales for 2003 were too small to register on the graphic.

The exhibits above show data for the heating oil distributors in the entire mid-Atlantic region. The ICF survey results show similar data for Long Island and the Hudson regions below in Exhibits III-25 through III-28. Data for the NYC Metro-NY cannot be shown because of confidentiality concerns. Distributors in the NYC Metro-NJ region did not respond to the survey.

Exhibit III-25: Sales of All Offroad No. 2 Fuel Oil by Sector for Long Island

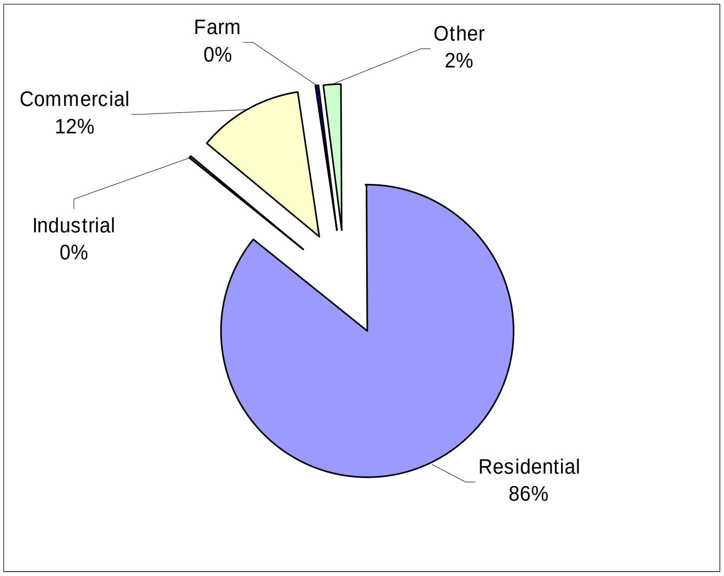
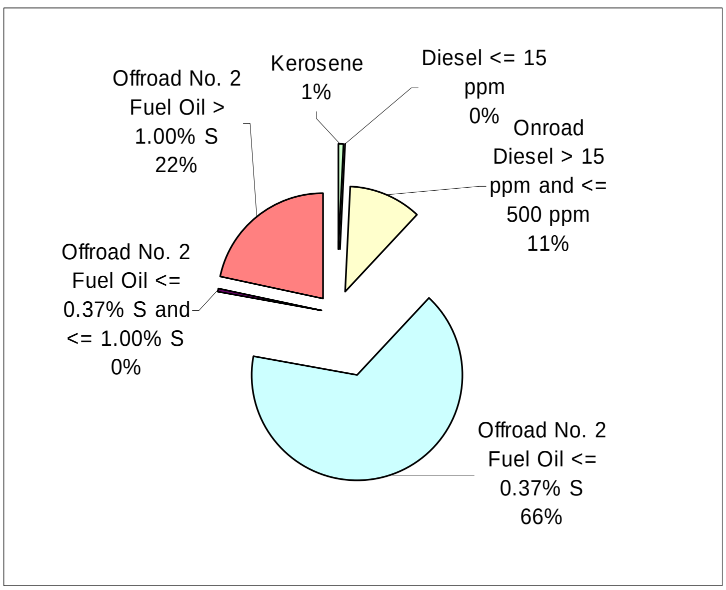


Exhibit III-26: Sales by Fuel Types from June 2002 – May 2004 for Long Island



Like the overall mid-Atlantic region, Long Island heating oil distributors service mostly residential heating oil requirements, as shown in Exhibit III-25. In terms of the fuel they sell, presented in Exhibit III-26, the majority of the heating oil sold is under one percent sulfur even though the legal maximum is 1.0 percent.

Exhibit III-27: Sales of All Offroad No. 2 Fuel Oil by Sector for Hudson Region

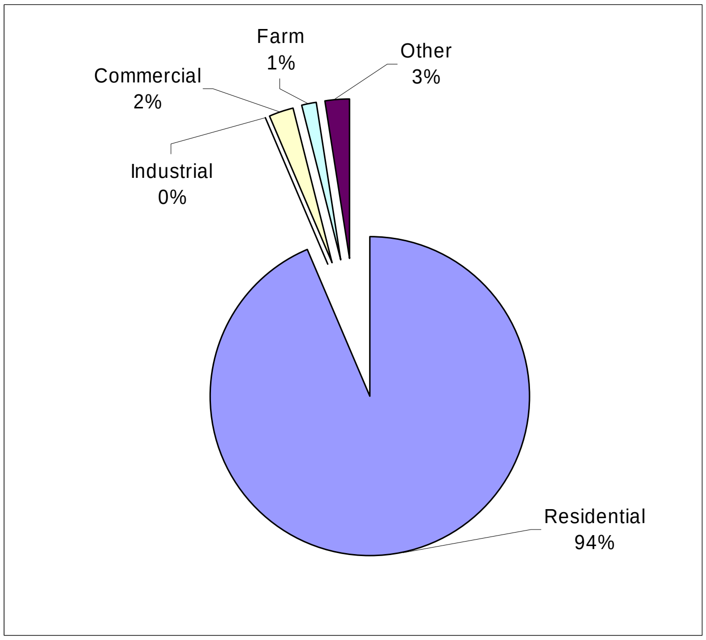
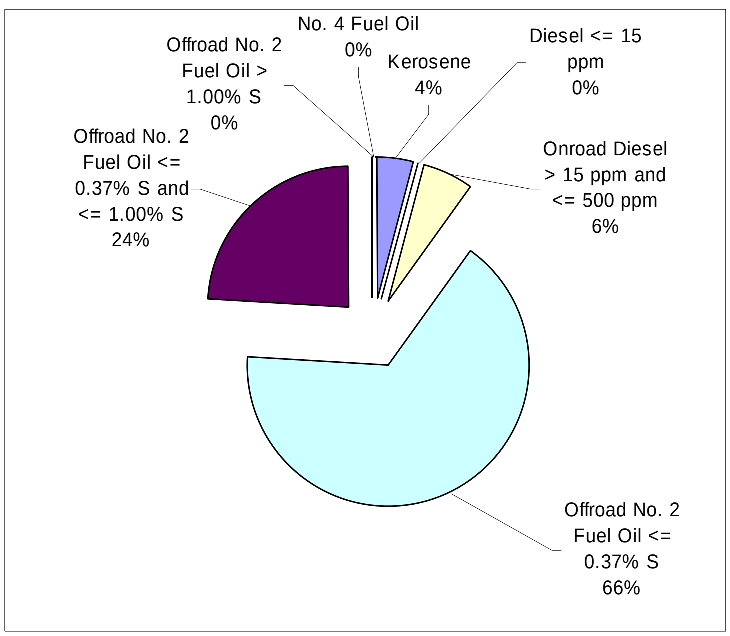


Exhibit III-28: Sales by Fuel Types from June 2002 – May 2004 for Hudson Region



Like Long Island, the Hudson region heating oil distributors' service mainly residential customers heating requirements, as illustrated in Exhibit III-27. However, the fuel oil that they sell, shown in Exhibit III-28, tends to have a higher sulfur content than the product sold on Long Island.

TRANSPORTATION

The two major methods of transporting petroleum products by water are barges and tankers. Barges range from 10 Mbbls to 300 Mbbls, and are single-hulled, double-bottomed, or double-hulled. The Oil Pollution Act of 1990 requires that all barges be double-hulled by 2015, and some International Maritime Association agreements suggest this hull specification be implemented in 2010. Barges require the use of tug boats to propel them from port to port. Tankers are self-propelled vehicles that can transport up to 300 Mbbls of product; however, there are a few self-propelled petroleum liquid tankers in the region that have much less capacity. Appendix C describes the detailed marine transport data available from the Army Corps of Engineers. There are two data sources available:

- The marine transport companies that operate in the region and the types of vessels they own and operate, and
- Individual vessel specifications by "home" port.

Exhibit III-29 shows the number of vessels operating in the study area according to the *Waterborne Transportation Lines of the United States* database.

Exhibit III-29: Number of Vessels Operating in the Study Area

International Classification of Ships by Type (ICST) Codes	# of Vessels, Individual Vessel Listing	# of Vessels, Company Vessel Summary
Liquid Oil Tanker	12	11
Liquid Tank Barge (Single Hull)	60	47
Liquid Tank Barge (Double Hull)	42	23
Liquid Tank Barge (Double Bottom Only)	13	not reported
Liquid Tank Barge (Other)	46	48

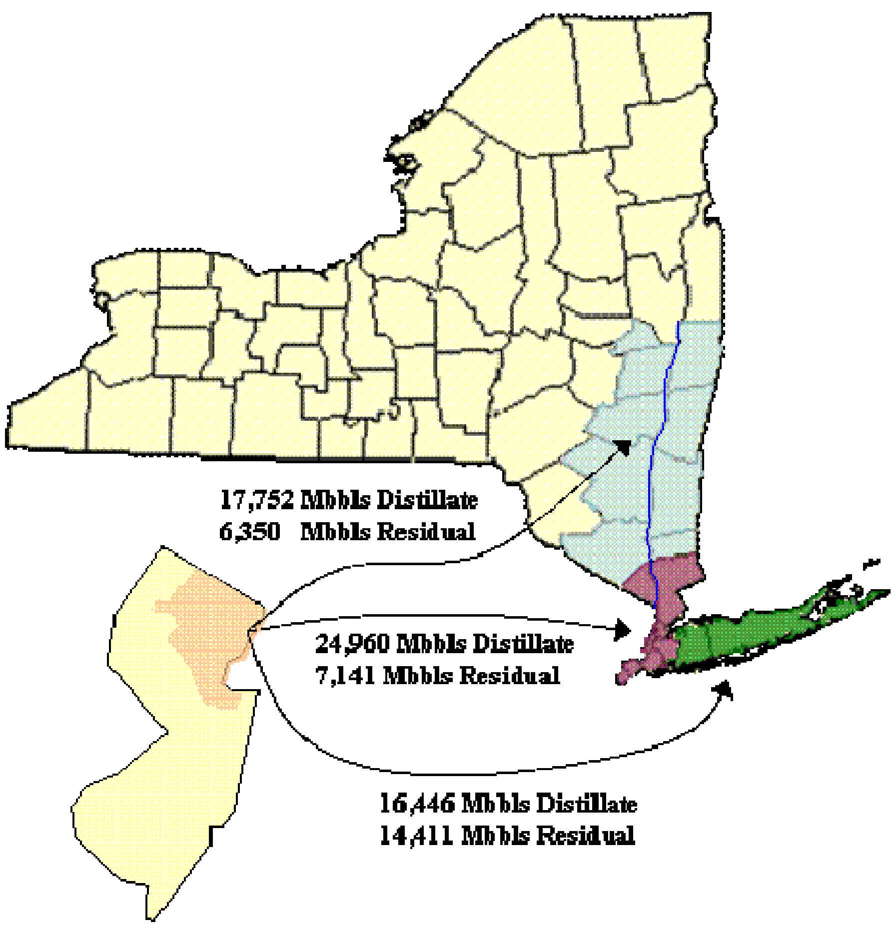
Source: Army Corps of Engineers' *Waterborne Transportation Lines of the United States*, Volumes I and II.

Tanker and Barge Movements

ICF received petroleum product movement data from the U.S. Coast Guard during the ice breaker season (December through March). Between December 2002 and March 2003 5,324 Mbbls of distillate were received in Hudson River ports. Additionally, 1,109 Mbbls of residual fuel and 613 Mbbls of kerosene were received during the same time period at these terminals. Average daily rates for the ice breaker season are just under 50 Mbbls/day for distillate fuels. The residual fuel oil shipments appear to be much lower than those of distillates, with an average rate for the ice breaker season of 9 Mbbls/day.

Exhibit III-30 shows the quantities of fuels transported in 2003 from the NYC Metro-NJ region to the other three regions in the study area. Movements to the Long Island and Hudson Valley regions are via tanker and barge, while movements to the New York Metro region include both marine and tank truck deliveries. Products transported by water are offloaded at marine ports where fuel oil distributors can truck product to end-users or their own bulk stations. Other, smaller movements between regions occur, but Northern New Jersey, with its large marine terminals, refineries, and interstate pipelines, serves as the central supply point for both domestic fuels and imports that were initially brought into the Newark and Perth Amboy marine terminals. All residual fuel oil is transported by water.

Exhibit III-30: 2003 Movements of Distillates and Residual Fuels from New Jersey to the New York Portion of the Study Area

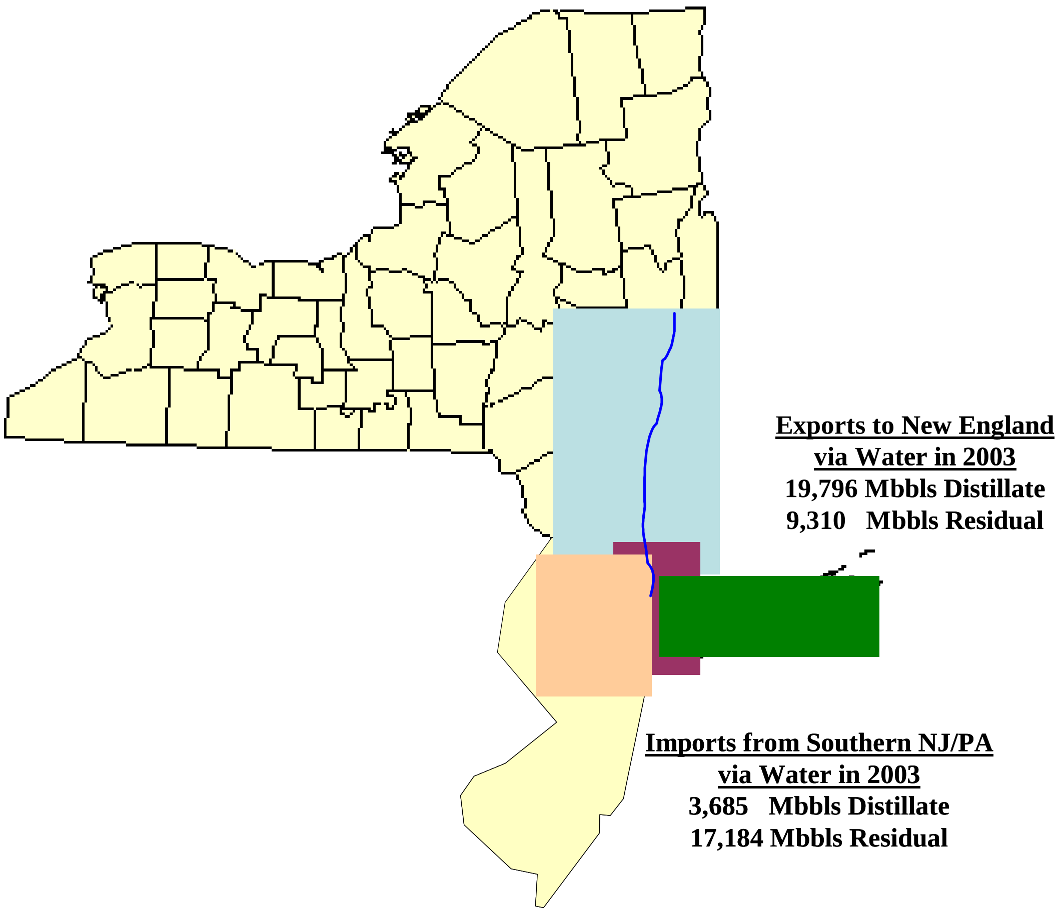


Source: U.S. Army Corps of Engineers, *Waterborne Commerce*

Exhibit III-31 illustrates the importance of water transportation to New York's role as a central distribution node on the East Coast. The exhibit shows domestic movements by water from southern New Jersey and

Pennsylvania. It also shows the export of products from New York to New England, largely by barges moving up the coast. This data was developed for ICF by the U.S. Army Corps of Engineers.

Exhibit III-31: 2003 Domestic Waterborne Movements into and out of the Study Region (Mbbls)



Source: U.S. Army Corps of Engineers, *Waterborne Commerce*

Rail Movements

The American Association of Railroads reports data on the movement of fuels at the national level. When contacted by the ICF team, they verified that CSX and Norfolk Southern are the only two major rail companies that transport product in and out of the study area. Conversations with industry experts verified that product is shipped out of the area via rail from Albany to terminals in Vermont and Western Massachusetts.

Truck Movements

To distribute distillate fuels between primary and secondary storage facilities, high volume marine transport is favored over truck and rail movements because of the cost advantage. Once distillate is sold to a secondary dealer however, it is typically loaded into the dealer's truck at a primary storage facility loading rack. The dealers may then store the distillate in their own facilities, keep it in their trucks, or transport it directly to their customers.

According to the U.S. Census Bureau, *New York Inventory and Use Survey*, the number of single unit trucks and truck tractors moving liquids and gases in New York State in 2002 is 12,400. The number of trucks by type, total miles traveled, and miles traveled per truck are shown in Exhibit III-32. The U.S. Census Bureau presents miles traveled in transport of various subgroups including gasoline, jet fuel, and fuel oil. In 2002, 26.2 million miles were traveled transporting gasoline and jet fuel, and 39.2 million miles, on a statewide basis, in transporting fuel oil. Assuming the average number of miles per truck presented in Exhibit III-32 is correct 1,530 fuel oil trucks are operating in New York State.

Exhibit III-32: 2002 U.S. Census Bureau, New York Truck Inventory and Use Survey

	Number of Trucks in NY	Total Miles Logged by Each Type of Truck	Miles per Truck (calculated)
Single Unit Truck, liquids or gases	8,600	82,700,000	9,616
Truck Tractor Tank	3,800	235,000,000	61,842
Total	12,400	317,700,000	25,621

Source: U.S. Census Bureau, *New York Inventory and Use Survey, 2002*

However data from the New York Department of Agriculture and Markets, Bureau of Weights and Measures, listing local delivery trucks by county, indicates there are a total of 745 trucks for the Hudson region, 1,411 for Long Island, and 1,716 for the New York city area. A press release from the New York City Department of Consumer Affairs stated that 1,500 home heating oil delivery trucks were inspected in New York City in one year. The ICF team assumed that because of the density of vehicles in the New York City area, the majority of trucks would be single unit trucks, and the number of trucks is closer to that reported by the Bureau of Weights and Measures.

The largest trucks in fuel oil distributors' fleets average 4,325 gallon capacity, while the smallest trucks in their fleets average 2,675 gallons of capacity[20]. On average, 1,159,143 gallons of heating oil, 126,500

[20] ibid

gallons of kerosene, and 198,124 gallons of diesel fuel are sold by each fuel oil distributor in the mid-Atlantic region.

Exhibit II-33 shows the movement of total petroleum refined products originating and arriving in the study area according to the New York State Department of Transportation (NYSDOT). Petroleum refined products include gasoline, jet fuel, kerosene, distillate fuel oil, lubes, asphalt, residual fuel, and other petroleum products. The original data were in tons and have been converted to thousands of barrels (Mbbls) of distillate.

EIA does not enumerate substate level movement of petroleum products. Most of the EIA state level data is from NYSDOT reports and is based on taxable sales of petroleum products at the site of first import. Exhibits III-33 and II-34 can be used, at least as, the upper bounds for the final estimations of truck movement. When the data are converted from tons to Mbbls of distillate, the estimated amount destined for New York counties in the study area by truck is almost 56,000 Mbbls..

Exhibit III-33: NYSDOT Petroleum Product Movements by County of Origin in the Study Area (Mbbls)

Origin	Car Loads	Truck Loads	Light Truck Loads	Private Truck Loads	Water	Total
Albany	2,919	292	26	160	1,355	4,752
Suffolk	-	-	-	-	9	9
Westchester	-	-	-	-	771	771
Total	2,919	292	26	160	2,135	5,532

Source: NYSDOT, Special Tabulations from Reebie Associates 2001 Transearch Database. Data converted from tons to Mbbls of Distillate.

Exhibit III-34: NYSDOT Petroleum Product Movements by County of Destination in the Study Area

(Mbbls)

Destination	Car Loads	Truck Loads	Light Truck Loads	Private Truck Loads	Water	Total
Albany	72	25,432	504	35,362	70,406	131,776
Columbia	-	32	0	19	-	51
Dutchess	-	30	2	105	-	137
Greene	-	18	-	15	-	33
Orange	23	92	5	150	-	270
Putnam	-	5	-	10	-	15
Rensselaer	-	200	6	658	-	863
Rockland	-	43	2	167	-	212
Suffolk	-	236	35	940	4,600	5,811
Ulster	-	6	-	58	-	64
Westchester	-	106	16	428	1,269	1,819
Total	95	26,199	571	37,912	76,275	141,051

Source: NYSDOT, Special Tabulations from Reebie Associates 2001 Transearch Database. Data converted from tons to Mbbls of Distillate.

IV. NATURAL GAS SUPPLY AND MARKET STRUCTURE

Customers who receive gas service under interruptible gas tariffs or contracts may significantly increase demand for distillate oil during winter peak periods. When the gas system is stressed because of cold weather, gas service to these customers is interrupted, due to either distribution system constraints or a lack of any "excess" supplies available to interruptible customers since the supplies would be needed to meet firm customer demands during peak periods. Interruptible customers must either shut down or use back-up supplies, predominantly petroleum fuels, to meet their requirements during the interruption periods. Interruptible service allows customers to take advantage of a competitive energy market; provides the local gas utilities with an important load management tool; and helps contribute to lower total system costs for all gas customers by allowing system operators to achieve a higher system capacity factor, increased utilization of fixed assets, and improved management of costs of service on average. It also provides economic opportunities for increased sales on the natural gas system. This chapter details how the gas market operates and describes the general trends in the gas market in the study area. How demand for oil arises from participation by interruptible gas customers and the effect on oil market behavior are described above.

OVERVIEW OF THE GAS MARKET

The study area is served by five natural gas local distribution companies (LDCs): Consolidated Edison (Con Ed), KeySpan Energy (KeySpan), National Grid (NG), Orange & Rockland (O&R, owned by Consolidated Edison), and Central Hudson Gas and Electric Company (CHGE). Exhibit IV-1 below shows the number of customers and throughput for these companies.

Exhibit IV-1: Market LDCs

Company	Number of Customers	2003 Sendout* (Bcf)	Service Territory
Con Ed	1,063,370	127.0	New York City
O&R	123,677	34.0	Rockland and Orange Cos.
NG**	209,000	42.7	Albany and County, Rensselaer and Columbia Cos.
CHGE	67,916	15.98	Poughkeepsie, Newburgh, Beacon, Kingston, and outlying areas
KeySpan	1,680,000	200.0***	Long Island, New York City Boroughs

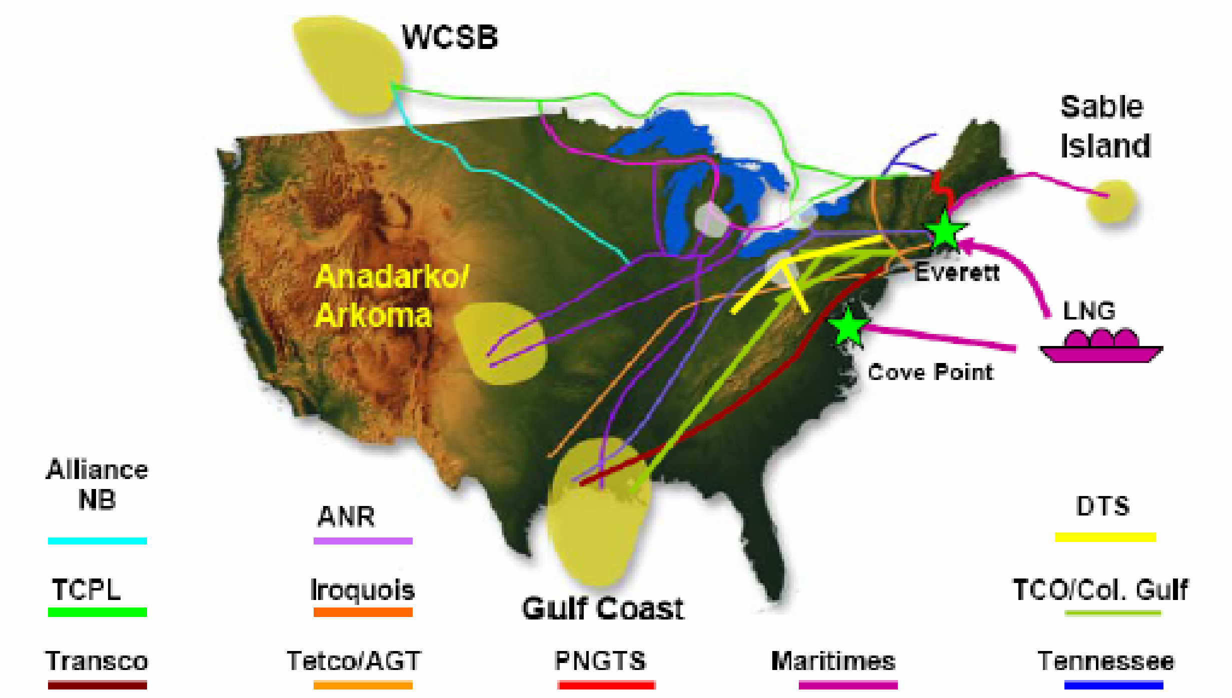
* Sendout equals sales plus transportation. ** 2004 estimated because NG territory does not correlate directly with the study area. ***ICF estimate

LDCs sell gas directly to customers and also transport gas on behalf of customers, so that the total sendout is the sum of both sales and transportation volumes. Customers can buy gas directly from LDC system supply, or from third party marketers who use the LDC pipes to deliver the gas.

LDCs receive natural gas from interstate transmission pipelines and distribute it to end use customers. The major transmission pipelines directly serving the LDCs in the study area are Tennessee Gas Pipeline (TGP), Texas Eastern Transmission Company (TETCo), Algonquin Gas Transmission (AGT), Transcontinental Gas Pipeline (Transco), Iroquois Gas Transmission Company (IGT), Dominion Transmission System (DTS) and Columbia Gas Transmission Company (TCO).

Through these and other upstream pipelines, the LDCs receive gas from the major North American producing basins and from liquefied natural gas (LNG) terminals. The majority of the gas supply into this region comes from U.S. domestic production, primarily Gulf Coast sources. Additionally, substantial volumes come from the Western Canadian Sedimentary Basin (WCSB), over the TransCanada Pipe Line (TCPL), and the Alliance and Northern Border (NB) systems to points near Chicago and then across pipelines south of Chicago. The IGT and portions of the TGP systems are directly tied into Canadian pipelines and the WCSB. New production from Sable Island, located off the east coast of Canada, enters the Northeast via the Maritimes & Northeast Pipeline (M&N) into New England. Through displacement, these volumes make additional supply available to the study area over TGP and AGT. Liquefied natural gas (LNG) imports enter the northeast at Everett, Massachusetts, in Boston Harbor and at Cove Point in southern Maryland. Proposed new LNG import facilities, if built, will provide additional supplies. These may include plants proposed in Nova Scotia and New Brunswick, Providence, Rhode Island, Massachusetts, New Jersey, and Long Island Sound.

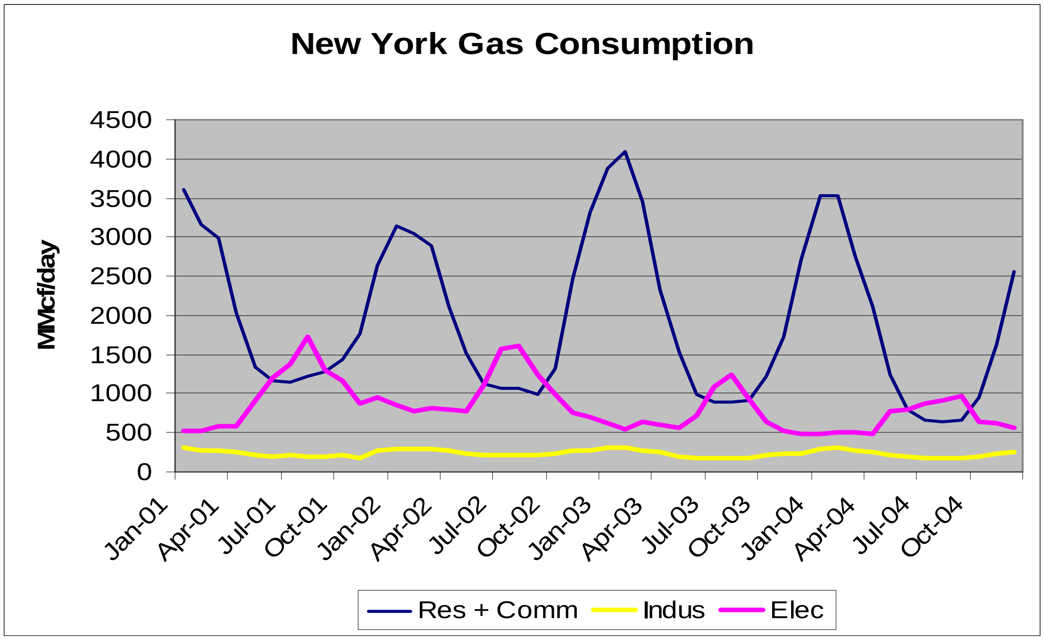
Exhibit IV-2: Source of Gas in Study Region



Pipeline capacity into New York is substantial. From Canada, approximately 2.8 billion cubic feet (Bcf) per day of pipeline capacity enters the state via Iroquois, TGP, and National Fuel Gas Company (NFG) (not shown). Approximately 2.5 Bcf per day enters the state from Pennsylvania, principally over the TGP and DTS. From New Jersey, TETCo, Transco and TGP have about 4.5 Bcf/d of capacity. Total net capacity into the state is about 6.3 Bcf per day (that is net of capacity dedicated to other markets in New England and middle Atlantic states). Of this capacity about 4.2 Bcf per day appears to be available to the study area.

Exhibit IV-3 shows gas demand in the region over the last four years and monthly patterns of gas demand for New York.

Exhibit IV-3: Monthly Patterns of Gas Demand



Source: Energy Information Administration, *Monthly Gas Statistics, States: New York*

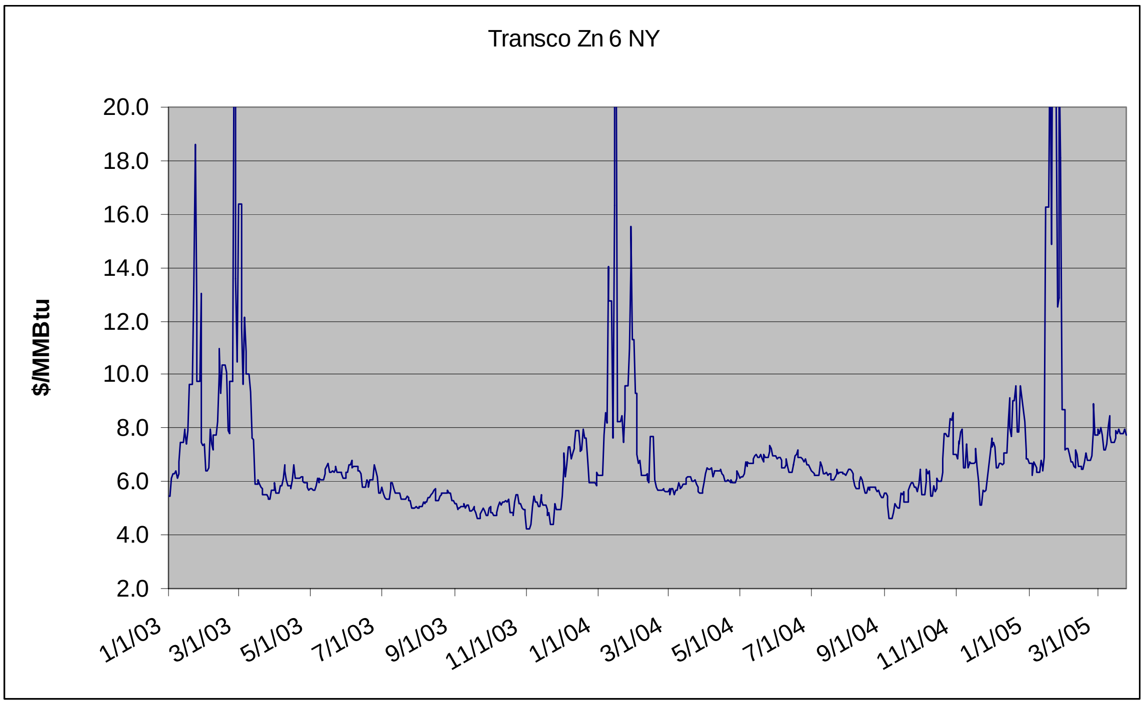
Exhibit IV-3 illustrates the wide swings in gas consumption in New York over the course of a year. Gas in the study area is primarily a heating fuel, such that winter demand is several times that of the summer and concentrated primarily in the residential and commercial sectors. Gas use by electricity generators tends to be counter seasonal, peaking in the summer. Industrial demand is relatively flat over the year. Pipelines, augmented by local storage and peak shaving facilities, must have the capacity to deliver full heating requirements on peak winter days. While monthly gas consumption may approach 2.5 Bcf daily, on any given day during the peak winter demand season, gas demand can increase to substantially higher levels.

LDCs employ several methods to manage swings in gas demand. During the winter season, pipeline delivered gas supplies are supplemented by storage gas, delivered over the same pipes from nearby upstream storage fields in Pennsylvania and New York State. Other sources of peak day gas supply will include LNG or propane-air peak shaving plants. A significant source of gas, however, comes from interrupting those customers on interruptible tariffs and delivering that gas to firm customers. Interruptible customers will then switch to back-up fuels, usually distillate fuels such as home heating oil, kerosene, or diesel fuel or residual fuel oil. Interruptible customers may also choose to have no backup capability and would then be forced to terminate operations until interruptible gas service is restored.

Gas prices in New York, like the rest of the United States, have increased substantially since 1999, when the average New York City gate price of gas was $2.92/MMBtu. In 2004, the average price was

$6.80/MMBtu at the Transco Zone 6 NY pricing hub[21]. Volatility has become a characteristic of gas prices generally and in New York in particular. As seen in Exhibit IV-4, daily prices in the last two years at Transco Zone 6 NY have shown substantial daily fluctuation, punctuated by episodes of dramatic price increases. Volatility appears to increase at the beginning of the heating season and becomes very dramatic during extreme cold weather, typically in January and February of each year. Gas prices peaked on January 15, 2004 at just over $45.00/MMBtu. These high gas prices correspond to the same periods of high prices in the heating oil markets as demand for both fuels surge in response to cold temperatures.

Exhibit IV-4: Transco Zone 6 NY Gas Prices



Source: *Gas Daily*, various issues

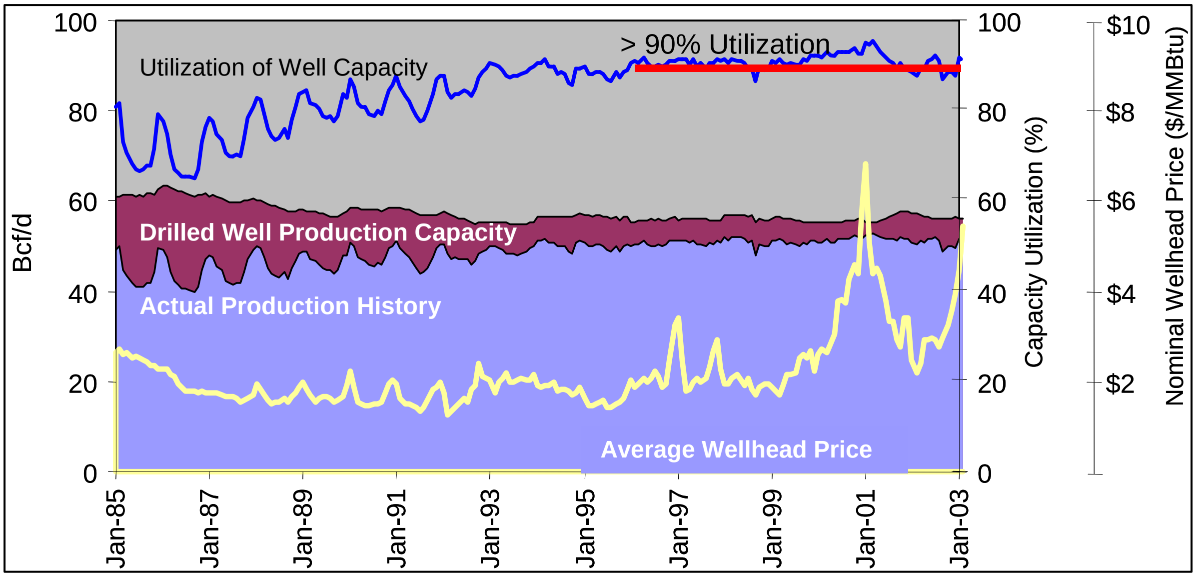
HOW THE MARKET PLAYERS HAVE CHANGED OVER TIME

The major change in gas markets has been the increased price of gas and the extreme volatility in gas prices. Gas prices have gone up nationwide as excess gas producing capacity has declined. As shown in Exhibit IV-5 this loss of producing capacity has led to both higher gas prices and more volatility in the gas market.

[21] *Gas Daily*, various issues

The exhibit also shows how through the early 1990s, seasonal swings in production were meeting high winter demands. As the excess capacity was worked off, this was no longer the case and prices became more volatile.

Exhibit IV-5: United States Gas Production and Prices 1985-2002



Source: Energy Information Administration, *Natural Gas Navigator*

A second development has been the overall increase in gas consumption by the power sector. Between 1990 and 2004, over 150 GW of gas-fired generating capacity was constructed out of a total generating net summer capacity of 938 GW in 2004 and 709 in 1990.[22] Of the 10 largest power facilities in New York, five, totaling 7.3 GW are dual fired and all are located in the study area.

In New York, over 4,000 megawatts (MW) of gas and dual-fired generation was added to the system between 1993 and 2002. Generation from gas increased over that time from 27 million megawatt hours (MWh) to 38 million MWh.[23] Total gas consumption for power generation was 263 Bcf in 1993 and 260 Bcf in 2002.[24] In the intervening years, gas consumption peaked in 1995 at 456 Bcf.[25] The level of gas consumption today reflects both increased efficiency of gas-fired power generation from combined cycle power plants and the recent high price of gas that has led to more imports of power. Higher demand from power generators contributes to higher consumption in off-peak summer months, more switching between gas and oil, and in volatility of gas prices.

[22] EIA, Electric Net Summer Capacity: Electric Power Sector 1949-2004. www.eia.doe.gov/emeu/aer/txt/ptb0811b.html.
[23] EIA, *State Energy Profiles, 2002*, www.eia.doe.gov/cneaf/electricity/st_profiles/new_york.pdf
[24] www.eia.doe.gov/emeu/states/main.ny.html
[25] NYSERDA, *Patterns and Trends: New York State Energy Profiles 1988 -2002*, Dec. 2003

WHAT ARE INTERRUPTIBLE SERVICE CONTRACTS?

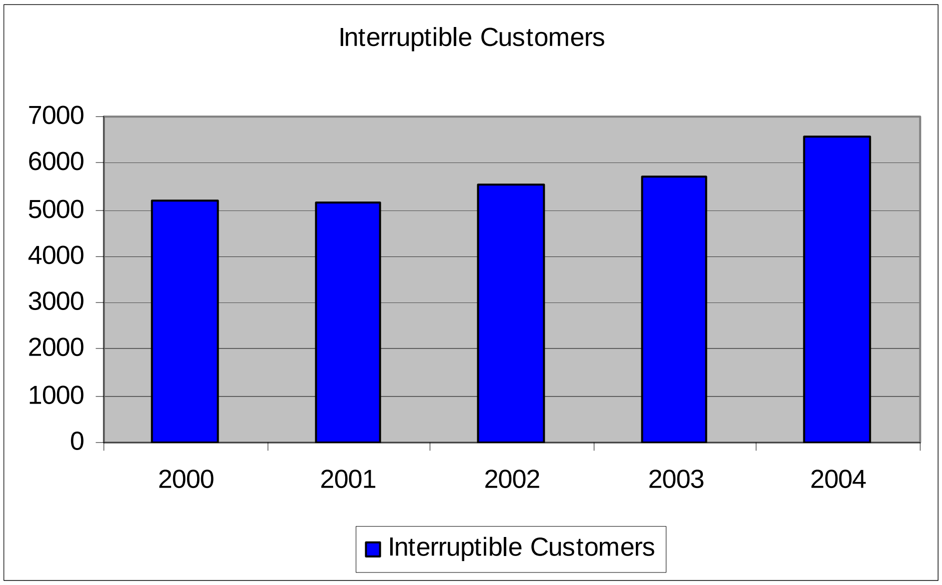
Each LDC in the study area has interruptible services and contracts. Customers under interruptible sales service agreements[26] are typically large users of gas – especially in comparison with firm residential users, whose average annual consumption per customer in 2003 was about 100 MMBtu. Interruptible customers consume gas in the thousands of MMBtu per year and may typically be commercial establishments, large apartment buildings, industrial plants, schools, hospitals, government buildings, and electricity generation facilities. Tariffs under which interruptible customers take service allow LDCs to interrupt gas service when low temperatures lead to high demand by firm service heating customers. Gas is made available to interruptible customers when firm customers do not require it. During high demand periods the gas is needed by the firm customers and there is no excess supply to be made available to interruptible customers. LDCs may also interrupt customers to manage pressures on the system and to maintain system wide deliverability. Such events usually occur during cold weather periods. Some customers who buy gas from a marketer or another third party, or who utilize interruptible pipeline transportation may be interrupted by that party, even if they have firm transportation service from the LDC. These interruptions are outside the control of the LDC.

Pricing of interruptible services are set in reference to the cost of the alternative fuel consumed by these customers. As such, the interruptible customers are a contestable market for LDCs and oil marketers.

The number of customers served by interruptible services (both sales and transportation) has grown since 2000, when just over 5,000 interruptible customers operated in the study area, to more than 6,500 by 2004 (see Exhibit IV-6). Well over 90 percent of the interruptible customers are located in New York City and Long Island and virtually all of the growth in customers has occurred in these areas.

[26] A sales service is when the LDC supplies the gas to the customer. Some large customers procure their own supplies from marketers and contract with LDCs for delivery service. These transportation contracts can also be interruptible when the LDC needs line capacity. Marketers also may be supplying the gas to the customer under an interruptible arrangement where such interruptions are governed not by LDC rules but by the bilateral contract agreement between the parties. Our focus in this study is on LDC interruptible sales services.

Exhibit IV-6: Growth of Interruptible Customers in Study Area



Source: Data received from Local Distribution Companies

Interruptible customers are required to have alternative fuel backup, with either on-site storage or contracts with alternative fuel suppliers. Depending on the type of interruptible service agreement, alternate fuel requirements can be for ten, seven, or five days of backup fuel.[27]

Interruptible sales and/or transportation customers fall into three categories:

Temperature Controlled (TC) Customers. Customers that are automatically switched to an alternative fuel when the temperature falls below a certain, pre-determined level.

Fully Interruptible Customers. Customers that can be interrupted on short notice at the option on the LDC and for as long as needed.

Contract Customers. Customers that generally have the largest loads and negotiate an individual agreement for service from the LDC (e.g., electric generators).

FREQUENCY AND DURATION OF INTERRUPTIONS

Interruptions are primarily weather sensitive and thus are highly correlated with the price spikes shown in Exhibit IV-4. Based on the data submitted by the LDC study participants, considerable variety exists in the frequency and duration of interruptions by LDCs in the study area. Interruptions appear to be highly related to physical constraints on the LDC or interstate pipeline systems. Exhibit IV-7 below summarizes interruption episodes in the study area over the past five years. . Days of interruption may be either full 24 hour days or as little as several hours in a given day.

[27] Interruptible customers can elect not to have a back-up fuel, but they would have to terminate operations when they are interrupted.

Exhibit IV-7: Interruption Episodes 2000-2004

Region	Hudson		New York City		Long Island	
Year	Dates	Duration	Dates	Duration	Dates	Duration
2000	1/17-1/21	5 days	1/13-1/26	14 days	1/14-2/1	19 days
	12/7-12/31	25 days				
2001	1/1-1/11	11 days	1/1-1/10	10 days	NR	NR
2002	12/3-12-19	17 days	NR	NR	NR	NR
2003	1/10-3/14	63 days	2/25-3/7	12 days	1/19-1/30	12 days
	12/5-12/8	4 days			2/14-2/17	4 days
					2/25-3/7	11 days
2004	1/7-2/2	26 days	1/9-1/12	4 days	1/9-1/12	4 days
	2/13-2/16	4 days	1/13-1/17	4 days	1/13-1/17	4 days
Average		**19 days**		**9 days**		**9 days**

Source: ICF based on data submitted by the gas companies.

One Hudson Valley LDC reported eight short duration interruptions lasting between 4 and 48 hours from late January through early March of 2003. In 2004, the LDC reported five interruptions of between 4 and 72 hours from January 10 to February 15. These interruptions fall within the dates listed above, but were generally for shorter periods of time.

Some LDCs distinguish between interruptions of temperature controlled customers and fully interruptible customers. While temperature controlled customers are interrupted more or less automatically (that is, they will switch to an alternate fuel once the temperature meets the threshold or upon notice from the LDC dispatcher), the fully interruptible customers are interrupted when notified by the LDC and interruptions are generally related to weather conditions. Temperature controlled customers tend to have natural gas as their primary fuel and are more likely to have distillate fuel oil as the back up. Fully interruptible customers may use distillate or residual fuel oil, or in the cases of power plants may simply shut down when interrupted.

PROFILE OF INTERRUPTIBLE CUSTOMERS IN THE STUDY AREA

To assist with the modeling of interruptions, ICF requested detailed data from the LDCs on their interruptible customers and the customers' gas consumption levels for the late fall and early winter heating season for 2004. These data were matched with a database of oil storage tanks to develop a better profile of interruptible customer characteristics (see Exhibit IV-8). The total number of customers in the combined data was 6,128, representing over 95 percent of all interruptible customers in the study area in 2004. Of these customers approximately 95 percent had gas sales service agreements (tariff services) while the remainder had interruptible transportation contracts with the LDCs.

Interruptible transportation customers, though fewer in number, have on average much higher gas consumption as compared to the gas sales customers. These gas transportation customers accounted for 44 percent in October 2004 and 37 percent in November 2004 of the total interruptible gas consumption. During October 2004 and November 2004, the average gas consumption by an interruptible gas transportation customer remained steady, indicating that customers received their normal contracted quantities.

Interruptible gas sales customers are typically residential (apartment houses) or commercial sector end-users whose primary fuel use is space heating. The volumes consumed by these customers depend on the weather, and has a seasonal pattern. The consumption of gas by interruptible sales customers increased 33 percent from October 2004 to November 2004 as the heating degree days increased from 464 to 764[28] and the need for space heating increased.

[28] Source: National Oceanic and Atmospheric Administration, ‘Heating Degree Day Data Monthly Summary, Climate Prediction Center-Ncep-Nws-Noaa, Monthly Data For Oct 2004 and Nov 2004’, Archives Section, 1997-current, Retrieved from the web on Feb 27, 2006. URL: http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/cdus/degree_days/

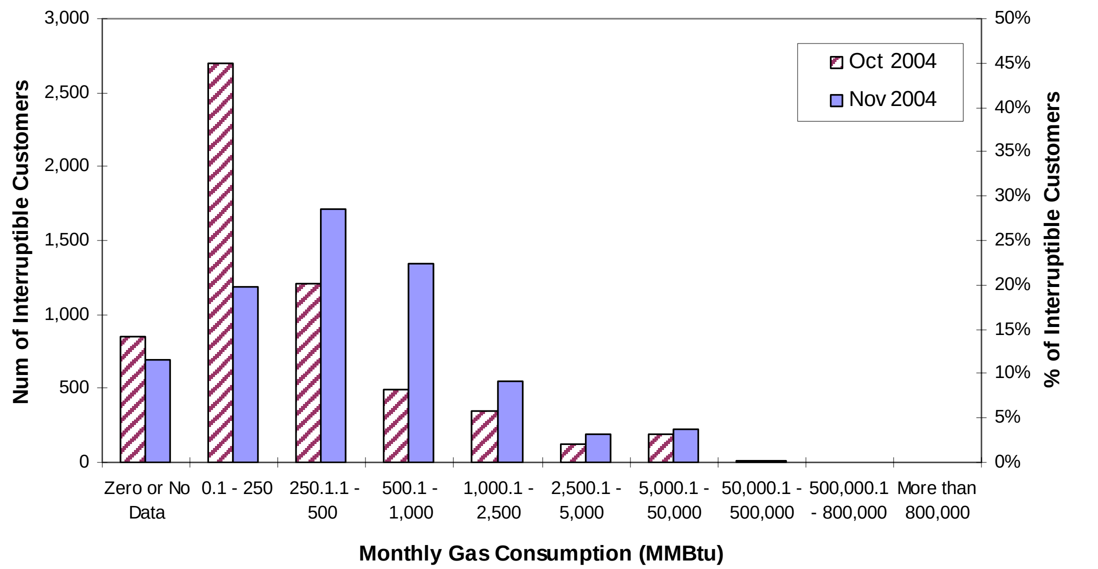
Exhibit IV-8 Interruptible Customer Profile

Data	Type of Interruptible Customer		
	Gas Sales	Gas Transportation	Total
Number of Customers	5,842	286	6,128
Percentage of Customers	95%	5%	100%
Oct 2004 Gas Consumption (MMBtu)	4,855,002	3,814,583	8,669,585
Nov 2004 Gas Consumption (MMBtu)	6,470,799	3,816,991	10,287,792
Percentage of Gas Consumption in Oct 2004	56%	44%	100%
Percentage of Gas Consumption in Nov 2004	63%	37%	100%
Average Consumption per Customer Oct 2004 (MMBtu)	831	13,338	1,415
Average Gas Consumption per Interruptible Customer Nov 2004 (MMBtu)	1,108	13,346	1,679

Source: ICF based on data submitted by the gas companies.

Exhibit IV-9 shows the distribution of gas interruptible customers in the study area based on their monthly gas consumption. In October 2004, about 45 percent of the interruptible customers consumed less than 250 MMBtu of natural gas, with another 20 percent consuming between 250 and 500 MMBtu. In the following month, as the weather turned colder, the median gas consumption in this population of customers increased from 201 MMBtu in the October 2004 to 400 MMBtu in November 2004.

Exhibit IV-9: Distribution of Gas Interruptible Customers in the Study Area based on their Monthly Gas Consumption



Note: This data only represents the information sent by the LDCs. It does not represent all interruptible customers in the NYSERDA study region.

BACK-UP FUEL STORAGE CAPACITY OF INTERRUPTIBLE CUSTOMERS

ICF matched the interruptible customers' data received from the LDCs with the storage tank database obtained earlier from NYSDEC and local county authorities. The goal of this exercise was to estimate the quantity of fuel oil storage capacity present on-site at the interruptible customers at the beginning of the heating season. The ICF team matched 2,394 customers or about 39 percent of customers in the LDC data, with exact addresses in the storage tanks data sets. The data set was filtered to identify customers with distillate or residual fuel storage by each study region. The resulting data are summarized in Exhibits IV-10 through IV-13. About 93 percent of all interruptible customers are in the NYC Metro-NY region, 6 percent are located on Long Island and the remaining in the Hudson region.

Apartment buildings constitute about 65 percent of the interruptible customers in the study area with distillate fuel oil storage capacity and 97 percent of these buildings are located in the NYC Metro-NY region. Schools are the next largest set of known interruptible customers making up about 9 percent of the interruptible customer population that have distillate fuel oil storage capacity.

ICF estimated the number of days of oil inventory held by customers based on their expected natural gas consumption over the full winter 2004-2005. The expected natural gas consumption for the months from December 2004 to March 2005 was extrapolated by applying scaling factors to October 2004 data which were estimated from statewide New York consumption data. The amount of fuel oil inventory divided by the expected daily demand provides an estimate of the winter daily demand coverage represented by the fuel oil inventory. (A description of the methodology is included in Appendix A). Exhibits IV-10 through IV-13 show the results. Exhibits IV-10 and IV-11 classify apartment buildings in the commercial sector consistent with EIA methodology and therefore use the calculated commercial scaling factors to estimate the full winter period demand.

The residential sector shows the maximum degree of seasonality in natural gas consumption with consumption in the peak winter months of January and February being considerably higher than that in October. For comparison, Exhibits IV-12 and IV-13 classify apartment buildings as residential buildings because such buildings may exhibit usage that mirrors residential usage. In this case, residential scaling factors are used to estimate full winter period demand. It should also be noted that sectoral New York state consumption data from the EIA for January 2005 were affected somewhat by interruptible customers being instructed to switch off gas, as the last half of that month was very cold. The specifics of those interruptions were as follows: KeySpan Long Island - customers were interrupted for 3 days, Con Edison - customers were interrupted for approximately 9 days, and Central Hudson - customers were interrupted for 15 days. These gas interruptions result in actual gas consumption being lower than true gas demand since some customers would have switched to alternative fuels during the interruption period.

As shown in Exhibits IV-10 and IV-11 gas sales customers with distillate oil as a back up had about 41 days worth of fuel in storage at the start of the heating season based on October and November gas consumption rate. When the larger expected winter demand is included, coverage declines in December 2004 to 19 days and to 21 days at the January 2005 rate of consumption. (Whether in fact these storage tanks are full to capacity at the beginning of the winter is unknown; we have assumed they are 100% full.) Gas sales customers with residual fuel oil as backup had similar days of coverage. Gas transport customers with residual fuel as back-up have 30 days worth of residual fuel at October rates of consumption and 21 days at November rates of consumption, but only 15 days at January 2005 rates of consumption. Gas transport customers with distillate fuel as back up had fewer days of coverage. They started the heating season with 3.2 days coverage based on October 2004 consumption rates and had 1.7 and 1.4 days coverage using the peak consumption rates during January and February 2004 respectively.

Reclassification of apartment buildings from the commercial sector to the residential sector increases their estimated gas consumption rate during February 2005 from 44 MMBtu/day to 100 MMBtu/day for buildings with distillate fuel as back-up (for the apartment building in the gas sales LDC rate class). The corresponding increase for apartment buildings with residual fuel as back up is from 34 MMBtu/day to 76 MMBtu/day. As shown in Exhibits IV-10 through IV-13 the increased consumption rates result in fewer numbers of days coverage available from the back up fuel. In February 2005, apartment buildings with distillate fuel as back up would have 8 days back up fuel coverage if they were treated as residential customers as compared to 19 days when they are treated as commercial sector customers. There is a similar decline in apartment buildings that have residual fuel as back up or belong to the gas transportation LDC rate class.

Customers on Long Island could not be categorized by site type as the tank storage database for Nassau and Suffolk counties obtained from the NYSDEC Region 1 did not have the necessary information. Hence, all Long Island customers whose addresses were a match in the storage capacity database were assigned 'Unknown' for site type. Out of the 2,394 customers that had a match, only 143 were located on Long Island. Of these Long Island customers, 138 had distillate fuel oil storage capacity and the remaining five had residual fuel oil storage capacity. Only seven customers on Long Island with distillate oil storage capacity had interruptible transportation contracts. However, these seven customers account for 95 percent of the gas volume used by the 72 interruptible transportation customers and 33 percent of the gas volume used by all 2,394 matched interruptible customers in October 2004. The seven customers have 0.4 days of back-up fuel storage capacity based on gas consumption rates in October and November 2004. This is a very low ratio of back-up capacity compared to all other categories of interruptible customers and there is some concern that the data may be suspect. If it is correct then the storage for the alternative fuel is minimal. Since customers with 'Unknown' site type were assumed to belong to the commercial sector, their gas consumption peaks in January 2005 and the fuel oil back-up capacity can cover only 0.2 days at those gas consumption rates. If these unknown customers were assumed to be in the electric sector, their gas consumption would have been lower in January 2005 as compared to October 2004. However, the fuel oil back-up capacity would still be sufficient to cover only 0.45 days of gas interruption at the January 2005 rates of consumption.

In any of the categories described above, ICF has no information about whether customers also have stand-by firm contracts with fuel oil dealers or terminals to supply the back-up fuel when required during interruptions as it is allowed under the tariffs. Therefore, any back-up fuel stored off-site in the form of firm fuel oil contracts will not be reflected in the number of days storage estimated in Exhibits IV-10 through IV-13.

Exhibit IV-10: Profile of Gas Interruptible Customers with Distillate Fuel Oil Storage Capacity by Region and Site Type (Customers Successfully Cross-referenced Between Databases)

				Avg. Daily Gas Consumption per Interruptible Customer (MMBtu/day)						Avg. Fuel Oil Storage Capacity per Customer (1000 gal)	Num of Days Storage Cap (Days)					
LDC Rate Class	NYSERDA Sub Region	Site Type	Num of Customers	Oct-04	Nov-04	Dec-04	Jan-05	Feb-05	Mar-05		Oct-04	Nov-04	Dec-04	Jan-05	Feb-05	Mar-05
Gas Sales	Hudson	Apartment Building	1	11	22	24	22	23	20	3	38	19	18	19	16	20
		Other	10	69	79	148	134	145	127	14	28	25	13	15	12	15
		School	8	17	26	36	32	35	31	9	74	47	35	38	32	40
		Utility	1	30	-	27	27	26	31	10	45	-	51	51	48	45
	Hudson Total		20	43	51	91	83	89	79	11	36	30	17	19	16	20
	Long Island	Unknown	131	16	27	35	31	34	30	12	99	60	46	51	43	54
	Long Island Total		131	16	27	35	31	34	30	12	99	60	46	51	43	54
	NYC Metro - NY	Apartment Building*	1,163	21	33	45	41	44	39	7	44	28	21	23	19	24
		Manufacturing	11	21	26	27	34	39	32	5	32	27	25	21	16	22
		Other	212	40	48	86	78	85	74	10	33	28	16	17	14	18
		Other Retail Sales	4	51	39	110	100	108	95	3	7.8	10	3.7	4.0	3.4	4.2
		School	153	19	21	40	36	39	34	10	76	68	36	39	33	41
		Utility	6	54	22	48	48	46	54	16	41	100	46	47	44	41
		Unknown	59	133	137	283	257	278	244	13	14	13	6	7	6	7
	NYC Metro - NY Total		1,608	28	37	59	54	58	51	8	38	28	18	20	17	21
Average of all Gas Sales Customers			1,759	27	37	57	52	56	50	8	41	30	19	21	18	22
Gas Transportation	Hudson	Manufacturing	3	186	262	236	289	333	278	27	20	14	15.7	12.8	10.1	13
		Other	4	81	106	173	157	170	149	120	206	158	96	106	89	112
		School	1	4	25	8	7	8	7	1	55	8.3	25.7	28.3	23.7	29.9
	Hudson Total		8	111	154	176	188	211	180	70	88	63	55	52	42	54
	Long Island	Unknown	7	5,392	4,667	11,511	10,461	11,299	9,918	14	0.4	0.4	0.2	0.2	0.2	0.2
	Long Island Total		7	5,392	4,667	11,511	10,461	11,299	9,918	14	0.4	0.4	0.2	0.2	0.2	0.2
	NYC Metro - NY	Apartment Building	34	9	17	19	17	18	16	5	81	41	38	42	35	44
		Manufacturing	2	51	39	65	79	91	76	7	19	25	15	12	10	13
		Other	7	29	19	62	56	61	53	9	44	68	20	22	19	24
		Utility	1	1	3	1	1	1	1	5	684	227	762	774	719	678
	NYC Metro - NY Total		44	14	18	27	26	28	24	6	59	44	30	31	26	33
Average of all Gas Transportation Customers			59	665	588	1,410	1,286	1,390	1,219	16	3.2	3.7	1.5	1.7	1.4	1.8
Average of all LDC Customers			1,818	48	55	101	92	100	87	8	24	21	11	12	10	13

Notes: Gas Consumption data for Oct-2004 and Nov-2004 are actual. Gas Consumption data from Dec-04 to Mar-05 is estimated using net heating degree days.

Exhibit IV-11: Profile of Gas Interruptible Customers with Residual Fuel Oil Storage Capacity by Region and Site Type (Customers Successfully Cross-referenced Between Databases)

				Avg. Daily Gas Consumption per Interruptible Customer (MMBtu/day)						Avg. Fuel Oil Storage Capacity per Customer (1000 gal)	Num of Days Storage Cap (Days)					
New LDC Rate Class	NYSERDA Sub Region	Site Type	Num of Customers	Oct-04	Nov-04	Dec-04	Jan-05	Feb-05	Mar-05		Oct-04	Nov-04	Dec-04	Jan-05	Feb-05	Mar-05
Gas Sales	Long Island	Unknown	5	58	120	123	112	121	106	28	67	32	31	35	32	36
	Long Island Total		5	58	120	123	112	121	106	28	67	32	31	35	32	36
	NYC Metro - NY	Apartment Building*	471	16	26	34	31	34	30	8	69	43	32	35	33	37
		Manufacturing	5	573	477	729	893	1,027	858	11	2.7	3.3	2.1	1.7	1.5	1.8
		Other	59	83	70	176	160	173	152	46	78	92	36	40	37	42
		Other Retail Sales	1	33	28	71	65	70	61	13	54	65	25	28	26	29
		School	13	359	145	766	696	752	660	70	27	67	13	14	13	15
		Utility	1	-	-	-	-	-	-	4	-	-	-	-	-	-
		Unknown	8	705	618	1,505	1,368	1,478	1,297	35	6.9	7.9	3.2	3.5	3.3	3.7
	NYC Metro - NY Total		558	46	46	94	87	95	83	14	42	42	21	22	20	23
Average of all Gas Sales Customers			563	46	46	94	87	95	83	14	42	42	21	22	20	23
Gas Transportation	Hudson	Other	1	320	405	683	621	670	588	20	8.7	6.9	4.1	4.5	4.1	4.7
	Hudson Total		1	320	405	683	621	670	588	20	8.7	6.9	4.1	4.5	4.1	4.7
	NYC Metro - NY	Apartment Building	12	5	11	11	10	11	9	5	140	63	66	72	67	76
	NYC Metro - NY Total		12	5	11	11	10	11	9	5	140	63	66	72	67	76
Average of all Gas Transportation Customers			13	29	42	63	57	61	54	6	30	21	14	15	14	16
Average of all LDC Customers			576	46	46	93	87	94	82	14	42	42	21	22	20	23

Notes: Gas Consumption data for Oct-2004 and Nov-2004 are actual. Gas Consumption data from Dec-04 to Mar-05 is estimated using net heating degree days.

Exhibit IV-12: Profile of Gas Interruptible Customers with Distillate Fuel Oil Storage Capacity by Region and Site Type: Apartment Buildings in Residential Sector

(Customers Successfully Cross-referenced Between Databases)

				Avg. Daily Gas Consumption per Interruptible Customer (MMBtu/day)							Num of Days Storage Cap (Days)					
LDC Rate Class	NYSERDA Sub Region	Site Type	Num of Customers	Oct-04	Nov-04	Dec-04	Jan-05	Feb-05	Mar-05	Avg. Fuel Oil Storage Capacity per Customer (1000 gal)	Oct-04	Nov-04	Dec-04	Jan-05	Feb-05	Mar-05
Gas Sales	Hudson	Apartment Building	1	11	22	34	46	53	45	3	38	19	12	9	7	9
		Other	10	69	79	148	134	145	127	14	28	25	13	15	12	15
		School	8	17	26	36	32	35	31	9	74	47	35	38	32	40
		Utility	1	30	-	27	27	26	31	10	45	-	51	51	48	45
	Hudson Total		20	43	51	91	84	91	80	11	36	30	17	19	16	20
	Long Island	Unknown	131	16	27	35	31	34	30	12	99	60	46	51	43	54
	Long Island Total		131	16	27	35	31	34	30	12	99	60	46	51	43	54
	NYC Metro - NY	Apartment Building*	1,163	21	33	65	88	100	86	7	44	28	14	11	8	11
		Manufacturing	11	21	26	27	34	39	32	5	32	27	25	21	16	22
		Other	212	40	48	86	78	85	74	10	33	28	16	17	14	18
		Other Retail Sales	4	51	39	110	100	108	95	3	7.8	10	3.7	4.0	3.4	4.2
		School	153	19	21	40	36	39	34	10	76	68	36	39	33	41
		Utility	6	54	22	48	48	46	54	16	41	100	46	47	44	41
		Unknown	59	133	137	283	257	278	244	13	14	13	6	7	6	7
	NYC Metro - NY Total		1,608	28	37	73	88	98	85	8	38	28	15	12	10	13
Average of all Gas Sales Customers			1,759	27	37	71	83	93	81	8	41	30	16	13	11	14
Gas Transportation	Hudson	Manufacturing	3	186	262	236	289	333	278	27	20	14	15.7	12.8	10.1	13
		Other	4	81	106	173	157	170	149	120	206	158	96	106	89	112
		School	1	4	25	8	7	8	7	1	55	8.3	25.7	28.3	23.7	29.9
	Hudson Total		8	111	154	176	188	211	180	70	88	63	55	52	42	54
	Long Island	Unknown	7	5,392	4,667	11,511	10,461	11,299	9,918	14	0.4	0.4	0.2	0.2	0.2	0.2
	Long Island Total		7	5,392	4,667	11,511	10,461	11,299	9,918	14	0.4	0.4	0.2	0.2	0.2	0.2
	NYC Metro - NY	Apartment Building	34	9	17	27	36	41	36	5	81	41	26	19	15	20
		Manufacturing	2	51	39	65	79	91	76	7	19	25	15	12	10	13
		Other	7	29	19	62	56	61	53	9	44	68	20	22	19	24
		Utility	1	1	3	1	1	1	1	5	684	227	762	774	719	678
	NYC Metro - NY Total		44	14	18	34	41	46	39	6	59	44	24	20	16	20
Average of all Gas Transportation Customers			59	665	588	1,415	1,297	1,403	1,230	16	3.2	3.7	1.5	1.7	1.4	1.8
Average of all LDC Customers			1,818	48	55	114	123	136	118	8	24	21	10	9	8	10

Notes: Gas Consumption data for Oct-2004 and Nov-2004 are actual. Gas Consumption data from Dec-04 to Mar-05 is estimated using net heating degree days.

Exhibit IV-13: Profile of Gas Interruptible Customers with Residual Fuel Oil Storage Capacity by Region and Site Type: Apartment Buildings in Residential Sector

(Customers Successfully Cross-referenced Between Databases)

New LDC Rate Class	NYSERDA Sub Region	Site Type	Num of Customers	Avg. Daily Gas Consumption per Interruptible Customer (MMBtu/day) Oct-04	Nov-04	Dec-04	Jan-05	Feb-05	Mar-05	Avg. Fuel Oil Storage Capacity per Customer (1000 gal)	Num of Days Storage Cap (Days) Oct-04	Nov-04	Dec-04	Jan-05	Feb-05	Mar-05
Gas Sales	Long Island	Unknown	5	58	120	123	112	121	106	28	67	32	31	35	32	36
	Long Island Total		5	58	120	123	112	121	106	28	67	32	31	35	32	36
	NYC Metro - NY	Apartment Building*	471	16	26	49	67	76	65	8	69	43	22	16	14	17
		Manufacturing	5	573	477	729	893	1,027	858	11	2.7	3.3	2.1	1.7	1.5	1.8
		Other	59	83	70	176	160	173	152	46	78	92	36	40	37	42
		Other Retail Sales	1	33	28	71	65	70	61	13	54	65	25	28	26	29
		School	13	359	145	766	696	752	660	70	27	67	13	14	13	15
		Utility	1	-	-	-	-	-	-	4	-	-	-	-	-	-
		Unknown	8	705	618	1,505	1,368	1,478	1,297	35	6.9	7.9	3.2	3.5	3.3	3.7
	NYC Metro - NY Total		558	46	46	106	117	131	113	14	42	42	18	16	15	17
Average of all Gas Sales Customers			563	46	46	107	117	131	113	14	42	42	18	17	15	17
Gas Transportation	Hudson	Other	1	320	405	683	621	670	588	20	8.7	6.9	4.1	4.5	4.1	4.7
	Hudson Total		1	320	405	683	621	670	588	20	8.7	6.9	4.1	4.5	4.1	4.7
	NYC Metro - NY	Apartment Building	12	5	11	16	21	24	21	5	140	63	46	34	30	34
	NYC Metro - NY Total		12	5	11	16	21	24	21	5	140	63	46	34	30	34
Average of all Gas Transportation Customers			13	29	42	67	67	74	64	6	30	21	13	13	12	14
Average of all LDC Customers			576	46	46	106	116	129	112	14	42	42	18	16	15	17

Notes: Gas Consumption data for Oct-2004 and Nov-2004 are actual. Gas Consumption data from Dec-04 to Mar-05 is estimated using net heating degree days.

V: INTERACTION OF THE NATURAL GAS AND HEATING OIL MARKETS

Introduction

The interaction of local natural gas and heating oil markets takes various forms. Local gas distribution companies and oil marketers compete for customers since customers with dual-fuel capabilities can switch between gas and oil to take advantage of price differences. Also, gas distribution customers with interruptible contracts enter the heating oil market when their gas service is interrupted, briefly increasing the demand for heating oil. The major question addressed in this study is how these markets interact when gas service is interrupted for selected customers. To analyze this interaction, a model of the local gas and heating oil markets was constructed and tested to determine how the markets respond.[29] The objective of the model was to understand how the markets operate when faced with incremental demand from interruptible gas customers and when no such demand exists.

Natural gas, distillate heating oil, and residual heating oil markets in the study area were modeled at the retail level only. The late submittal of the IRS data, which was discussed earlier in the report, precluded modeling the wholesale sector as well. For each market, a demand curve was constructed that describes demand as largely a function of heating degree days (HDD). The demand curve is sensitive to the relative prices for oil and gas, however, and price differences can change the quantities consumed. The supply of oil is based on the available on-site inventories, delivery capacity of marketers, wholesale terminal capacities, and import capacities. Gas supply consists of pipeline flowing gas, storage, and peak shaving. Supply *capacity* is largely fixed; supply *volumes* depend on inventories and deliveries into the region.

The base prices for gas and oil are set equal to TETCO M-3 and the New York Harbor wholesale prices to reflect outside effects such as the world price of crude oil. Then the inside effect, HDD, can drive demands to bid up prices above outside levels. The model examines how the market operates under winter weather conditions, and shows inventories, inventory draws, and fuel switching. This fuel switching is driven by economics as customers optimize their fuel choices. Mandatory gas interruptions are then introduced that force short-term, sharp increases in the demand for oil. The model chooses when to interrupt, based on the level of demand relative to supply.

The model focused on the heating season for 2002-2003. This was a cold winter, with a large number of interruptions. Using interruption rules supplied by the ICF team, the model interrupted 71 days (versus in reality 76 days[30]), with 61 of those occurring on the same days as the historical interruptions actually

[29] The details of the model can be found in Appendix B.
[30] It should be noted that the majority of days of interruption applied to only one LDC; the other LDC's in the study area had a significantly lower number of days on interruption. Further, for the one LDC, only a small portion of their interruptible load was interrupted for the noted days.

occurred. The effects of the interruptions on oil markets are seen in reductions in inventories and movements in prices that the model tracks as a consequence of gas interruptions.

Outcome of the Economic Modeling

The model was initially run without the imposition of mandated interruptions. Four demand sectors were examined; residential, commercial, industrial, and electric power generation. Residential consisted of single-family homes as data conventions placed multiunit apartment complexes in the commercial sector. Consequently, residences were assumed to use either heating oil or natural gas with no ability to switch fuels. The commercial, industrial, and electric power sectors were assumed to all have some customers who had the ability to switch between natural gas and the liquid fuels, either distillate or residual fuel oil. Although not explicitly modeled, the electric power system also had the option to purchase power from outside the study area. Additionally, there is a fleet of electric generation peaking turbines without dual fuel capability: their only fuel is distillate oil. These units are only used at the coldest points of the winter season, the same time gas interruptions occur and traditional residential heating oil demand is at its maximum peak.

Exhibit V-1 shows the demand sectors, the possible combination of fuels burned, and the daily estimated demand by each sector. Quantity units are decatherms and the price is the derived retail price. Publicly available prices are the wholesale barge and spot prices in New York Harbor. Retail prices are not published. Appendix B explains the process for converting wholesale prices to retail prices which were then used in the market modeling. The demand function coefficients show the rate of change in demand due to changes in HDD and price as the market seeks an equilibrium across the three markets. The exhibit also shows the own-price elasticities for the market sectors that have been computed. All the demands are inelastic except for demand in the electric power sector (the demand for residual fuel alone is inelastic) but the power sector also has the option of purchasing power from outside the area.

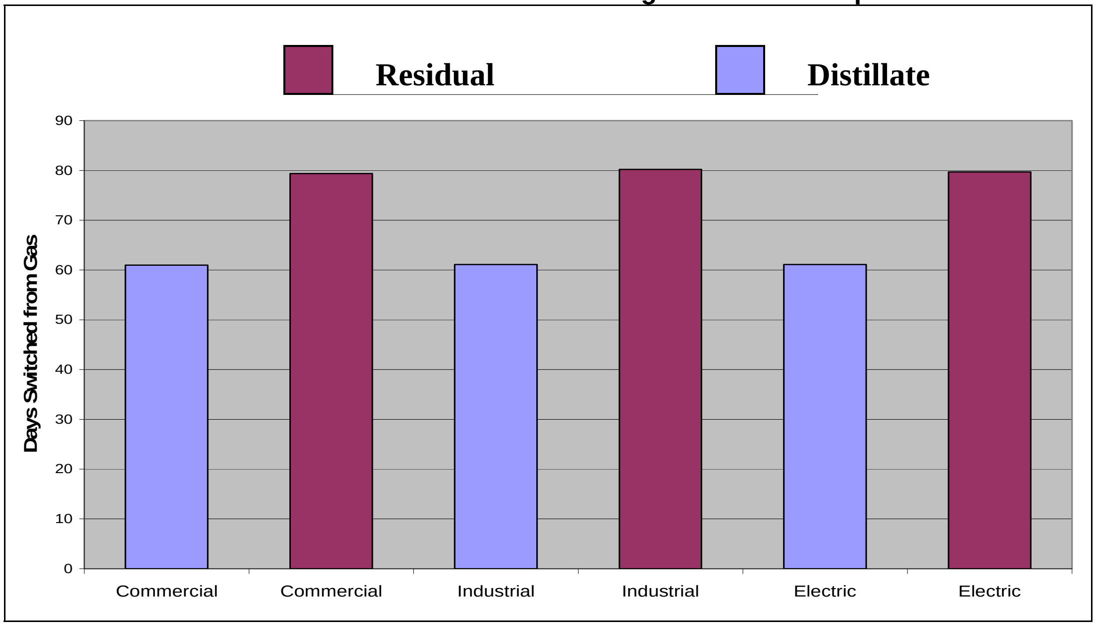
Exhibit V-1: Market Sectors used in the Simulations

Sector	Fuels Burned	Typical Consumption (Dth/day)	Demand Function Coefficients Intercept	HDD	Price	Elasticity at Means
Residential	Distillate Oil	1,415,313	241,560	38,175	-65,246	-0.52
Residential	Natural Gas	1,812,341	37,160	48,614	-8,338	-0.23
Commercial	Distillate Oil	599,568	342,892	16,185	-614	-0.57
Commercial	Natural Gas	1,064,285	150,318	33,804	-32,084	-0.31
Commercial	Residual Oil	419,047	144,079	11,312	-307	-0.35
Commercial	Gas & Dist.	176,430	51,068	5,314	-3,550	-0.40
Commercial	Gas & Resid.	106,119	20,622	3,238	-2,381	-0.32
Industrial	Distillate Oil	68,265	51,760	1,843	-97.7	-0.76
Industrial	Natural Gas	227,639	109,180	4,163	-2,274	-0.08
Industrial	Residual Oil	114,429	100,928	3,089	-215	-0.89
Industrial	Gas & Dist.	19,112	10,294	385	-144	-0.23
Industrial	Gas & Resid.	38,898	23,671	820	-75.2	-0.34
Elec. Utility	Distillate Oil	18,038	87,392	487	-196	-4.88
Elec. Utility	Natural Gas	545,982	756,133	27,147	-266,422	-1.71
Elec. Utility	Residual Oil	643,038	308,404	17,358	-656	-0.48
Elec. Utility	Gas & Dist.	3,442	8,227	148	-1,108	-2.63
Elec. Utility	Gas & Resid.	210,932	189,060	7,901	-22,484	-1.05

On the supply side, the focus is on tertiary storage as we do not have data on primary storage levels. The supply is estimated as the maximum quantity that can be supplied in a day. This is estimated based on data we received from the survey. In addition, the survey gave us information on estimated impacts on delivery time of snow and ice in a bad winter.

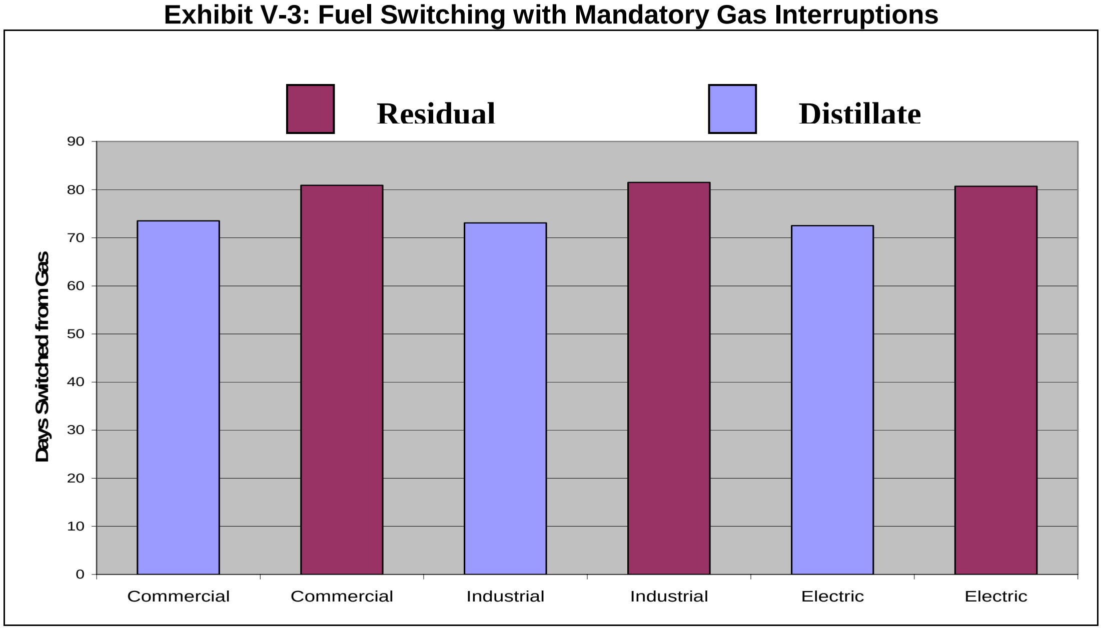
A base case was run with the model in which the nonresidential sectors were allowed to switch fuels in a cold winter but no mandatory gas interruptions were imposed. The model polls each sector that has fuel switching capabilities and lets it switch an increment of fuel demand from a higher price fuel alternative to one with a lower price. This polling and switching will continue until all customers have achieved an optimal level beyond which no further price saving is achieved. Exhibit V-2 shows the number of days switched from gas to either distillate or residual fuel. The winter modeled is the 2002-2003 heating season.

Exhibit V-2: Economic Fuel Switching from Gas to Liquids



The base case was then rerun with the actual mandatory gas interruptions overlaid. Exhibit V-3 shows the fuel switching that then occurred.

Exhibit V-3: Fuel Switching with Mandatory Gas Interruptions



There are some interesting comparisons to be made between the two exhibits. There is very little change in the days switched in the customers that switch from gas to residual oil indicating that prices would drive this irrespective. However, for those customers who can switch from gas to distillate, the days switched fell markedly, again likely driven by the price differential. Another result of all this is in the economic switching scenario, the number of predicted days in the heating season when gas demand exceeded supply jumped from 71 to 79. By not requiring switching more gas was burned, meaning that later on in the season less gas was available.

Comparing the two graphs gives a sense of what customers would do if left to themselves and if they were making the switching decision purely in response to market signals, such as price, which in turn, would reflect the availability of the various fuels. Implicitly, the model results reveal what the cross-price elasticities of the fuels are among the different customers. Single-fuel entities have no cross-price elasticity at all. They can economize during cold weather, but they cannot switch fuels. The model shows how dual-fuel entities can be expected to switch their demand in response to changes in relative prices, and they respond instantaneously. By contrast, an econometric model designed to estimate the general cross-price elasticity in the study area would find an average that would not be representative of either group. It would be too high for single-fuel users and too low for duel-fuel users. Moreover, no daily data exist that could support such a model to allow it to predict day-to-day fuel switching.

The model also tracks the number of days that each entity runs out of fuel. In both of the base cases discussed above, no entity ran out of fuel for even a fraction of a day. The sensitivity cases examined, among other things, how more severe conditions might cause consumers to run out.

These other sensitivity cases were examined:

- A once-in-a-century winter where heating season HDD was 6135 compared to an average 5167
- A delay in supplies due to bad weather. The heating oil distributors' survey told ICF that deliveries are on average reduced by 30 percent in bad weather. This is what we used in the base runs. We increased the reduction to 50 percent for a sensitivity run.

Exhibit V- 4 summarizes the results of the model runs. The statistics show the HDD and the number of days that demand exceeded supply for the three fuels. All of these runs included mandated interruptions. The third column of numbers represents the once-in-a-century winter, and the fourth column, the further delay in deliveries that cold weather causes.

The conclusions from these runs as well as the various base case runs are that generally, the volume of distillate and residual supplies at the retail level are sufficient. The model indicates that no one runs out even in the most extreme conditions. Even though the demand for residual, for example, exceeds the supply during 23 days of the once-in-a-century winter, the tertiary inventories indicated by the data can carry the users over until their tanks can be refilled.

Exhibit V-4: Summary Results from Sensitivity Runs

Statistics from 1999 Iterations of the Simulation

Entity	Minimum	Maximum	Mean	Standard Deviation	Once in a Century	Cold Reduces Supply	10 Days of Inventory
HDD	3529.00	6669.00	5167.00	408.77	6134.99	6120.42	6095.00
Days Supply Exceeded							
Gas	0.00	120.00	59.07	21.25	80.04	85.99	83.14
Distillate	0.00	21.00	2.31	2.44	6.95	17.07	6.90
Resid	0.00	40.00	9.86	5.34	22.19	27.05	21.41
Runout Days:							
Residential Distillate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercial Distillate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercial Resid	0.00	3.24	0.05	0.24	0.56	1.27	0.29
Commercial Gas & Distillate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercial Gas & Resid	0.00	6.52	0.01	0.16	0.28	0.67	0.00
Industrial Distillate	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Industrial Resid	0.00	2.90	0.07	0.26	0.69	1.26	0.49
Industrial Gas & Distillate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial Gas & Resid	0.00	2.24	0.01	0.11	0.19	0.50	0.01
Electric Utility Distillate	0.00	0.31	0.00	0.01	0.01	0.03	0.00
Electric Utility Resid	0.00	2.99	0.05	0.24	0.58	1.21	0.32
Electric Utility Gas & Distillate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electric Utility Gas & Resid	0.00	4.71	0.01	0.16	0.21	1.13	0.00

V-A. STUDY AREA HEATING OIL PRODUCT FLOWS

Introduction

This section reviews the inventory levels and product flows through the oil terminals in the study area. It is based on data received from the IRS on inventory levels, receipts, and non-bulk deliveries (truck or rail car) of different petroleum products at oil terminals'[31]. In response to a Freedom of Information Act (FOIA) request, the IRS provided aggregate monthly data (IRS data), for terminals within the study area. The IRS data cover the period June 2002 to February 2005. Exhibit V-A-1 shows the number of terminals covered by the IRS data in various regions including the study area. Data for South New Jersey (NJ) and a portion of Pennsylvania (PA) are included since these terminals may be a source of supply to the study area. South NJ covers terminals south of the New York City Metro-New Jersey region and the PA region includes terminals in and around Philadelphia.

Exhibit V-A-1 Number of terminals covered by the IRS data in each region

Study Region	Number of Terminals
Hudson	20
Long Island	13
NYC Metro-NY	26
NYC Metro-NJ	27
South NJ	11
Pennsylvania (PA)	8
Total	**105**

The analysis shown in this section uses data from April 2003 to March 2004, as this was the latest complete winter period for which data were available. Exhibit V-A-2 shows the average beginning of month inventory levels during this one-year time period for different products by region available in the IRS data. The product 'Diesel Fuel #2 High Sulfur Dyed' (226) accounts for just over half (54.1%) the total inventory in all the regions. For the purposes of this report, the product 'Diesel Fuel #2 High Sulfur Dyed' is assumed to be same as No. 2 heating oil. Other products with significant inventory levels are 'Diesel Fuel #2 Low Sulfur Undyed (167)', Jet Fuel (130), and 'Kerosene Low Sulphur Undyed (145)'. Further analysis of heating oil inventories and movements is shown later in this chapter.

[31] IRS definition of Terminal: **Terminal** means a taxable fuel storage and distribution facility that is supplied by pipeline or vessel and from which liquid products, such as taxable fuel, may be removed at a rack. However, the term does not include any facility at which gasoline blendstocks are used in the manufacture of products other than finished gasoline and from which no gasoline is removed. Also, the term does not include any facility where finished gasoline, undyed diesel fuel, or undyed kerosene is stored if the facility is operated by a taxable fuel registrant and all such taxable fuel stored at the facility has been previously taxed under section 4081 upon removal from a refinery or terminal.

Exhibit V-A-2: Average Beginning of Month Inventory Levels for Different Product from April 2003 to March 2004 (Mbbls)

		Region Name							
Product Category for Report	**IRS Product Name**	**Hudson**	**Long Island**	**NYC Metro-NJ**	**NYC Metro-NY**	**PA**	**South NJ**	**Total**	**% of total**
Diesel Fuel #2 Low Sulphur Und (167)	Diesel Fuel #2 Low Sulphur Und (167)	370	44	1,377	74	71	204	2,140	19%
Diesel Fuel #4 Dyed (153)	Diesel Fuel #4 Dyed (153)	55	0	253	109	0	9	426	4%
Heating Oil	Diesel Fuel High Sulphur Dyed (226)	952	306	3,805	587	136	328	6,114	54%
Jet Fuel	Jet Fuel (130)	11	24	837	0	0	88	961	9%
Kerosene	Kerosene High Sulphur Dyed (74)	0	0	46	0	0	0	46	0%
	Kerosene Low Sulphur Dyed (73)	-2	7	0	0	0	12	17	0%
	Kerosene Low Sulphur Undyed (145)	166	70	543	9	20	77	886	8%
Other Diesel No. 1, 2, or 4 Fuel Oil	Diesel Fuel #1 Dyed (231)	-1	0	0	0	0	0	-1	0%
	Diesel Fuel #1 Low Sulphur Und (161)	23	0	28	6	0	0	58	1%
	Diesel Fuel High Sulphur #1 Un (282)	0	0	0	0	0	0	0	0%
	Diesel Fuel High Sulphur #2 Un (283)	0	0	230	0	6	0	236	2%
	Diesel Fuel Low Sulphur Dyed (227)	149	157	13	1	0	-1	319	3%
	Marine Diesel Oil (279)	0	0	89	0	0	1	90	1%
Total		**1,723**	**610**	**7,222**	**786**	**233**	**718**	**11,292**	**100%**

Source: Aggregate data received on 12/09/2005 from the Internal Revenue Service in response to a Freedom of Information Act request dated 03/31/2005. The data is collected by the IRS using Form 720 TO, Terminal Operator Report

Exhibit V-A-3 shows the average daily non-bulk deliveries[32] by truck or rail car made by the terminals over the one year time period from April 2003 until March 2004. Heating oil deliveries account for just under half (48.1%) of all deliveries, whereas diesel fuel #2 low-sulfur undyed (167) (equivalent to on-road diesel) deliveries account for one-third (32.5%) of the total.

[32] IRS definition for deliveries via non-bulk transport carriers: **Transport carriers (non-bulk)** includes trucks or railcars delivering or removing liquid product at approved terminals and removals from terminals (other than by truck or rail) for sale or use.

Exhibit V-A-3: Average Daily Non-bulk Deliveries made from Terminals from April 2003 to March 2004 (Mbbls/d)

		Region Name							
Product Group	**Product**	**Hudson**	**Long Island**	**NYC Metro-NJ**	**NYC Metro-NY**	**PA**	**South NJ**	**Grand Total**	**% of total**
Diesel Fuel #2 Low Sulphur Und (167)	Diesel Fuel #2 Low Sulphur Und (167)	15	6	34	5	5	8	72	33%
Diesel Fuel #4 Dyed (153)	Diesel Fuel #4 Dyed (153)	1	0	3	5	0	0	9	4%
Heating Oil	Diesel Fuel High Sulphur Dyed (226)	25	15	28	24	4	9	106	48%
Jet Fuel	Jet Fuel (130)	0	2	6	0	1	1	10	4%
Kerosene	Kerosene High Sulphur Dyed (74)	0	0	0	0	0	0	0	0%
	Kerosene Low Sulphur Dyed (73)	1	0	0	1	0	0	2	1%
	Kerosene Low Sulphur Undyed (145)	2	0	5	0	1	1	8	4%
Other Diesel No. 1, 2, or 4 Fuel Oil	Marine Diesel Oil (279)	0	0	1	0	0	0	1	0%
	Diesel Fuel #1 Dyed (231)	0	0	0	0	0	0	0	0%
	Diesel Fuel #1 Low Sulphur Und (161)	1	0	0	0	0	0	1	0%
	Diesel Fuel High Sulphur #2 Un (283)	0	0	2	0	0	0	2	1%
	Diesel Fuel Low Sulphur Dyed (227)	5	2	2	0	0	0	10	4%
Total		**49**	**25**	**81**	**36**	**11**	**19**	**221**	**100%**

Source: Aggregate data received on 12/09/2005 from the Internal Revenue Service in response to a Freedom of Information Act request dated 03/31/2005. The data is collected by the IRS using Form 720 TO, Terminal Operator Report

The high inventories shown for the NYC Metro NJ terminals in Exhibit V-A.2, 64 percent of the total of all fuels, combined with the non-bulk deliveries that are consistent with the New York State terminals, highlights the important role of the NYC Metro NJ terminals in supplying the wholesale markets. The next section examines in greater detail the trends in heating oil activity at the terminals.

Non-Bulk Deliveries by Study Area Terminals into New York State

Non-bulk deliveries are defined by the IRS as sales delivered by truck or rail-car. These are different from bulk deliveries which are made by barge or small coastal tanker. Non-bulk deliveries may be directly to end users or to smaller terminals for retail distribution. Exhibit V-A-4 shows the average daily non-bulk deliveries made by terminals to the New York users over different time periods. The non-bulk deliveries are also compared with the estimated distillate demand in 2004 for the same regions. Although these deliveries could be made anywhere in the state of New York, it is likely that they are made to customers who are in close proximity to the terminal location (within a 50 mile radius) and hence, mostly within the New York portion of the study area. This assumption is made since 99 percent of the deliveries are made by truck and only one percent by rail. Hudson is the only region in the study area where rail is used as a possible transportation mode for non-bulk delivery.

Exhibit V-A-4: Average Non-bulk deliveries of Heating Oil made by Terminals in the Study Area into the State of New York (Mbbls/d)

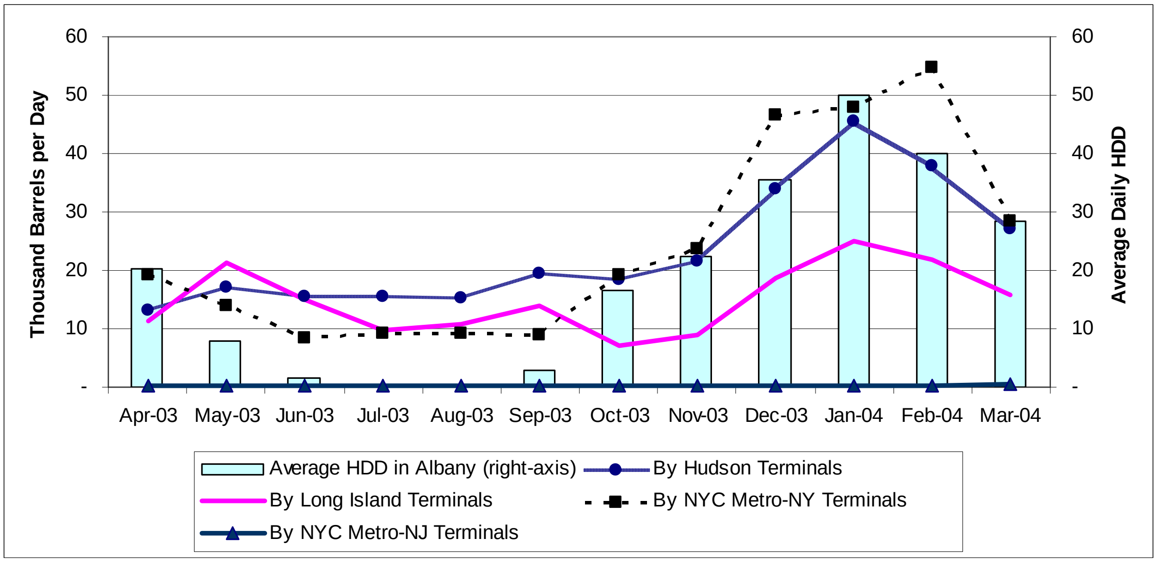
	Delivery into NY State					2004 Distillate Demand*)	Delivery Outside NY State
Time Period	By Hudson Terminals	By Long Island Terminals	By NYC Metro-NJ Terminals	By NYC Metro-NYC Terminals	Total Deliveries		By All Terminals in NY Portion of Study Area
Full Year Average (Apr 03-March 04)	23.36	14.98	0.24	24.11	62.69	95.36	2.02
Winter Months Average (Nov 03-March 04)	33.24	18.07	0.27	40.27	91.85	95.36	2.60
Highest Delivery Month (January 2004 Average)	45.62	24.98	0.26	48.01	118.87	95.36	3.88
Note:* Distillate demand taken from exhibit II-3 and includes 2004 distillate demand for Residential, Commercial, Industrial and Electric Sectors for Hudson, Long Island and NY-Metro-NY regions of the study area. It does not include Transportation demand which is assumed to be primarily on-road diesel (low-sulfur)							

Source: Aggregate data received on 12/09/2005 from the Internal Revenue Service in response to a Freedom of Information Act request dated 03/31/2005. The data is collected by the IRS using Form 720 TO, Terminal Operator Report

Several observations may be made from Exhibit V-A-4. First, very little non-bulk heating oil was delivered from the NYC Metro-NJ portion of the study area into New York State. In addition, the data show no heating oil was delivered from South NJ and PA area terminals into New York State by non-bulk transport mode. Therefore, ICF concludes that the terminals located south of the study area are not major sources of supply to the study area. Second, the New York State terminals do not deliver great amounts of heating oil outside the state. Third, the major sources of heating oil for the study area are terminals located in the NYC Metro-NY and Hudson regions. These terminals delivered about the same volume of heating oil (35 to 45 percent) during the three time periods presented in Exhibit V-A-4. The Long Island area terminals deliver about 15 to 25 percent of the total volume, depending on the time of year.

A fourth observation relates to the seasonal pattern of deliveries. As expected, deliveries made from the terminals during the winter months were nearly fifty percent greater than the average deliveries made during the summer months from April to October. Average daily deliveries in January were nearly twice the daily average for the full year. The seasonal pattern of deliveries against the average number of heating degree days is illustrated in Exhibit V-A-5. During peak winter months, the volume of heating oil deliveries can be as much as six times that in the summer months. Long Island terminals show the least amount of seasonal variation in heating oil deliveries..

Exhibit V-A-5: Average Non-bulk Deliveries of Heating Oil made by Study Area Terminals into the State of New York (Mbbls/d)

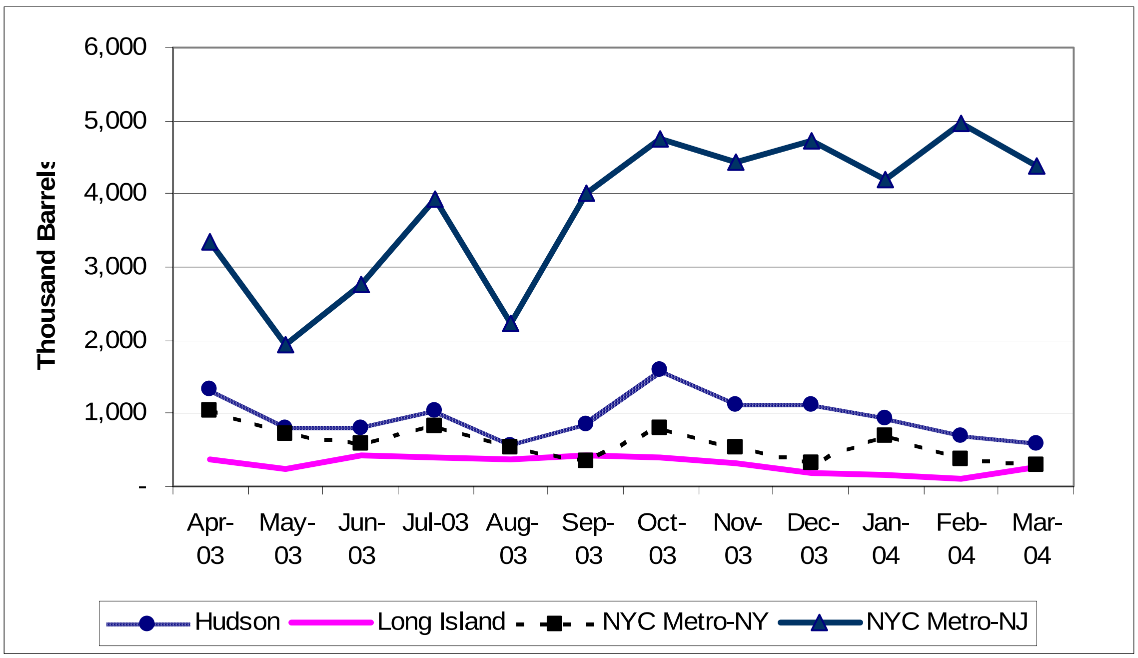


Source: Aggregate data received on 12/09/2005 from the Internal Revenue Service in response to a Freedom of Information Act request dated 03/31/2005. The data is collected by the IRS using Form 720 TO, Terminal Operator Report

Heating Oil Inventory Levels

Exhibit V-A-6 shows the heating oil inventory levels at terminals in the four study sub-regions from April 2003 to March 2004. The important wholesale role played by the NYC Metro-NJ terminals in supplying the study area is illustrated by both the size of the inventory, compared to the inventory levels at terminals in the other regions and the inventory pattern over the year. Inventory actually builds in these NYC Metro-NJ terminals during winter, just as inventory at the distribution terminals located in New York is drawn down. A majority of the volume transacted by terminals in New Jersey occurs at the wholesale level. These terminals are the endpoint for the Colonial Pipeline and have direct access to the New York Harbor, allowing the NYC Metro NJ area to act as major fuel depot for the Northeast. The NYC Metro-NJ region also includes one million barrels of heating oil stored for the Department of Energy's, Northeast Heating Oil Reserve. The three New York regions in the study area have a much lower inventory level than the New Jersey portion of the study area. Within these three regions, the Hudson terminals have the highest inventory levels, followed by NYC Metro-NY terminals, and the Long Island terminals having the lowest inventory levels. All of these regions show declining inventory during the winter months.

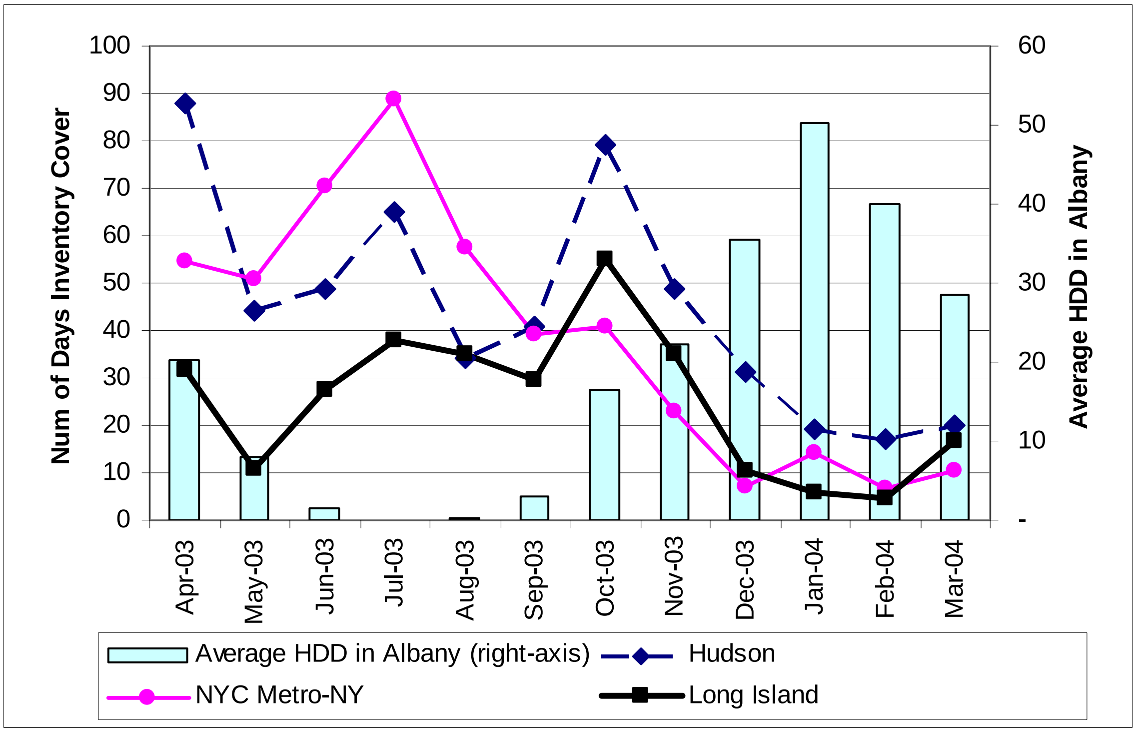
Exhibit V-A-6: Heating Oil Inventory Levels in the Study Region from April 2003 to March 2004



Source: Aggregate data received on 12/09/2005 from the Internal Revenue Service in response to a Freedom of Information Act request dated 03/31/2005. The data is collected by the IRS using Form 720 TO, Terminal Operator Report. Heating Degree data obtained from National Oceanic and Atmospheric Administration.

Exhibit V-A-7 shows the estimated number of days that the heating oil inventory held in the New York State terminals at the start of the month can cover the non-bulk deliveries made from the terminals during the same month. Relative inventory in all three New York regions increases by the start of October as terminals prepare for the anticipated cold weather. Between October and February there is a precipitous drop in the inventory cover in all three regions as temperatures decline. The inventory levels on Long Island at the start of February 2004 covered only 5 days worth of deliveries. Starting on January 9th, 2004, natural gas interruptions took place for four days in New York City and on Long Island, and for 26 days in the Hudson region (See exhibit IV-7). Consumption of heating oil by these natural gas interruptible customers would have increased non-bulk deliveries from the terminals during this period.

Exhibit V-A-7: Estimated Heating Oil Inventory Cover in the Study Area (Days)



Source: Aggregate data received on 12/09/2005 from the Internal Revenue Service in response to a Freedom of Information Act request dated 03/31/2005. The data is collected by the IRS using Form 720 TO, Terminal Operator Report. Heating Degree data obtained from National Oceanic and Atmospheric Administration.

The inventory level is lower in absolute volume as well as in the number of days of non-bulk deliveries that it can cover. Exhibits V-A-8a through V-A-8c show terminal inventory levels, receipts, and non-bulk deliveries, in each of the New York regions of the study area for the period April 2003 to March 2004. In the Hudson region, the inventory cover ranged from 88 days at the start of April 2003, to a low of 17 days at the start of February 2004. The maximum volume of heating oil stored in the Hudson region was nearly 1.6 million barrels at the start of October 2003. In January 2004, non-bulk deliveries from the Hudson area terminals were 49 Mbbls/d, the highest among the 12 months reviewed for the region.

Exhibit V-A-8a: Monthly Heating Oil Inventories and Non-bulk Deliveries for Terminals in the Hudson Region

Time Period	Inventory at Month Start (Mbbls)	Daily Terminal Receipts (Mbbls/d)	Daily Non-Bulk Deliveries (Mbbls/d)	Num of Days Inventory as per Non-bulk Deliveries
Apr-03	1,330	22	15	88
May-03	794	22	18	44
Jun-03	788	20	16	49
Jul-03	1,047	18	16	65
Aug-03	553	28	16	34
Sep-03	853	38	21	41
Oct-03	1,594	16	20	79
Nov-03	1,119	19	23	49
Dec-03	1,125	19	36	31
Jan-04	936	26	49	19
Feb-04	696	22	40	17
Mar-04	583	16	29	20

Source: Aggregate data received on 12/09/2005 from the Internal Revenue Service in response to a Freedom of Information Act request dated 03/31/2005. The data is collected by the IRS using Form 720 TO, Terminal Operator Report

In the Long Island region, the heating oil inventory cover ranged from 55 days at the start of October 2003 to a low of 5 days at the start of February 2004. The maximum volume of heating oil stored in the Long Island region was 422 Mbbls at the start of September 2003. In January 2004, non-bulk deliveries from the Long Island region terminals were 26 Mbbls/d, the highest among the 12 months reviewed for this region.

Exhibit V-A-8b: Monthly Heating Oil Inventories and Non-bulk Deliveries for Terminals in the Long Island Region

Time Period	Inventory at Month Start (Mbbls)	Daily Terminal Receipts (Mbbls/d)	Daily Non-Bulk Deliveries (Mbbls/d)	Num of Days Inventory as per Non-bulk Deliveries
Apr-03	383	59	12	32
May-03	242	47	22	11
Jun-03	421	28	15	27
Jul-03	389	18	10	38
Aug-03	381	24	11	35
Sep-03	422	20	14	29
Oct-03	406	6	7	55
Nov-03	317	6	9	35
Dec-03	199	13	19	10
Jan-04	147	15	26	6
Feb-04	107	24	22	5
Mar-04	262	10	16	17

Source: Aggregate data received on 12/09/2005 from the Internal Revenue Service in response to a Freedom of Information Act request dated 03/31/2005. The data is collected by the IRS using Form 720 TO, Terminal Operator Report

In the NYC Metro-NY region, the heating oil inventory cover ranged from 89 days at the start of July 2003, to a low of 7 days at the start of both December 2003 and February 2004. The maximum volume of heating oil stored in the region was 1,045 Mbbls at the start of April 2003. In February 2004, non-bulk deliveries from the NYC Metro-NY region terminals averaged 55 Mbbls/d, the highest among the 12 months reviewed for all the regions.

Exhibit V-A-8c: Monthly Heating Oil Inventories and Non-bulk Deliveries for Terminals in the NYC Metro-NY Region

Time Period	Inventory at Month Start (Mbbls)	Daily Terminal Receipts (Mbbls/d)	Daily Non-Bulk Deliveries (Mbbls/d)	Num of Days Inventory as per Non-bulk Deliveries
Apr-03	1,045	38	19	55
May-03	707	19	14	51
Jun-03	585	17	8	70
Jul-03	819	14	9	89
Aug-03	527	13	9	57
Sep-03	351	15	9	39
Oct-03	784	24	19	41
Nov-03	541	22	24	23
Dec-03	324	56	47	7
Jan-04	686	55	48	14
Feb-04	374	72	55	7
Mar-04	298	31	28	10

Source: Aggregate data received on 12/09/2005 from the Internal Revenue Service in response to a Freedom of Information Act request dated 03/31/2005. The data is collected by the IRS using Form 720 TO, Terminal Operator Report

VI. CONCLUSIONS

Using the existing data ICF was able to gather from the heating oil distributors and modeling the retail sector the ICF Team was able to draw some broad conclusions. Namely, that current storage capacity of distillate at the retail level appears to be adequate other than in severe extremes, such as short term periods of intense cold or when there are bottlenecks and constraints in the distribution system. Unfortunately, ICF was unable to obtain similar data on the wholesale side in a timely fashion. The IRS data does appear to indicate that this may not be true for the wholesale terminals. The IRS data indicates that coverage at the terminals in New York City and particularly on Long Island, can run very low. This combined with a general decline in petroleum capacity and the growth of natural gas interruptible customers should raise concerns.

MARKETS

Although the petroleum distribution market has been as subject to mergers and concentrations as any other part of the industry, it does remain highly competitive at the heating oil distributors end, particularly among the dealers that sell between one and two million gallons per year.

The ICF analysis suggests that interruptible customers enter the heating season with storage capacity generally adequate for meeting short term interruptions of gas supply. This may not be true of Long Island, but the data are so spotty that it is hard to draw a definitive conclusion. ICF was unable to confirm what percentages of gas interruptible customers rely solely on delivery contracts from fuel oil suppliers. That the number of interruptible customers has been increasing highlights the fact that this appears to be a contestable market; sales of gas to interruptible gas customers are sales not made by fuel oil marketers. Under these conditions, when interruptions of gas supply are implemented, these customers fall back upon their stored fuel oil, enter the fuel oil market, or both. This does not appear to cause shortages of fuel oil under normal conditions, even though it may increase the level of business activity just when oil markets are at their tightest.

The modeling shows that even if mandated gas interruptions did not occur there would be considerable fuel switching during the heating season, driven by the relative prices on a BTU basis. There does appear to be a substantial difference in the distillate and residual fuel oil markets. In an unrestricted market, gas users do switch to distillate but at a lower rate than in a market with mandated interruptions. Gas users who can use residual fuel desire to switch irrespectively.

In an unrestricted market, price is the main determinant, assuming transaction costs are low. However, there are changes coming in the fuels markets that may shift the price relationships between the three fuels. World wide demand for distillate is surging and there is intense competition for distillate on the international market. An area such as the Northeast United States that relies heavily on imports, should be aware of international demand and supply considerations that likely will impact price. Changes are also occurring in the residual fuel market, particularly in the bunker fuel sector. Likely changes will require the use of low sulfur bunkers and marine diesels by vessels along the East Coast which in turn may drive up the price of residual fuel shifting the relationship between fuels.

PHYSICAL CONSTRAINTS

The chapters in the report describing the physical infrastructure of the petroleum industry detail the changes that have occurred in demand, but also in supply storage at both the primary and secondary level.

Several large primary storage sites, with cumulative volumes of lost storage capacity[33] equaling 6.1 million barrels have closed between 1998 and 2005, and there may be further closings of major terminals. There are small retail tank farms further away from the major wholesale terminals, but many retailers do not have tanks. Rather they just use tank trucks to distribute fuels from the wholesalers.

The modeling that ICF has performed appears to indicate that the stocks of distillate are adequate at the retail level even in a quite cold winter, but that distribution constraints and bottlenecks have an immediate and substantial impact. Clearly there are events that are beyond anyone’s control that might delay shipment of product into the general area either by pipeline or marine transportation. Assuming that the stocks can get to the study area, then the problem becomes the distribution within the area.

According to the data supplied in the survey from the heating oil distributors, snow and ice reduce deliveries of supplies by 30 percent on average. Distributors maintain distribution facilities to deal with average winters, not the extremes. From an economic point of view, there is no incentive to incur costs for an expensive piece of capital equipment, such as storage facilities, that will sit idle for much of the time. In addition, anecdotal data from the dealers indicates that part of the problem is the shortage of experience and qualified drivers. ICF would tend to agree with this comment as we are aware that this is an emerging problem in several industries nation wide that requires qualified commercial drivers.

The 30 percent reduction is based on average winter conditions. However, if major wholesale terminals, or tanks continue to close, this 30 percent will be exacerbated. Tank trucks will have to travel further distances to fill up; have to contend with longer periods on the road; and have to contend with greater

[33] The lost capacity represents reduction in total ‘In-service’ and ‘Temporarily out-of-service’ capacity marked for diesel, distillate fuel oil, residual fuel oil and kerosene. It also includes storage capacity marked as “Empty”, i.e. not reserved for any specific fuel.

congestion. Note that in the modeling, the scenario with the greatest impact was the one where deliveries where constrained to 50 percent because of distribution problems.

ICF believes that the bottleneck that exists is the distribution of heating oil to customers. The closure of wholesale facilities has brought a disconnect between the point of supply and the point of demand. Rationalizing this would be difficult as any new fuel storage facility would face siting constraints due to ground water concerns and other environmental and land use priorities.

The IRS data highlights another problem. Inventory at wholesale terminals can fall precipitously low in cold winters, particularly on Long Island. If this trend is combined with increasing number of natural gas interruptible customers, and possible future closures of terminals then the area is heading towards a major problem in severe winters.

ROLE OF THE NORTHEAST STRATEGIC HEATING OIL RESERVE

The U.S. Northeast Strategic Heating Oil Reserve is stored at various commercial sites in the Northeast. One million barrels is currently stored at the Amerada Hess terminal at Woodbridge, New Jersey, with the remaining one million stored in Connecticut and Rhode Island.

Like the Crude Oil Reserve, the Heating Oil Reserve was developed to mitigate any physical shortage that might have serious consequences for U.S. safety and economic wellbeing. To date, the Reserve has never been utilized. Congressional action enabling the Reserve resulted in the inclusion of a trigger mechanism based on price that might bring drawdown. The trigger has been passed two times but the government has declined to draw down the Reserve on both occasions.

Consequently, although the Reserve is there it rarely factors into economic decisions relating to stock levels. The Department of Energy has an internal trigger mechanism based on a model relating HDD forecasts to estimated stock levels, and to the estimated spread between New York Harbor wholesale prices for heating oil and WTI. The trigger is set by the spread at a level that has only been exceeded twice in the last forty years. The aim of this trigger was to set it at a level that would have no impact on private heating oil stock decisions in the Northeast; a decision that seems to have achieved its aim.

A TRUE PHYSICAL SHORTAGE?

True physical shortages are a rarity in the oil market. Tightness in the market translates into high prices that ration the available product. From an economic point of view, if one is willing to pay the price, one can get the fuel that is needed. The analysis that has been conducted for this report has led ICF to conclude that the problems in the study area are not stock levels per se but the distribution bottlenecks in getting product to customers in severe weather.

An actual physical shortage of heating oil could occur given the right environment from a number of different scenarios. These would be:

- Sabotage or an accident to the Colonial pipeline
- Sabotage or some form of accident that prevented tankers entering New York Harbor
- A major accident at the Mid-Atlantic refineries or at other refineries that are major suppliers to the study area.
- A major crude oil supply disruption that severely impacted refineries.

The IRS data shows that a possible physical shortage could occur from a combination of a very severe winter, substantial natural gas interruptions, and the further closing of any wholesale terminals. Critical to the impact would be the timing of the event. An event in mid-summer would have much less of an impact than one in the depths of winter. Also critical would be the duration of the event. A short event may cause some upset and drive up prices but the market would stabilize quickly.

The effect of any of these events would be an immediate spike in the spot price. If the higher prices lasted for any length of time or were perceived as likely to last for a while, supplies of product would be attracted from everywhere. This certainly occurred during the 100-year winter event in New England in 1989-1990. Prices soared and, with a lag, product began arriving from around the world.