

# Distillate Fuel Oil Assessment for Winter 1996-1997

by Craig H. Cranston

Under assumptions of normal weather, demand for distillate fuel oil this heating season (October 1, 1996 - March 31, 1997) is projected to be only slightly greater than that of last winter (Table FE1). Unusually low distillate stocks, however, are expected to result in a tighter-than-normal supply situation and higher heating oil prices. This article describes findings of an analysis of the current low level of distillate stocks which are available to help meet the demand for heating fuel this winter, and presents a summary of the Energy Information Administration's distillate fuel oil outlook for the current heating season under two weather scenarios.

It showed that distillate stocks were on a generally declining path in the 1980's. This was largely because of petroleum industry downsizing and improving efficiencies in inventory management. That trend reversed in 1990, and stock levels were generally rising through 1994. Three factors are cited as possible causes of the turnaround: (1) Stocks were depressed by a series of colder than normal winters in the late 1980's; (2) the Persian Gulf War in 1990-91 may have contributed to precautionary inventory building; and (3) environmental regulations imposed by the Clean Air Act Amendments of 1990 reduced the fungibility of diesel fuel and heating oil inventories. In contrast to the shift in trend in distillate stocks, gasoline and crude oil inventories have gradually declined throughout the 1980's and the 1990's.

## Distillate Stocks

An analysis of longer term historical trends in distillate fuel oil inventories appeared in the June issue of the *Petroleum Marketing Monthly*.<sup>1</sup>

The purpose of this analysis is to provide a shorter term perspective on the exceptionally low level of distillate fuel oil inventories as

<sup>1</sup>Energy Information Administration, *Petroleum Marketing Monthly*, "Recent Distillate Fuel Oil Inventory Trends: What EIA Data Show," June 1996, DOE/EIA-0380(96/06).

**Table FE1. Distillate Fuel Oil Demand and Supply Factors, Winter (October - March) 1993-94 Through 1996-97**

Factor	History			STEO Mid Case Winter 1996-97
	Winter 1993-94	Winter 1994-95	Winter 1995-96	
Economic Growth (percent per year):				
Gross Domestic Product Growth Rate .....	2.5	3.3	1.5	2.6
Industrial Production Growth Rate.....	3.8	6.0	1.5	4.5
Average Prices:				
Imported Crude Oil (per barrel) .....	\$13.61	\$16.59	\$17.56	\$19.70
Retail Heating Oil (per gallon excluding tax).....	\$0.90	\$0.87	\$0.93	\$1.02
Diesel Fuel Oil (per gallon including tax) .....	\$1.13	\$1.10	\$1.14	\$1.23
Heating Degree-Days:				
Number:				
U.S. Average .....	4,144	3,623	4,122	3,962
New England .....	5,953	5,022	5,715	5,536
Middle Atlantic .....	5,474	4,554	5,231	5,019
Percent Difference From Normal:				
U.S. Average .....	4.6	-8.6	3.3	0
New England .....	7.5	-9.3	2.5	0
Middle Atlantic .....	9.1	-9.3	3.5	0
Supply and Demand (million barrels per day except stocks):				
Demand .....	3.35	3.30	3.44	3.46
Refinery Production .....	3.26	3.15	3.20	3.26
Net Stock Withdrawal .....	0.18	0.16	0.23	0.13
Net Imports .....	-0.08	-0.00	0.01	0.07
Stocks begin/end (million barrels) .....	131/99	145/115	132/90	112/89

Unless otherwise referenced, data in this article are taken from the following Energy Information Administration sources: *Weekly Petroleum Status Report*, DOE/EIA-0208(96-39); *Petroleum Supply Monthly*, September 1996, DOE/EIA-0109(96/09); *Petroleum Supply Annual 1995*, DOE/EIA-0340(95); *Petroleum Marketing Monthly*, September 1996, DOE/EIA-0380(96/09); *Short-Term Energy Outlook*, DOE/EIA-0202(96/4Q) and 4th Quarter 1996 Short-Term Integrated Forecasting System; and an address by EIA Administrator Jay E. Hakes on the Fall 1996 Heating Fuel Assessment before the National Association of State Energy Officials, September 16, 1996.

we enter the 1996-97 heating season, and to identify some contributing causes and potential implications of the situation.

## Background

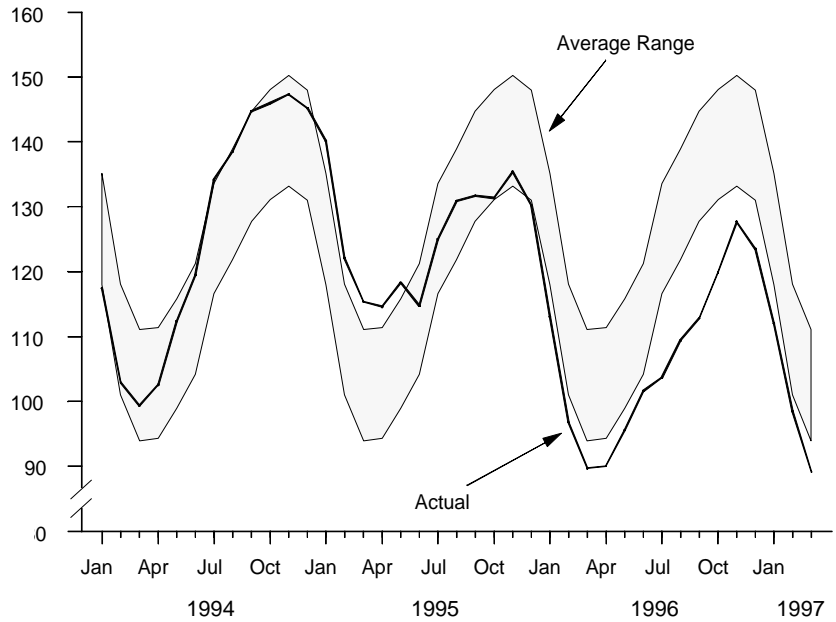
This has been a year of unusual market behavior with regard to petroleum products. Earlier this year, gasoline prices<sup>2</sup> in the United States rose sharply from \$1.08 in mid February to \$1.29 by May 17. In response to public concern, President Clinton, on April 29, asked that the Department of Energy investigate the reasons for the runup, and prepare a report on the situation within 45 days. The report,<sup>3</sup> published in June, concluded that crude oil price increases and normal seasonal gasoline price increases accounted for most of the change, but that unusual factors in gasoline markets also played a role. These unusual factors included: a late-winter cold spell causing refiners to focus longer than usual on production of distillate instead of gasoline; lower-than-normal gasoline stocks; high gasoline demand and little excess refining capacity; and persistent expectations that crude oil and gasoline prices would fall in the future, which discouraged building stocks. Now, at the beginning of the heating season, distillate fuel has replaced gasoline as the focus of concern.

## How Did We Get Here?

Distillate fuel is used for two purposes, diesel fuel and heating oil. Demand for diesel fuel is fairly stable over the course of a year, but demand for heating oil has a substantial seasonal component. Distillate stock levels are highly seasonal due to heating fuel needs in the winter (Figure FE1). Stocks are typically lowest around March, and build to a peak around November. Distillate stocks were higher than normal at the beginning of 1995 due to a warm 1994-95 winter. The excess was drawn down over the summer, and stocks were on the low side of the normal range at the beginning of the 1995-96 heating season. Stocks did not rise as they typically do in October and November, in part due to cold weather in November. Cold weather kept stocks low through the winter; distillate stocks at the end of the last heating season were 89.7 million barrels, the lowest end-of-month level since March 1967, when distillate fuel demand in the U.S. was about 70 percent of the current level.

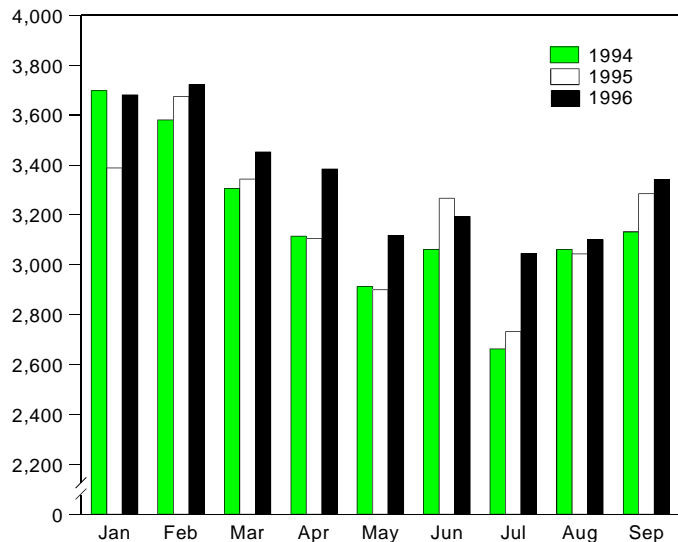
Unusually strong demand in the spring and summer of 1996, attributable in part to increasing diesel fuel consumption spurred by robust economic growth, slowed the normal seasonal rebuilding of distillate stocks (Figure FE2). A late cold spell in April drove distillate demand to higher levels than normal. This was the time of year when gasoline production should have been rising and distillate production declining. Gasoline production was

**Figure FE1. U.S. Distillate Fuel Stocks (Million Barrels)**



Note: Level and width of Average Range (the shaded band) are based on 3 years of monthly data: July 1993-June 1996. See *Weekly Petroleum Status Report*.

**Figure FE2. Distillate Demand (Thousand Barrels per Day)**



affected briefly by the need to produce additional distillate to meet demand. The late season focus on distillate became a concern to the markets because gasoline stocks were running lower than normal, and served to help increase wholesale gasoline spreads several cents over average during April. Also, diesel-driven demand was unusually high in July when distillate stock build is typically at its highest level of the year. Through September, distillate demand in 1996 has exceeded last year's demand by nearly 5 percent.

<sup>2</sup>National average retail price of regular self-serve gasoline.

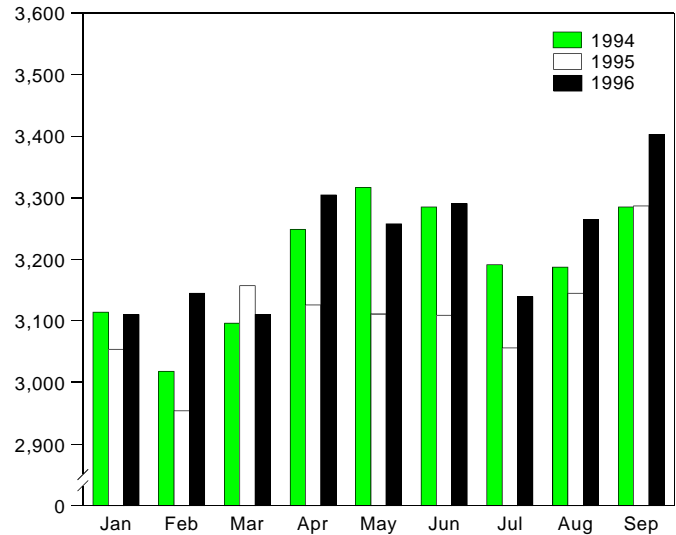
<sup>3</sup>U. S. Department of Energy, *An Analysis of Gasoline Markets: Spring 1996*, June 1996, DOE/PO-0046.

Distillate production and imports have both been strong this year, but not strong enough to rebuild stocks to more normal levels. Production has exceeded last year's January-September level by nearly 4 percent (Figure FE3). Net imports were more than 100 percent higher<sup>4</sup> than last year's January-September level (Figure FE4), but still they account for only a small proportion (less than 2 percent) of total product supplied so the magnitude of the increase in percentage terms may be misleading.

Ironically, gasoline markets in general--and gasoline imports in particular--have contributed to the low distillate stocks this year. Gasoline imports to the East Coast have been running very high this year. From January through July, gasoline imports into Petroleum Administration for Defense District 1 (PADD 1) were about 100 thousand barrels per day higher than in 1995. If a barrel of gasoline is produced in the U.S. rather than imported, it is accompanied by about half a barrel of distillate product. Thus, if the 100 thousand barrels per day of PADD 1 gasoline imports had been produced domestically, approximately 50 thousand barrels per day of distillate also would have been produced. If all of the additional distillate production went into PADD 1 inventory, stocks there might have been 10 million barrels or 33 percent higher by the end of July.

Perhaps the biggest factor discouraging stock building this year in all petroleum markets has been the persistent "backwardation" in crude oil markets. That is, the markets have continually been expecting crude oil prices to drop in the near future. If crude oil prices fall in the future, product prices follow. Figure FE5 is a depiction at four points in time of the prices of crude oil futures contracts traded on the New York Mercantile Exchange. In the spring of 1996, refiners were discouraged from building stocks of crude oil or petroleum products as current spot prices rose in the

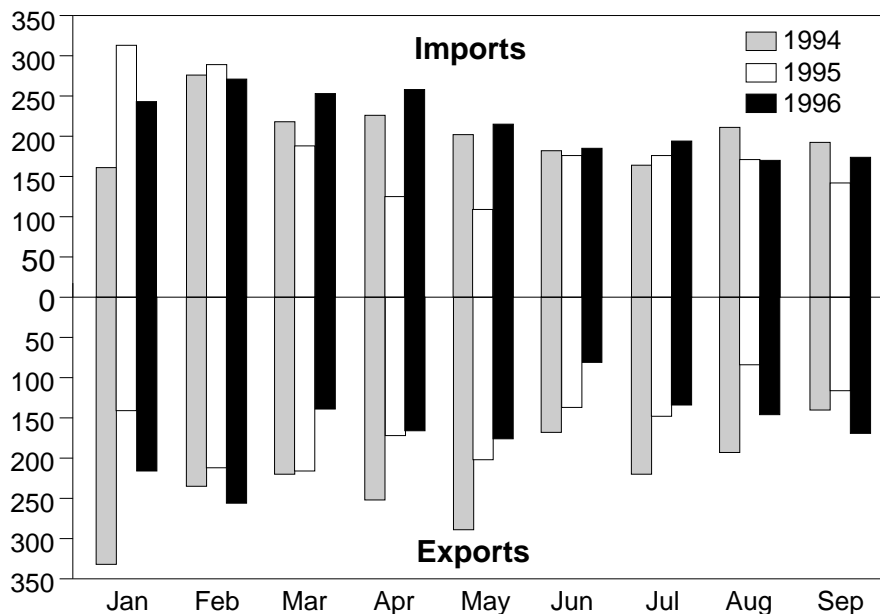
**Figure FE3. Distillate Production**  
(Thousand Barrels per Day)



face of low future prices. This situation is reflected as a "steepening" of the backwardation curves. After crude oil prices fell back, the differences between current prices and expected prices diminished, but still persisted. (New non-OPEC supplies were expected in the third quarter, but now are expected in the fourth quarter, while Iraqi sales have been postponed indefinitely.) Over the summer, distillate futures prices have been barely, if at all, above current prices. Storage of distillate under these circumstances almost guarantees a loss from the suppliers' perspective.

From the record low stock levels at the end of last winter, the distillate stock builds that occurred in May and June were typical of the builds seen in recent years (Figure FE1). The lack of storage replenishment in July, historically the biggest build month of the year, began to raise concerns. Over the past 3 years, the average July build has been 12 million barrels, but this July it was less than 5 million barrels. The replenishments in August and September were also smaller than normal. The average third-quarter stock build over the past three years has been 23 million barrels. This year, it was only 10 million barrels.

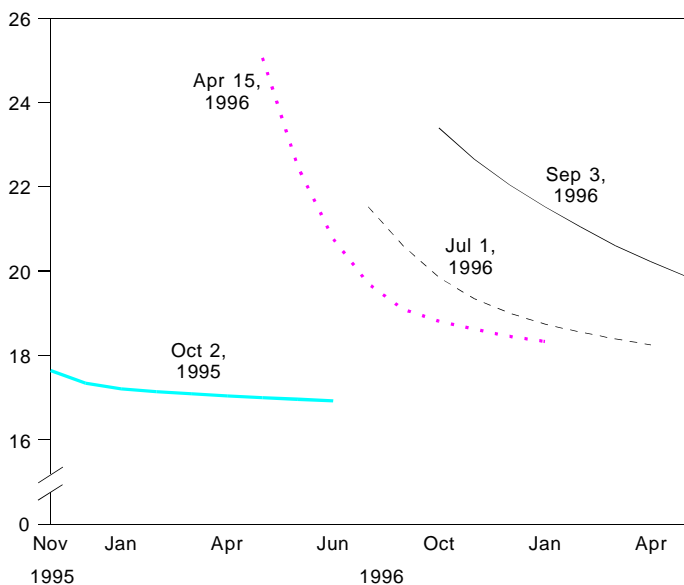
**Figure FE4. Distillate Imports/Exports**  
(Thousand Barrels per Day)



In summary, we can point to several factors that have contributed to the current low level of distillate stocks: (1) The cold snap in the spring of 1996; (2) expectations of lower crude oil prices in the future; (3) strong diesel fuel demand; (4) increased imports of gasoline; and (5) the continuing longer-term trend in the petroleum industry toward improving efficiencies in inventory management.

<sup>4</sup>Based on preliminary data for September 1996.

**Figure FE5. Crude Oil Price Expectations**  
(Dollars per Barrel)



Source: New York Mercantile Exchange.

## Where Are We Now?

As of the beginning of the current heating season, distillate stocks were at 112 million barrels. This marks the lowest level at this point of the year in EIA's monthly data series, which extends back some 40 years when distillate demand in the U.S. was about half what it is today. In terms of more recent history, distillate stocks at the end of September were 20 million barrels, or 15 percent, below the levels of last year.

The East Coast, PADD 1, represents the heating fuel capital of the United States. It accounts for most of the winter heating oil consumption in the U.S., and nearly all of the seasonal build and drawdown in distillate stocks (Figure FE6). At the end of September, total distillate stocks in the U.S. were 24 million barrels below the 3-year average September levels, and this shortfall was entirely in PADD 1. Thus, the region of the country that relies most heavily upon stock withdrawals to meet its winter distillate demand is the region with the shortfall. At this late date, it is most unlikely that the shortfall will be made up before the East Coast begins drawing down its stocks.

Within PADD 1, further insight can be gained from disaggregation of distillate by sulfur content. Prior to the Clean Air Act Amendments (CAAA) of 1990, distillate product used as diesel fuel or as heating oil was indistinguishable. The CAAA established a requirement that the maximum sulfur level of diesel fuel be reduced by 80 percent, from 0.25 percent to

<sup>5</sup>Energy Information Administration, *Petroleum Marketing Monthly*, "Distillate Fuel Oil Assessment for Winter 1995-1996," November 1995, DOE/EIA-0380(95/11).

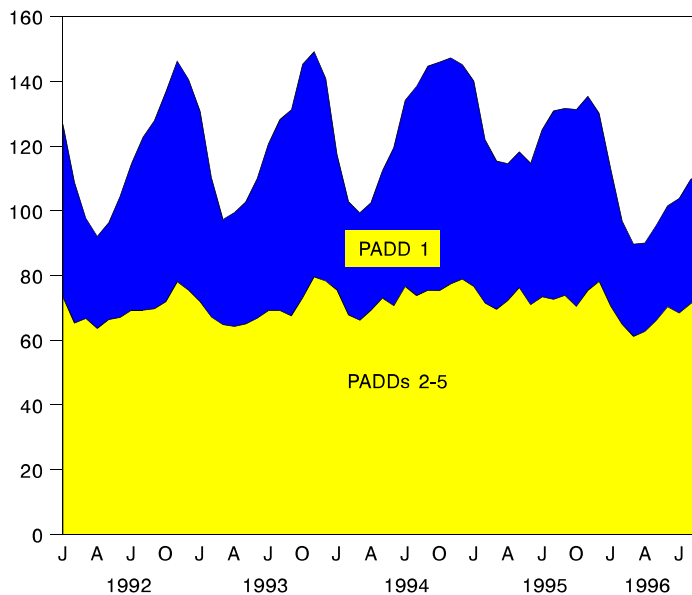
<sup>6</sup>This generality may be breaking down. There are signs that low-sulfur distillate is being used increasingly for heating.

0.05 percent by weight, as of October 1, 1993. (A fuller description of the CAAA and an analysis of supply, demand, and prices of distillate fuel by sulfur content can be found in last year's Distillate Fuel Oil Assessment.<sup>5</sup>) As a result, distillate stocks are now segregated by sulfur content, whereas they had been interchangeable prior to implementation of the CAAA. In general, stocks of high-sulfur distillate (i.e., sulfur content greater than 0.05 percent) are destined for use as heating oil, and stocks of low-sulfur distillate (i.e., sulfur content 0.05 percent or less) are destined for use as diesel fuel.<sup>6</sup> Within PADD 1, heating oil stocks account for a disproportionate share of the September distillate shortfall (Figure FE7). In the years since the CAAA went into effect, high-sulfur distillate stocks in PADD 1 as of the end of September have exceeded 70 percent of the total; this year high-sulfur stocks account for only 62 percent of the total.

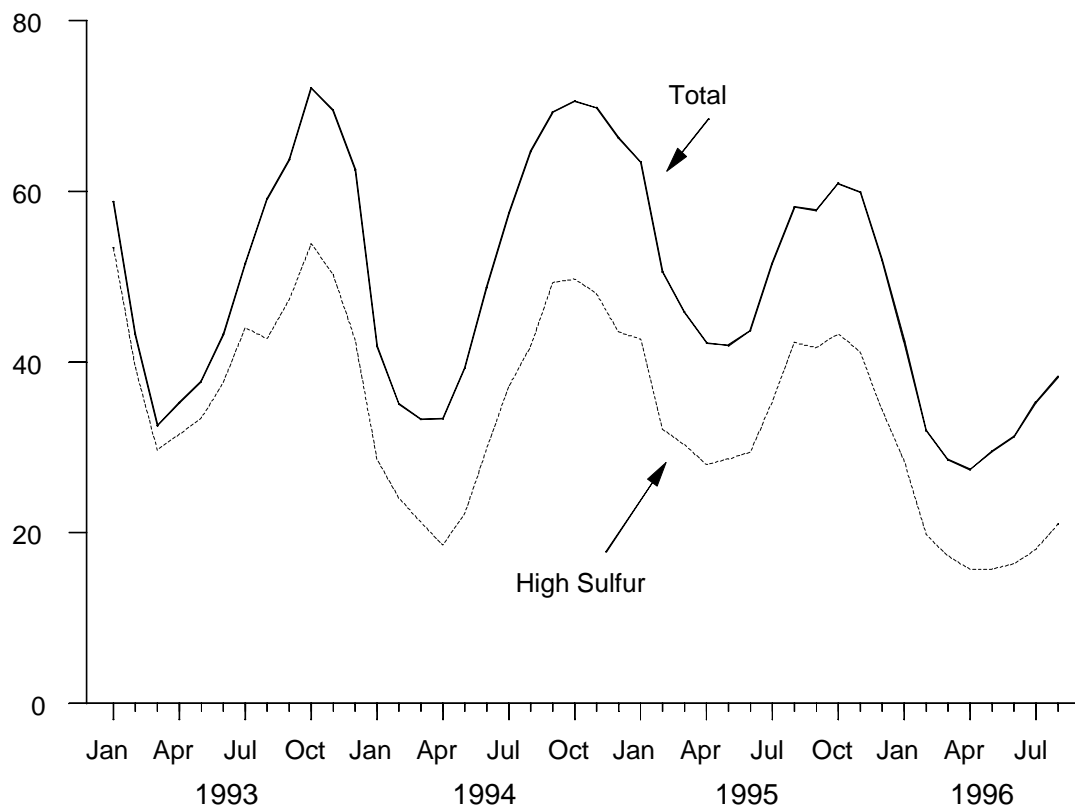
Current prices are beginning to reflect the market's focus on distillate. Spot distillate prices crossed over gasoline prices on August 21 and have continued to strengthen (Figure FE8). Crude oil prices have remained above \$21 per barrel (for West Texas Intermediate) since the beginning of August, as world stock rebuilding has been occurring, keeping demand higher than it normally would have been over the summer months than if we had begun the year with normal stock levels. The early-September military activity in Iraq has, of course, caused additional price volatility and overall upward pressure, due to the indefinite postponement of Iraqi "oil-for-food" sales and uncertainty about further disruptions in the region.

Both crude oil and petroleum product prices currently stand well above year-ago levels. As of September 30, the spot price of WTI crude oil was almost \$7 per barrel higher than at the same point in 1995, while regular gasoline at New York Harbor was up 6 cents

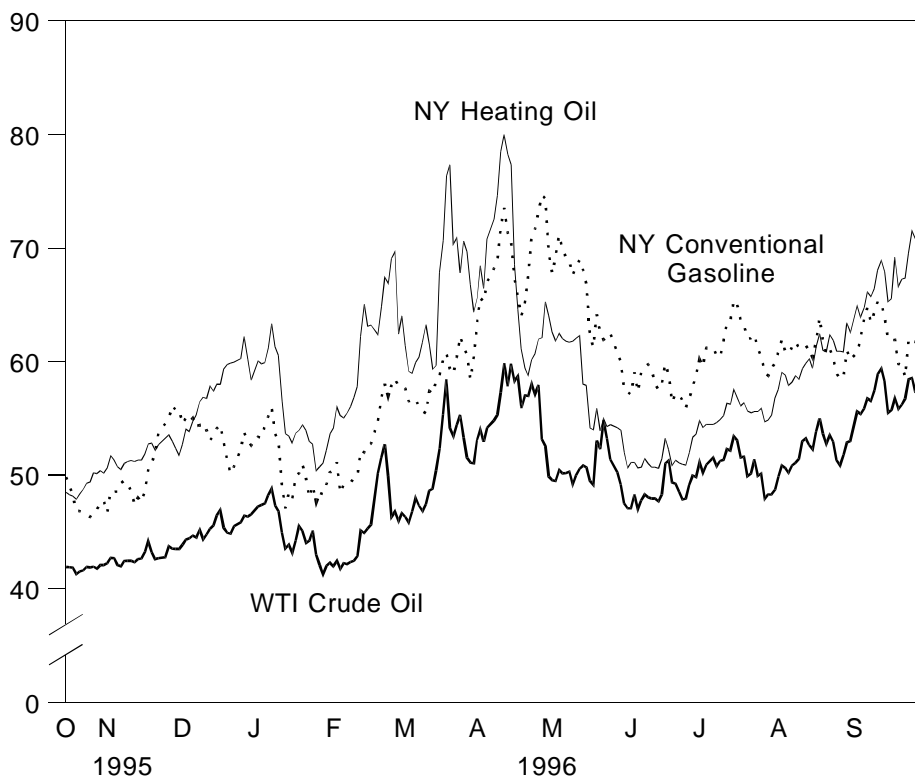
**Figure FE6. Distillate Stocks**



**Figure FE7. PADD 1 Distillate Fuel Stocks**  
(Million Barrels)



**Figure FE8. Spot Crude Oil, Gasoline, and Heating Oil Prices**  
(Cents per Gallon)



Source: Reuters News Service.

per gallon, and No. 2 heating oil was up 23 cents. Some of the recent price rise is due to the Iraqi situation, and may be temporary, but upward price pressure already existed before this arose. Retail prices have also begun to reflect recent increases at the wholesale level. Retail regular gasoline, after falling about 9 cents from its spring peak, has flattened at about \$1.20 per gallon nationally, while diesel fuel reached a low at the end of June and has since risen about 12 cents per gallon.

## Winter Outlook

This outlook summarizes distillate fuel oil supply and demand for the current heating season. Two projections are provided: (1) A base-case scenario, which assumes normal winter weather patterns; and (2) a severe-weather scenario, in which the January-to-March 1997 quarter is assumed to average 10 percent colder than normal, in terms of heating degree days. These projections are derived from simulations of the Short-Term Integrated Forecasting System (STIFS) model, which is used to produce the Energy Information Administration's quarterly *Short-Term Energy Outlook*. In addition, two topics related to the forecasts are addressed: the circumstances surrounding some historical cold snaps of shorter duration, and the effect of sharply increased distillate imports.

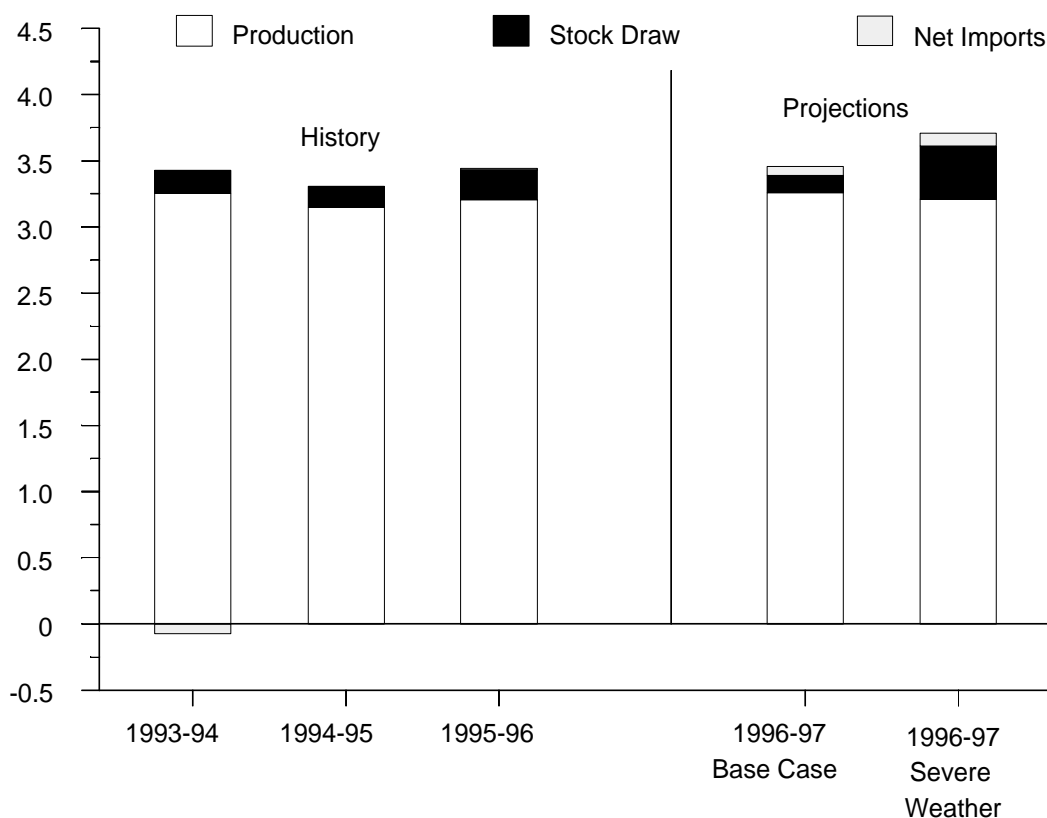
## Where Are We Heading?

### Base-Case Scenario

The Energy Information Administration projects only a slight increase in demand for distillate fuel oil in the current heating season. With healthy growth in projected industrial production boosting diesel demand, muted by an assumption of normal, warmer weather than last winter reducing heating oil demand, overall distillate consumption is projected to increase by 0.5 percent from last winter, to 3.46 million barrels per day (Table FE1 and Figure FE9). The effects of warmer weather compared to last year are expected to offset some of the continued growth in the dominant transportation sector in determining total distillate fuel demand. In the first quarter of 1997, heating oil demand is actually projected to decline slightly from the same period last winter.

At the beginning of the 1996-97 heating season, distillate stocks were 112 million barrels, 15 percent lower than at the same point last year. Given this exceptionally low level of stocks, the outlook is for sharply reduced reliance on stock withdrawals to meet the heightened heating season demand. Stock withdrawals this winter are projected to be 130 thousand barrels per day, in sharp contrast to 230 thousand barrels per day last winter. While so low a level of heating season stock withdrawals is not without historical precedent, it is substantially below the average over the past ten years of nearly 200 thousand barrels per day.

**Figure FE9. Winter Distillate Supply/Demand**  
(Million Barrels per Day)



Note: Net Imports in 1994-95 and 1995-96 were so small that they are imperceptible in this figure. See Table FE1.

This 44 percent drop from last winter in projected stock withdrawals is offset by increased refinery production and net imports of distillate fuel. In absolute terms, the magnitude of these two increments is roughly equal, with each of them contributing about 60 thousand barrels per day over the levels of last winter. In relative terms, however, they are markedly different. The projected increase in refinery production is small, amounting to only 1.7 percent. The projected increase in net imports is huge, amounting to 600 percent, because net imports last winter were barely above zero. Two years earlier, in the winter of 1993-94, the U. S. was a net exporter of some 80 thousand barrels per day of distillate fuel. This winter, the U.S. is projected to be a net importer of 70 thousand barrels per day.

Retail heating oil prices are expected to be higher than last winter, reflecting the combined effects of higher crude oil prices and lower distillate stocks. Heating oil prices are projected to average more than \$1.00 per gallon this heating season, an increase of 10 percent over last winter (Figure FE10). This would make average heating oil prices this winter the highest since 1990-91, when crude oil prices were driven up by the Persian Gulf War. With the assumption of normal weather, distillate demand levels in the first quarter of 1997 are projected to be slightly lower than in the colder first quarter of 1996. This factor, combined with lower expected crude oil prices, leads to a decline in projected heating oil prices by the end of the heating season to about the same level as last winter.

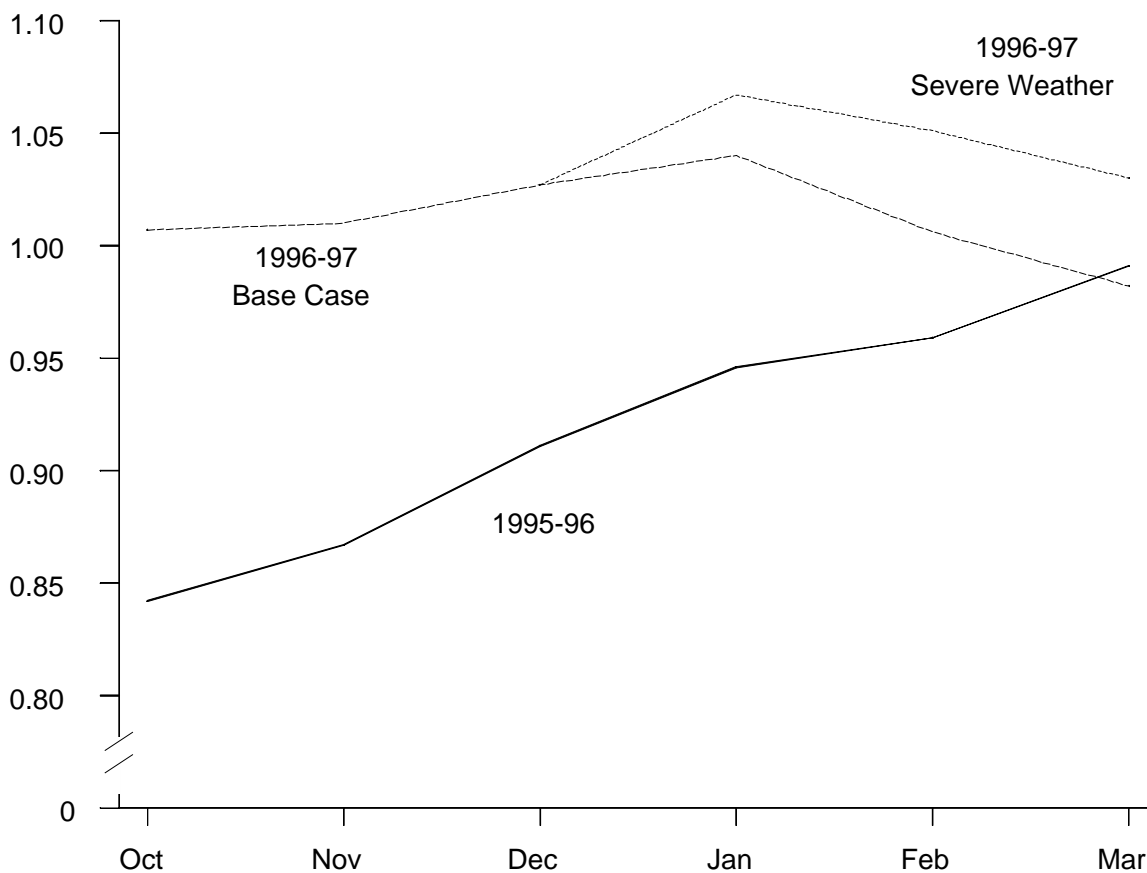
This forecast scenario depends on rapid growth in distillate fuel oil stocks during the fourth quarter. The model projects a net stock build in the fourth quarter of 11 million barrels; on average over the past three years, distillate stocks have been unchanged in this quarter. This scenario also depends on readily available imported distillate fuel, principally on the East Coast.

### Severe-Weather Scenario

This scenario assumes that weather, in terms of heating degree days, is 10 percent colder than normal for the entire January-to-March quarter. To derive the alternative case, this percentage deviation was proportionally distributed throughout the quarter and applied to the nation as a whole and to the Northeast, the prime market for heating oil.

Distillate fuel demand for the first quarter of 1997 averages 3.71 million barrels per day in the severe-weather case, higher than the base-case projection by 120 thousand barrels per day, or about 3 percent (Table FE2 and Figure FE9). In absolute terms, refinery production would absorb the largest share of the increased demand, rising by 60 thousand barrels per day over the base case. But this represents an increase of only 2 percent over the base case production level. In relative terms, imports would absorb the largest share of the increased demand. In the severe-weather scenario, net imports rise to 100 thousand barrels per day, 67 percent higher than in the base case. Stock withdrawals would

**Figure FE10. Winter Retail Heating Oil Prices**  
(Dollars per Gallon)



**Table FE2. Distillate Fuel Oil Demand and Supply Factors Under Alternative Scenarios, First Quarter, 1996 - 1997**

	1Q 1996	1Q 1997 Base Case	1Q 1997 Severe Weather
Demand/Supply (million barrels per day except stocks)			
Demand .....	3.62	3.59	3.71
Refinery Production .....	3.12	3.15	3.21
Net Stock Withdrawal.....	0.44	0.38	0.40
Net Imports .....	0.05	0.06	0.10
Stocks begin/end (million barrels).....	130/90	124/89	124/88
Price (dollars per gallon)			
Retail Heating Oil .....	0.96	1.01	1.05

increase by 20 thousand barrels per day, resulting in stocks of 88 million barrels at the end of the heating season, about the same level as in the base-case forecast and at the end of last winter. The retail price of heating oil in the severe-weather scenario would average \$1.05 per gallon, 4 cents higher than the base case, and 9 cents higher than in the first quarter of 1996 (Figure FE10).

**A Few Caveats**

There are clearly some limitations and uncertainties in the forecast scenarios described above. Two of them, the characterization of severe weather and the impact of increasing dependence on imported distillate fuel, are addressed here.

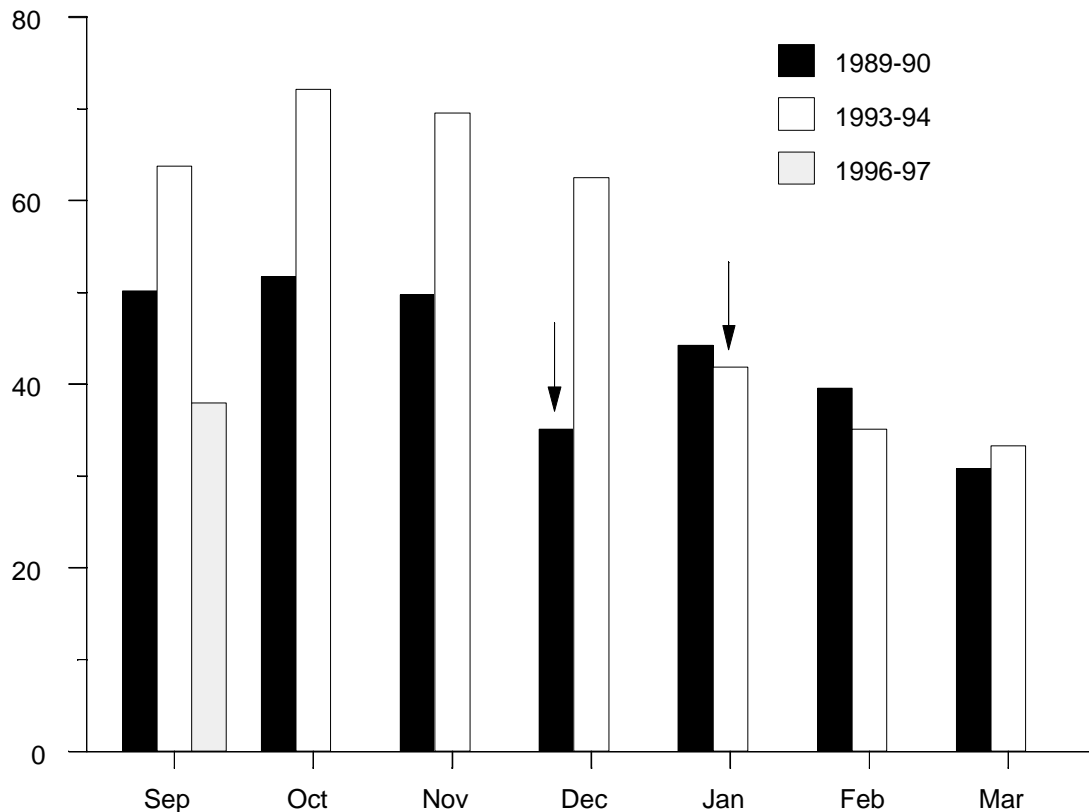
The severe-weather scenario provides valuable insight into the overall effects of a cold winter. However, Mother Nature rarely

gives us consistently cooler-than-normal weather over a period as long as 90 days on a nationwide basis. Instead, cold snaps are generally greater in severity, shorter in duration, and more regional than national in scope. Our forecasting resources do not enable us to examine the effects of an occurrence of cold weather that might be more typical in these respects. What we can do instead is look at some particularly cold months in recent history, with a focus specifically on the East Coast (PADD 1), and compare them

to the circumstances of the current heating season.

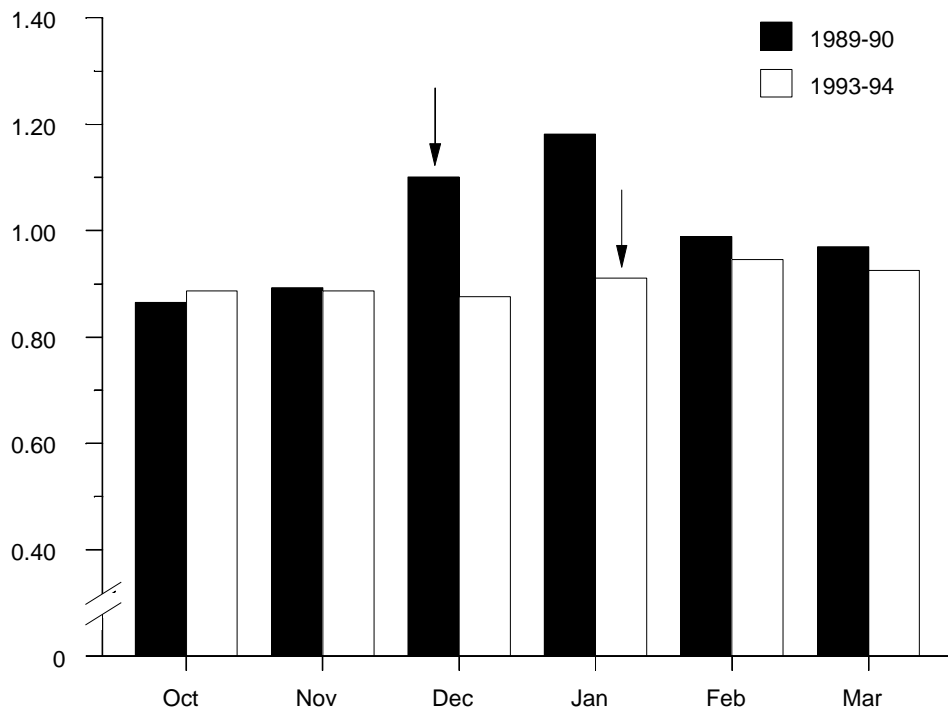
December 1989 and January 1994 brought some particularly frigid weather to the Eastern U.S. In terms of heating-degree days, PADD 1 was 38 percent colder than normal in December 1989, and 15 percent colder than normal in January 1994. PADD 1 distillate stocks and prices in these sample winters are depicted in Figures FE11 and FE12. Both of these sample winters entered the heating season with substantially greater end-of-September PADD 1 stocks than are available this year, particularly in 1993-94. In December 1989, PADD 1 distillate stocks were drawn down by nearly 15 million barrels, and retail heating oil prices shot up by 21 cents per gallon from the prior month. In January 1994, stock withdrawals were even greater (nearly 21 million barrels) but from a much higher stock level. The heating oil price increase was only 3.5 cents, barely more than the normal

**Figure FE11. East Coast Distillate Fuel Stocks in Selected Winters**  
(Million Barrels)





**Figure FE12. East Coast Retail Heating Oil Prices in Selected Winters**  
(Dollars per Gallon)



seasonal price increase in January. If there is a moral that can be drawn from these two stories, it would be that higher East Coast distillate stocks effectively cushion the price impact of a particularly severe cold snap. As of the beginning of the current heating season, that cushion is a very small one.

In the context of this discussion of weather, it should be noted that the National Oceanographic and Atmospheric Administration (NOAA) forecasts warmer-than-normal temperatures in the Eastern United States during the January-March 1997 quarter. In particular, NOAA projects that temperatures throughout New England and the Middle Atlantic States will be, on average, 5-10 percent warmer than normal.<sup>7</sup> Given the low level of heating oil stocks in PADD 1, it will be good news indeed if this forecast comes to pass.

The second area of uncertainty relates to the impact of the sharply increased reliance on net imports to meet our projected distillate demand this winter, particularly in the severe-weather scenario. To recap, net imports in the base case are projected to rise from 10 thousand barrels per day last winter to 70 thousand barrels per day this winter (Table FE1). In the severe-weather scenario, they are

projected to average 100 thousand barrels per day in the first quarter of 1997 (Table FE2). Net imports are the aggregate of two components, exports and imports.<sup>8</sup> Both of these components will be subject to dramatic change from last winter's levels if these projected levels are to be attainable.

Distillate exports are almost entirely out of the West Coast and Gulf Coast. Destinations are predominantly in the Pacific Rim, South and Central America. Through September, they have averaged 165 thousand barrels per day in 1996. Prices of distillate in the U.S. will be subjected to upward pressure if exporters are to be persuaded to market their product domestically instead.

Distillate imports come predominantly from Canada, the Virgin Islands, and Venezuela. Over 90 percent arrive in the U.S. on the East Coast. Through September, they have averaged 218 thousand barrels per day. Even in the base

case, but particularly in the severe-weather scenario, sharply rising U.S. imports will tighten Atlantic Basin supply and exert upward pressure on distillate prices. The East Coast competes primarily with Europe for distillate imports. At the beginning of the current heating season, European distillate stocks were unusually low, just as they were in the U.S. Moreover, distillate prices in Europe were several cents per gallon higher than in this country stimulating an increase in exports from the U.S. to Europe. Prices in the U.S. and Europe will have to converge if they are to compete for imports on equal terms. In the course of the winter, if cold snaps hit both sides of the Atlantic simultaneously, the demand for imports could cause short-term price spikes substantially higher than EIA's forecasts for the winter in either the base case or the severe-weather scenario. Also, cold weather in the U.S. typically means cold weather in Canada, our primary source of distillate imports, exerting further price pressure in Atlantic Basin markets.

On the other hand, we may experience a mild winter on both sides of the North Atlantic, with abundant distillate supplies and softening prices....

<sup>7</sup>Source: Climate Prediction Center, National Oceanographic and Atmospheric Administration, Climate Outlooks Release Date October 17, 1996, accessible via Internet at [http://nic.fb4.noaa.gov:80/products/predictions/multi\\_season/13\\_seasonal\\_outlooks/color/page3.gif](http://nic.fb4.noaa.gov:80/products/predictions/multi_season/13_seasonal_outlooks/color/page3.gif)

<sup>8</sup>Some truths are self-evident.

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