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**DISTILLATE FUEL OIL:
CHANGING MARKET PATTERNS**

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The distillate oil market has changed in recent years, with a lower share of distillate oil used in the residential heating sector and a substantially larger share in diesel transportation. This has resulted in a less pronounced seasonal fluctuation in overall demand. Inventory holding, too, has changed, with a lower share held in bulk terminal facilities and a higher share at refineries and in pipelines. Other changes have affected the price of distillate oil which has dropped sharply this year, directly and relative to natural gas. This report discusses these developments and the outlook for distillate oil supply and demand in the current heating season and to 1990.

A. EXECUTIVE SUMMARY

o Distillate heating oil consumption has declined substantially since the late 1970's. The principal reason is the combined effect of (1) a reduction in the number of oil heated housing units brought about by a low oil-heat share in newly built housing, conversions from oil to gas and demolitions/abandonments, and (2) a 25% (330 gallon) decline in heating oil consumption per home between the 1975/76 and the 1985/86 heating season.

o While heating oil demand for distillate declined, transport demand--diesel fuel use--has grown steadily. In 1985 it accounted for 39% of total distillate demand while heating oil stood at 26%. Prior to 1980 heating oil's share had always been the larger.

o As a result of the above changes the seasonal swing in total distillate demand has been greatly reduced. In 1985 the peak monthly demand was 20% above the annual average and the lowest monthly demand 15% below the average. In 1980 the comparable percentages were 39% and 24%.

o Distillate imports peaked at 9% of total supplies in 1984, declined to 7% in 1985 and rose to 8% in the first nine months of 1986. Nearly all imports come to the East Coast (PAD 1), where they accounted for 19% of total supplies in the January to September 1986 period. Given the relatively high domestic refinery operating rates in 1986, some of these imports may have supplemented rather than displaced domestic supplies.

o The volume of peak distillate stocks has fallen considerably. On a days-of-supply basis, the lowest inventory level in 1985 was equal to 35 days of consumption, the highest to 45 days. Ten years ago the figures were 50 and 91 days respectively. Most of the decline has occurred since 1980.

o Since 1980 there has been a shift in distillate inventory holdings from bulk terminals to refineries and pipelines. In 1980 bulk terminals carried 57% of total stocks at the end of the year, in 1985 50%. Part of the reason is the decline in waterborne deliveries and the corresponding increase in pipeline shipments.

o During the current heating season supplies should be fully adequate even though the weather is likely to be colder than during the previous season. End-November stocks were 8% above the year-ago level. Refinery output of distillates is below capacity while recent import levels were relatively low and could quickly be raised, if required, given the relatively high level of foreign stocks.

o Crude oil cost accounted for 60% of the end-user price of distillate oil in 1985 and 40% in 1986. The crude price decline has been fully passed on to consumers. The average U.S. city consumer price of 73 cents/gallon in October represented a drop of \$14/Bbl from the previous October. The same is true for diesel fuel prices. For U.S. city consumers the average cost of oil heating is now for the first time below that of gas heating.

o In New York State the average heating oil price in the last quarter of 1985 was 12-13% higher than the average gas heating cost, but is probably 20-25% lower than gas in the current quarter. An increase in crude prices to OPEC's \$18/Bbl target would not end heating oil's new price advantage over gas heat.

o Distillate demand has so far not reacted sharply to the 1986 price drop. The 1.8% increase in the January to November period in comparison to 1985 is substantially below the demand increase for the other major products. A greater price response in this heating season is likely, however.

o Distillate demand is expected to grow by 10% between 1985 and 1990 to reach 3.2 million B/D in the latter year. The principal contributor to the growth will be the transportation sector. Industrial use and use for electric power generation will also grow while heating oil demand will remain flat, following its decline through the first half of the 1980's.

B. DISTILLATE DEMAND AND SEASONALITY

Displacement of heating oil by other fuels and residential fuel conservation have substantially reduced the volume of

heating oil consumed, as well as its share of total distillate oil demand.

- The share of new one-family homes heated with oil has fallen from about 10% of completions nationwide in the last half of the 1970's to 2-3% in the first half of the 1980's.

Several factors were important in reducing the share of new homes heated with oil. Economic and population growth, and thus new home construction, was taking place outside the Northeast, the only region where heating oil has an appreciable share of the new home market. Furthermore, the number of new homes completed annually fell because of slower overall economic activity and rising interest rates, factors which quickly impinge on construction activity. The cost of installing an electric or gas heating system is lower than that of an oil system, a major consideration for the commercial builder. Oil price and perceived availability of oil were also constraining factors during the late 1970's and early 1980's.

As shown in Table I, about 100,000 oil heated *single family*

~~oil heated home completions~~
registered a drastic further decline, averaging only 21,000 annually. The break took place directly after the sharp price increases and sporadic gasoline shortages of 1979. Whether the increase in oil-heated home completions in 1985 reflects a trend reversal remains to be seen. However, the cumulative experience of five years of plentiful supplies and declining prices, the sharp further price decline in 1986 and the recent increase in

the Northeast's share of U.S. home completions may provide the base for it.

TABLE I
COMPLETIONS OF SINGLE FAMILY HOMES AND
SHARES BY HEATING FUEL, 1975-1985

	<u>Total U.S.</u> (Thousands)	<u>Gas</u> (%)	<u>Electricity</u> (%)	<u>Oil</u> (%)	<u>Other/None</u> (%)
1975	875	40	49	9	2
1976	1034	39	48	11	2
1977	1258	38	50	10	2
1978	1369	37	52	8	3
1979	1301	39	51	7	3
1980	957	41	50	3	5
1981	819	41	50	2	7
1982	632	40	50	3	8
1983	921	44	49	2	6
1984	1025	45	48	2	5
1985	1072	43	49	3	4

Source: U.S. Department of Commerce and U.S. Department of Housing and Urban Development.

- Competition resulted in rapid conversions from oil heat to gas heat. Although the rate of conversion has now abated, the converted homes remain on gas.

Conversions from oil to gas peaked in 1980, when nearly 500,000 housing units were converted, according to gas industry data. In recent years, annual conversions have averaged 110,000 units. Between 1975 and 1985, an estimated 1.7 to 2.0 million homes were converted from oil to gas. (A small share of these units were heated with kerosene or residual fuel oil).

As a result of these conversions and the lower share of new oil heated units, the number of oil-heated residential units declined from 16.8 in 1975 million to less than 13 million in 1985. (Oil-heated homes also tend to be older than gas or electricity heated homes and thus have a higher rate of abandonments, demolitions and other removals from the inventory.)

- The average use of heating oil per customer nationwide has fallen more than 25% between the mid-1970's and the mid-1980's, and has fallen even more rapidly in the North East.

In the 1975-76 heating season, consumption of distillate averaged 1250 gallons per residential customer nationwide. The oil-heat regions use more: in New England, average consumption was about 1320 gallons and in the Mid-Atlantic region, 1570 gallons. The higher consumption in the Mid-Atlantic region is not a function of degree days in that region, which are lower there than in New England, but of home size and income. By the 1985-86 heating season, average consumption per residential customer had fallen to 915 gallons nationwide, to 935 in New England and about 1045 in the Mid-Atlantic region. In each case, the drop in consumption per degree day was slightly faster than the drop in consumption per customer.

Three developments which contributed to the declines in heating oil from 1979-83 have recently either slowed or reversed: 1) added insulation (both new and retrofit), 2) lowered thermostats, and 3) use of supplements such as wood stoves and kerosene heaters. With the lower prices experienced in 1986, there is now much less incentive for continuation of these conservation effort.

C. THE TRANSPORTATION MARKET'S RISING SHARE

- Sales to weather-sensitive markets have fallen to 25-30% of total annual distillate fuel demand. During the heating season they may reach 40% of total distillate demand. The major market for this product during all seasons is now diesel consumption for transportation.

According to Department of Energy data, residential uses of distillate fuel for space and water heating accounted for 16% of

total distillate demand in 1985, and commercial heating uses -- garden apartments, stores, schools and hospitals -- accounted for 10%. The most important use of distillate fuel was in diesel-powered vehicles (excluding farm vehicles). In 1985, this "on-highway diesel" category accounted for 39% of total distillate use compared to 21% 10 years and 30% 5 years ago. (See Table II.) On-highway diesel fuel use has provided the only significant growth market for distillate fuel. In the period 1980-85 it grew at an annual rate of 5%, reaching 411,000 B/D in the end year.

TABLE II
DELIVERIES OF DISTILLATE FUEL OIL
BY SECTOR, SELECTED YEARS, 1975-85

	<u>1975</u>	<u>1980</u>	<u>1984</u>	<u>1985</u>
Total (MB/D)	2851	2866	2845	2868
Shares by Sector (%)				
Residential	NA	21	16	16
Commercial	NA	8	11	10
Industrial	NA	8	5	6
Farm	NA	7	7	7
Subtotal	<u>53</u>	<u>44</u>	<u>39</u>	<u>40</u>
Oil Company	1	2	2	2
Electricity	6	3	2	1
Rail/Bunker	12	12	12	11
Diesel On-Highway	21	30	38	39
Military	2	2	2	2
Diesel Off-Highway and Miscellaneous	<u>6</u>	<u>7</u>	<u>6</u>	<u>4</u>
	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>

Source: Dept of Energy, Energy Information Administration.

The shift from heating oil to diesel fuel in distillate demand has greatly reduced the seasonal demand swing. In 1975, for example, the daily demand in January and February was almost

40 percent higher than the annual average, and in the third quarter, 25% lower than the annual average. In 1985, by contrast, the highest monthly demand (January) was only about 20% more than the average, and the lowest monthly demand (July) was 15 percent less (Figure 1). Figure 1 also shows that most of the seasonal flattening out has occurred since 1980.

PIRINC estimates that the heating load now accounts for 35 - 40% of total distillate demand in the first quarter, 20% in the 2nd quarter, 15-20% in the 3rd quarter, and 30% in the 4th quarter. Thus, even in the coldest period, heating oil demand no longer approaches even half of the total.

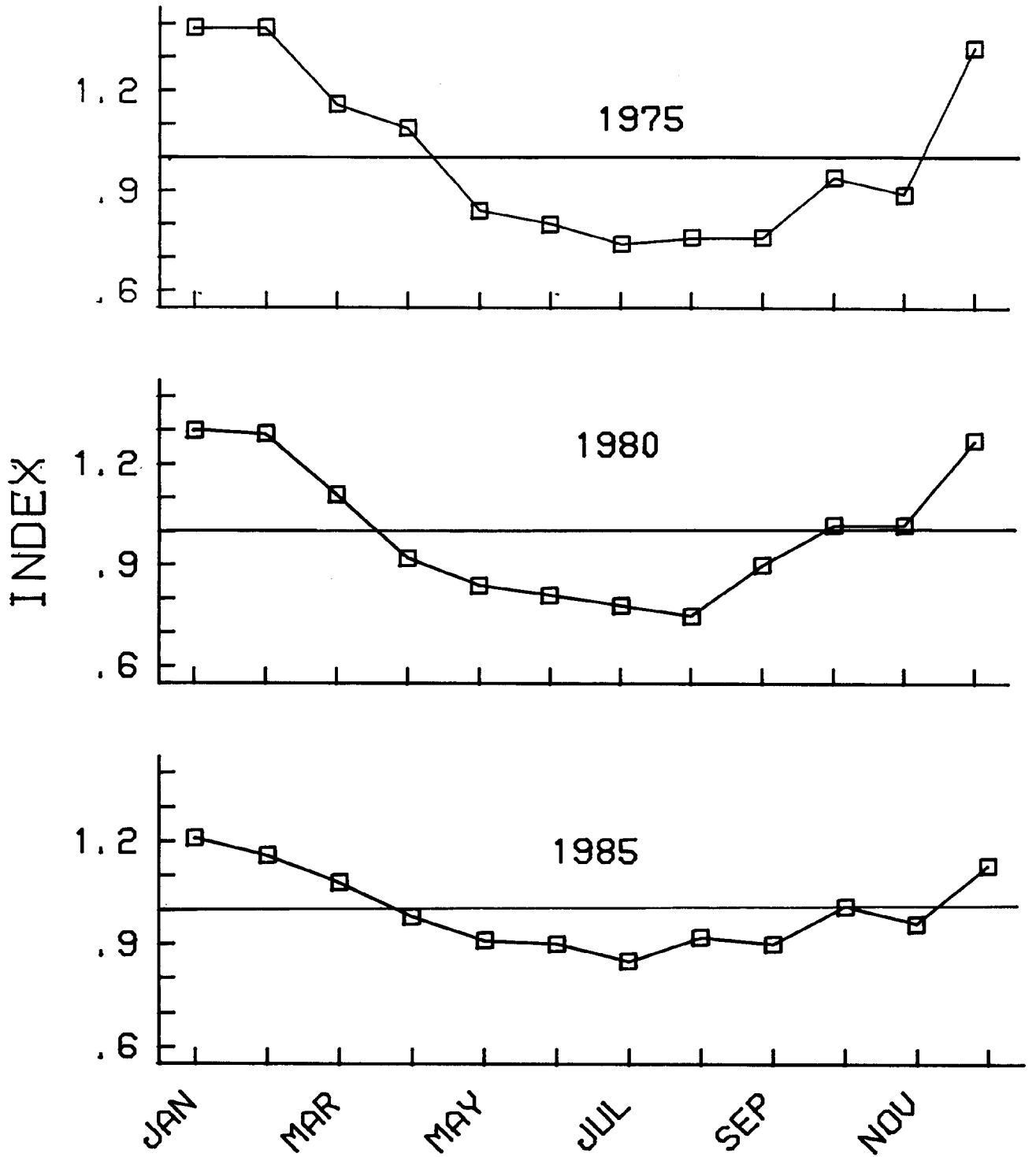
D. DISTILLATE SUPPLIES--DOMESTIC AND FOREIGN

Distillate supply has traditionally come primarily from domestic refinery output. In the 1975 - 85 period, U.S. refineries generally supplied about 93% of the total. Imports and changes in inventory levels account for the remainder, and imports supplied an average of 6 percent over the period on an annual basis.

Imports, including supplies from the U.S. Virgin Islands, have provided a somewhat higher share in recent years than previously. In 1984, for instance, gross imports reached 272 MB/D, 9% of gross supplies, exceeding the previous peak of 250 MB/D and 7% of gross supplies established in 1977. Import volume fell again in 1985, but the share remained at 7%. Through September 1986, the latest data available, import volumes had risen by 28% over the comparable 1985 period to 224 MB/D and the share was running at about 8%. Since PAD I-III refineries were

Fig. 1

MONTHLY INDEX OF DISTILLATE DEMAND
(Annual Average = 1.0)



generally operating at very high utilization rates to meet this year's sharp growth in U.S. gasoline and jet fuel demand, a large portion of the additional imports supplemented rather than displaced domestic supplies.

The East Coast (PAD I) is virtually the only market for imports of distillate fuel oil since other areas have surplus local refining capacity (as the Gulf Coast), and/or do not have coastal access to imports (the Mid-West). Imports into PAD I account for 90% and more of total U.S. distillate imports. Imports from 1975 - 1985 averaged 14% of demand on the East Coast. In 1984 it surpassed the previous (1977) peak; nearly as much of PAD I's distillate supply was imported (24%) as was produced locally (27%). In 1985 import levels fell back to the long term average, but in the first nine months of 1986 they rose to 19%. About three-quarters of these imports come from the three top suppliers -- Venezuela, the Virgin Islands and Canada.

E. DISTILLATE INVENTORIES

Inventory management practices have also changed in recent years. Inventories are generally lower, both in total and relative to demand, with a lower share held by bulk storage terminals and a higher share held by refineries and pipelines.

Stocks of distillate peak at the beginning of the heating season, usually in October or November. During the period 1975-80 the end-of-month stock level in October and November was about 236 million bbls. Since 1980, peak stocks have fallen substantially: In the 1981-85 period peak stocks averaged slightly over 160 million barrels, and this year they were about

155 million barrels. At 155 - 160 million barrels, the seasonal peak is about one-third lower than it was in the late 1970's.

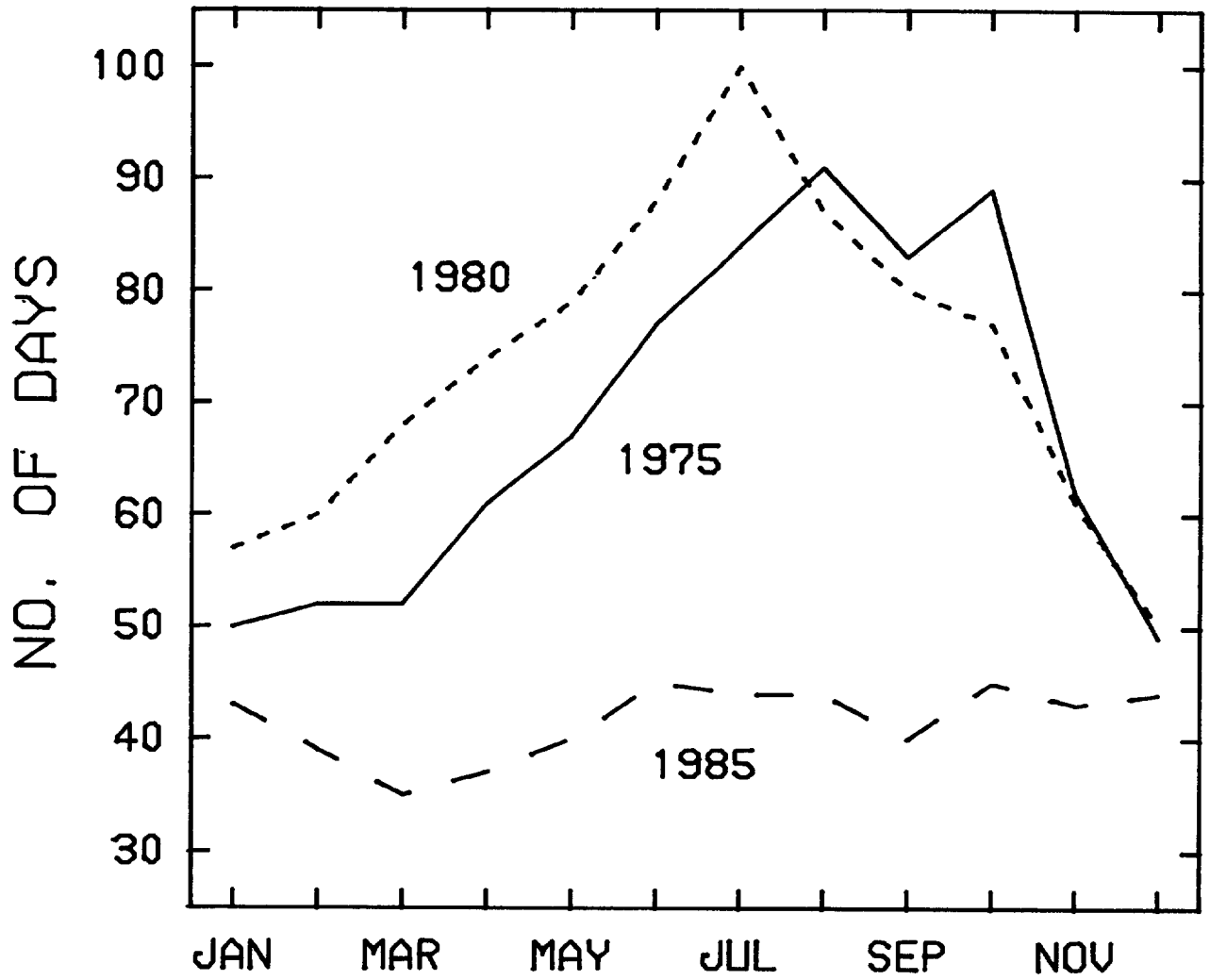
Days-of-supply, a measure that relates stock levels to consumption, permits more meaningful historical comparisons than inventory volumes alone, because reduction in the days-of-supply reflects a real change in inventory management practices.

Since the mid-1970's, the stock coverage on a days-of-supply basis has fallen for all seasons of the year. In 1975, end-month inventories ranged from 50 days of supply in January to 91 days in August. By 1985 the lowest end-month coverage had fallen to 35 days (March) and the highest was only 45 days (June and October). (See Figure 2). Part of the reason for the lower coverage now in relation to the mid-1970's is the increased importance of diesel and other non-heating uses of distillate which has reduced the upswing in demand between the non-heating and the heating season.

Minimum operating inventories--those volumes necessary to make the system function--are included in the above day-of-supply figures. They are set by the physical characteristics of the storage, transportation and delivery system and thus are not volatile. Minimum operating inventories (min-ops) only change when new tanks are added or taken out of the system, or when a pipeline is opened or shut down. Throughput and utilization rates do not affect min-ops. Among the elements of min-ops are tank bottoms, tank tops, and pipeline fill. For example, the opening of the Alaskan pipeline in 1977 added 9 million barrels to the minimum operating inventory for crude oil.

Fig. 2

DAYS' SUPPLY OF DISTILLATE STOCKS



In 1983, the National Petroleum Council (NPC) updated its estimate of minimum-operating inventories. For distillate, the NPC placed the min-op at 105 million barrels. Since that time, actual inventories have fallen below that level several times, with only minimal logistical inconveniences, even when stocks have been as low as 97 million barrels. This suggests the NPC's estimate for minimum inventories could be somewhat high.

In the last 5 years there has been a pronounced shift in where stocks are held. In 1980, bulk terminals held about 57% of total stocks, refineries about 27% and pipelines (including their related storage facilities) 16%. By 1985, the share held by bulk terminals had fallen to 50% while the pipelines' share increased to absorb the difference. See Figure 3, which also illustrates the dramatic drop in total inventories since 1980. The pipelines' very high minimum inventories, because the pipeline must always be physically full, make their inventory holding practices less responsive to market conditions than those of bulk terminals. Furthermore, since 1975, the amount of distillate moved by tanker or barge, and thus requiring bulk terminal storage at both ends of the trip, has been cut substantially. In 1975, 43% (340 MB/D) of the distillate shipped from PAD III to PAD I came via tanker or barge. By 1980, the tanker and barge share of these interdistrict shipments was 24% (164 MB/D) and in 1985, it amounted to only 18% (106 MB/D) of the total.

Another aspect of these inventory figures is that the seasonal swing tends to be more pronounced in bulk terminal stocks, as product moves downstream to meet consumer demand. The spread between the seasonal low point and the seasonal high point

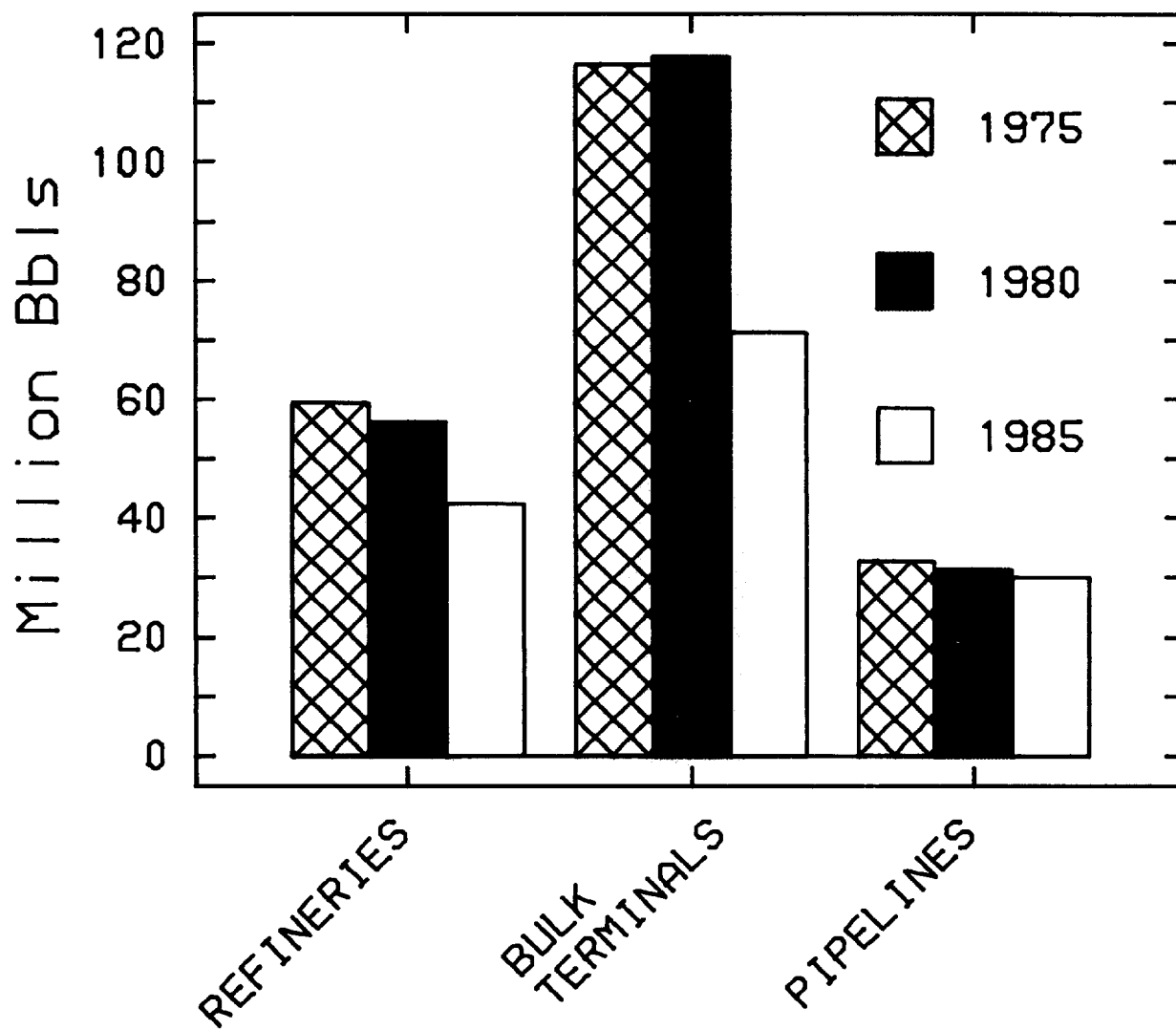
of stocks is consistently largest for bulk terminals. For instance, in 1985, the low point in bulk terminals stocks, end-April, was only 60 percent of the high, end-January. In contrast, the low point in refinery stocks occurred at end-March was 71% of the high (April), and for pipelines, the March low was 72% of December's high. The variation in the swing comes not only from logistical factors (pipelines' minimums, e.g.), but also from an increasing competitiveness and liquidity in the wholesale level of the downstream market. Bulk terminal operators are more active in trading, tap more supply sources, use the futures market, and thus can assess inventory risk in a new light.

F. THE CURRENT HEATING SEASON

Preliminary data show stocks at the end of November at about 147 million bbls, or 8% above the year-ago level. Demand in the 4th quarter is likely to be higher than last year's 2.97 million B/D, since the weather in the Northeast in the current quarter has been substantially colder than last year through early December. Middle distillate supplies will be ample for the current heating season: if need be, U.S. refiners, whose output averaged just under 2.9 million during November, could quickly increase their production to 3.2-3.3 million B/D; imports, mostly from Caribbean-Venezuelan sources, could be raised significantly from their relatively low October-November average of about 190,000 B/D. The current high level of foreign distillate stocks should be of help in this connection.

Fig.3

YEAR-END DISTILLATE INVENTORIES



Since the 1st quarter of 1986 was about 3% warmer than normal in the Northeast, demand in the first quarter of 1987 is also likely to be somewhat higher, assuming normal weather, but the additional requirements should be readily available from existing stocks and new supplies. Thus, absent sustained exceptionally cold weather, the remainder of the current heating season should be normal for consumers. Which means they can expect the full benefit of this year's price drop throughout the heating season, as is discussed in the following section.

G. DISTILLATE PRICES

The principal factor affecting distillate fuel prices is the cost of crude oil. Last year the average U.S. refiner acquisition cost of crude (\$26.76/Bbl) was equal to about 60% of the end-user price of distillate products. The remaining 40% represented refining, transportation and distribution costs plus profit margins. This year's price decline has brought the crude cost (\$13 average for the period March-September) down to about 40% of the end user price of distillate fuel oil.

In October, the latest month available, the U.S. city average retail price for #2 distillate heating oil amounted to 73.3 cents per gallon which was a 33.5 cents drop from the October 1985 price. This was equivalent to a drop of \$14/Bbl, or about the same as the drop in the crude oil acquisition cost for U.S. refiners during the same period. Thus, the crude oil price collapse of 1986 has been fully passed on to heating oil consumers. The same has generally been true for diesel fuel prices. As could be expected, there was a time lag between the

decline in crude prices and the decline in consumer prices. But by late spring the latter had caught up with the former.

The decline in distillate prices has made oil heating significantly more competitive with gas heating. As the following table shows, the average U.S. city price for gas heat was about the same in October as in January of this year, while the heating oil price has dropped by 35%. On a national average, residential oil heat is now cheaper than gas heat. This represents a reversal of the historical price relationship between these two heating fuels.

The impact of this change in the price relationship between these fuels falls mainly on the heating market in the Northeast where interfuels competition is most prevalent. An example is New York State: gas heating price during the last quarter of 1985 amounted to \$7.17 per million BTU vs. \$8.08 for heating oil (at \$1.12/gal); for the last quarter of 1986 we estimate gas prices at about \$7 and oil prices at about \$5.50. How long this new price relationship between residential heating oil and gas will last depends largely on what happens to crude prices. An increase to OPEC's new crude price target of \$18 would reduce but not end heating oil's current price advantage over gas nationally. In the Northeast region the advantage would in fact, still be quite substantial.

TABLE III

**PRICES OF DISTILLATE FUEL OIL AND NATURAL
GAS TO RESIDENTIAL CONSUMERS, JAN-OCT 1986**

<u>1986</u>	<u>Natural Gas</u>	<u>Fuel oil #2</u>	
	<u>\$/million BTU</u>	<u>\$/per gallon</u>	<u>\$/million BTU</u>
Jan	5.90	1.126	8.12
Feb	5.87	1.011	7.29
March	5.81	.937	6.76
April	5.41	.875	6.31
May	6.14	.830	5.98
June	6.17	.806	5.81
July	5.99	.751	5.41
Aug.	6.01	.726	5.23
Sept.	5.92	.736	5.31
Oct.	5.84	.733	5.29

Source: Bureau of Labor Statistics

H. 1986 DEMAND AND THE OUTLOOK TO 1990

In 1986 demand for distillate oil showed very little increase. For the first 11 months it was up by only 1.8%, much less than the increases registered this year by all other major oil products. One reason is that the 1st quarter (and especially January) was warmer than in 1985 in the Northeast region. Also, as pointed out earlier, the price decline did not reach consumers until the end of the prime heating season last spring.

The decline in heating oil demand was apparently more than offset by increases in other consuming sectors. In particular, truck tonnage is substantially up from last year. In addition, industrial distillate use (especially petrochemical feedstocks) has increased.

We expect the transportation sector to continue to account for the bulk of total growth in distillate demand for the next several years. By 1990 it should be 10-12% above last year's 1.5

million B/D. Meanwhile distillate heating demand will stay approximately flat, despite our expectations that prices for the remainder of the decade will be significantly below the 1984-85 level. In part, the lack of growth reflects continued competition from natural gas and electricity, and in part continued improvement in the efficiency of heating equipment and residential-commercial space insulation.

Distillate demand in the industrial sector is also expected to grow, largely because of higher needs for this product in the petrochemical industry. Finally, we see a substantial increase in the small volume of distillate fuel (30,000 B/D in 1985) used in electric power generation. This reflects the higher utilization of existing turbine capacity in power stations as well as the addition of some combined-cycle turbines by 1990 to help meet the growth in demand for electric power. Our forecast for total distillate fuel oil demand to 1990 is summarized in the table below, together with recent historical data.

TABLE IV
DEMAND FOR DISTILLATE FUEL OIL

(Million B/D)

	<u>1979</u>	<u>1984</u>	<u>1985</u>	<u>1990</u>
Residential/Commercial	1.0	0.8	0.8	0.8
Transportation	1.3	1.5	1.5	1.7
Industrial/Other	<u>1.0</u>	<u>0.6</u>	<u>0.6</u>	<u>0.7</u>
	3.3	2.9	2.9	3.2

After 1990, we expect more rapid distillate demand growth, led again by the transportation sector and electricity generation.