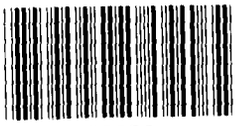
BY THE U.S. GENERAL ACCOUNTING OFFICE

Report To The Chairman, Subcommittee On Oversight And Investigations, House Committee On Energy And Commerce

Potential Middle Distillate Supply And Demand: 1982-1990

Based on the Department of Energy's (DOE's) projections and assumptions for the 1982-83 winter, nationwide supplies of distillate fuel oils will be adequate to meet demand. The oil industry's projections for 1984 refinery capacity also appear promising for meeting anticipated distillate demand through 1990. However, temporary local shortages of fuel oils could occur this winter and in later years depending on weather, delivery problems, and other variables.

DOE's petroleum demand and supply statistics and forecasts provide the capability to monitor nationwide middle distillate trends. DOE collects limited data, however, on current aspects of supply and demand at the State and local level, such as secondary and tertiary inventories.



GAO/RCED-83-43
DECEMBER 17, 1982

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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

RESOURCES, COMMUNITY,
AND ECONOMIC DEVELOPMENT
DIVISION

B-209667

The Honorable John D. Dingell
Chairman, Subcommittee on Oversight
and Investigations
Committee on Energy and Commerce
House of Representatives

Dear Mr. Chairman:

Your December 1, 1981, letter requested that we review the potential for a serious imbalance during the next 2 to 10 years between the supplies of and demand for middle distillate petroleum products. We examined (1) the U.S. refinery industry's capabilities to meet the Nation's projected 1982-83 winter demand for home heating oil, diesel fuels, and light industrial fuel oils; (2) the refinery capacity needed between 1982 and 1990 to keep pace with anticipated changes in domestic petroleum product demand and crude oil quality; and (3) the Federal Government's efforts to monitor short- and long-term trends in middle distillate supply and demand. This report presents the results of our review.

As agreed with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 5 days from its date of issuance. At that time, we will send copies to the Director, Office of Management and Budget; the Secretary of Energy; and other interested parties.

Sincerely yours,

J. Dexter Peach
Director

REPORT BY THE
U.S. GENERAL ACCOUNTING OFFICE
TO THE CHAIRMAN, SUBCOMMITTEE ON
OVERSIGHT AND INVESTIGATIONS,
HOUSE COMMITTEE ON ENERGY AND
COMMERCE

POTENTIAL MIDDLE DISTILLATE SUPPLY AND DEMAND: 1982 THROUGH 1990

D I G E S T

Middle distillate petroleum products include distillate fuel oils, i.e., heating oils, diesel fuels, and light industrial fuels; jet fuels; and kerosene. These petroleum products are vital to U.S. economic activities. Depending on the time of year, they are used in almost every sector of the Nation's economy. (See p. 1.)

In response to a request by the Chairman, Subcommittee on Oversight and Investigations, House Committee on Energy and Commerce, GAO reviewed (1) the potential for a shortage of distillate fuel oils during the 1982-83 winter heating season, (2) the potential for an imbalance between the demand and supply of middle distillates during the 1980s, and (3) the Federal Government's monitoring of middle distillate trends.

Based on available U.S. refinery capacity and the Department of Energy's (DOE's) projections and assumptions for the 1982-83 winter, nationwide distillate fuel oil supplies will be adequate to meet the short-term, winter needs. Local shortages are possible, however, because of the levels of pre-winter distillate fuel oil stocks. As of November 26, 1982, about 178 million barrels of fuel oil were at the Nation's major storage facilities. This is about 11 percent lower than the 200 million barrels at these facilities the same time last year.

For the longer term, if the oil industry achieves its 1984 refinery expansion goals, it will have the equipment needed to process the anticipated heavier, higher sulfur, crude oils which will be available during the 1980s. The equipment expansions needed by 1984 are small in relation to the capacities of equipment on hand.

Tear Sheet

GAO/RCED-83-43

DECEMBER 17, 1982

DOE's fiscal year 1982 and anticipated fiscal year 1983 middle distillate supply and demand monitoring and reporting activities provide the Congress with the capabilities to discern national and regional trends. However, DOE collects limited current data on State and local petroleum supply and demand. Without this information, DOE cannot anticipate potential local distillate supply problems.

NATIONWIDE DISTILLATE SHORTAGES THIS WINTER ARE UNLIKELY, ALTHOUGH LOCAL SHORTAGES ARE POSSIBLE

From a national perspective, daily domestic refinery production is the key element in sustaining the Nation's distillate fuel oil supplies. Based on the Energy Information Administration's (EIA's) projection for the 1982-83 winter, GAO estimated that U.S. refiners will produce about 85 percent of the Nation's 3.21-million-barrels-per-day average distillate demand. Inventory withdrawals and imports will account for only about 15 percent of the Nation's winter demand. (See pp. 5 to 8.)

GAO estimated that U.S. refiners can produce their projected 85-percent share of the 1982-83 winter's anticipated distillate fuel oil demand by operating at less-than-historic equipment utilization rates. Refiners can produce the required 2.71 million to 2.80 million barrels per day by operating at an average 77 percent to 78 percent equipment utilization rate. During 1978 and 1979, U.S. refineries averaged about 87 percent equipment utilization. (See pp. 8 to 10.)

Refiners have several options for increasing domestic distillate production above the projected output levels. GAO estimates that by increasing refinery utilization to 87 percent and maintaining a 21-percent distillate yield from each barrel of crude oil, U.S. refiners can produce about 10 percent more than EIA's high 2.80-million-barrels-per-day refinery production estimate. During the first 6 months of 1982, U.S. refiners achieved a 20.6-percent distillate yield. For the 4 weeks ending November 26, 1982, U.S. refiners achieved an average 25-percent distillate yield. (See pp. 10 and 11.)

Although they are a small percentage of nationwide distillate supply, distillate inventories are important to Northeast and other East Coast States because they serve as a buffer between local demand and deliveries of distillates produced outside the region. During 1981, about half of the area's distillate needs was supplied by Gulf Coast refineries, primarily by pipeline. (See pp. 12 and 13.)

According to oil company officials GAO contacted, in the event of an unanticipated increase in distillate demand, it would take about 3 weeks for additional, new orders of supplies to reach the Northeast from Gulf Coast refineries by pipeline. Using tankers, deliveries of additional supplies from Gulf Coast and Caribbean refineries can take between 3 and 5 days if tankers are available when needed--an assumption which DOE officials do not believe is realistic since most tankers are booked months in advance. Until these additional supplies could be delivered, unanticipated increases in distillate demand would have to be met primarily by withdrawals from inventories and/or increased production from local refineries.

The Northeast and other East Coast States began December 1982 with about 84 million barrels of primary distillate inventories, about 12 percent less than at the beginning of December 1981. If refiners follow their historical patterns and decrease stocks as the winter progresses to minimize their storage costs, some local areas may not have sufficient stocks to meet unanticipated end-of-winter increases in demand until new supplies arrive from outside the region. If weather or transportation problems delay these deliveries, temporary shortages are possible. (See pp. 13 to 14.)

U.S. REFINERY CAPACITY APPEARS PROMISING FOR PROJECTED 1982-90 DEMAND

Projected changes in petroleum product demand, crude oil quality, and U.S. refinery capacity are key variables affecting the potential for long-term middle distillate shortages. At this time, it appears that U.S. refiners will have the refinery capacity to meet the Nation's projected 1985 and 1990 petroleum needs and

the capability to refine the heavier, higher sulfur crude oils expected in the 1980s.

Government and non-Government energy forecasts agree that between 1982 and 1990, middle distillates will become an increasing proportion of the Nation's total petroleum product demand. However, the projected changes are gradual. Based on six studies which GAO reviewed, middle distillate demand is expected to increase by about 3 percent per year, while gasoline demand is projected to decrease by about 1 to 3 percent per year. (See pp. 15 to 18.)

Industry projections indicate that between 1982 and 1990, crude oil available to U.S. refiners to meet this increased middle distillate demand will become heavier and contain a larger percentage of sulfur. This lower crude oil quality makes it more difficult, with existing equipment, to obtain even the average 21-percent distillate yield that refiners achieved during January through June 1982. (See pp. 18 to 19.)

In its 1980 Refinery Flexibility report, the National Petroleum Council projected U.S. refinery equipment needs to (1) meet anticipated increases in demand and (2) refine the anticipated increase in supplies of heavier, higher sulfur crude oils. GAO's analysis showed that U.S. refiners' projected 1984 equipment capacities exceed the Council's projected 1985 needs for all equipment except that used to produce gasoline. Although U.S. refiners will have to install additional equipment to meet projected 1990 needs, these additions appear small in relation to equipment on hand. (See pp. 19 to 23.)

FEDERAL ACTIVITIES TO MONITOR SHORT- AND LONG-TERM MIDDLE DISTILLATE TRENDS

EIA collects and publishes a wide range of petroleum supply and demand statistics and forecasts. Information collected from petroleum companies is aggregated to present regional and national information. EIA collects limited current data on petroleum supply and demand at the State and local level. For example, EIA does not collect statistics on distillate fuel oil stocks held by distributors and consumers. (See pp. 24 to 28.)

With this type of information, DOE can develop an awareness of potential supply and demand problem areas. However, without local information, DOE cannot anticipate the timing and location of local shortages.

In the event of a middle distillate shortage, DOE's Deputy Assistant Secretary for Energy Emergencies would be responsible for responding to the situation. Depending on the severity and cause of a shortage, the Department's response would be an ad hoc effort to (1) learn the scope and causes of the problem using published EIA and industry statistics, informal industry contacts, and information volunteered by States and (2) work with Federal, State, and industry representatives to resolve the situation. (See pp. 29 to 30.)

In its fiscal year 1983 budget proposal, the administration proposes to reduce funding for EIA and the Deputy Assistant Secretary for Energy Emergencies by 31 percent and 47 percent, respectively. GAO's review in this area was limited to examining the effects of the proposed reductions on DOE's middle distillates-related activities. These activities are a small part of the organizations' petroleum monitoring and reporting efforts. Except for eliminating EIA's long-term middle distillates forecasting, the proposed reduction would have a limited effect on the organizations' middle distillate activities. (See p. 28 and pp. 31 to 32.)

AGENCY COMMENTS

At GAO's request, the Department of Energy reviewed copies of the draft report. In general, the Department concurred with GAO's analysis. Although the Department did not rule out the possibility of middle distillate shortages, either this winter or through the end of the 1980s, it believes such shortages are very unlikely. It believes that U.S. refiners will be able to adequately anticipate changing market conditions and will adjust distillate refinery production, product imports, and refinery equipment expenditures to meet middle distillate demand. (See p. 23 and app. II.)

Contents

ABBREVIATIONS

API	American Petroleum Institute
DOE	Department of Energy
DRI	Data Resources Incorporated
EIA	Energy Information Administration
NPC	National Petroleum Council
PAD	Petroleum Administration for Defense

CHAPTER 1

INTRODUCTION

Middle distillate petroleum products are vital to U.S. economic activities. This category of petroleum products includes distillate fuel oils, i.e., heating oils, diesel fuels, and light industrial fuels; jet fuels; and kerosene. Middle distillates provide energy to heat homes and businesses; power cars, trucks, ships, planes, and farm equipment; and operate small industrial furnaces. Depending on the time of the year, they are used in almost every major sector of the Nation's economy.

Whether supplied from domestic or foreign refineries, the Nation's supplies of middle distillates are interwoven with production of and demand for other petroleum products. Refining a barrel of crude oil yields a mix of gasoline, heavy residual oils, and other products, as well as middle distillates. Based on U.S. refinery production during July 1982, each 42-gallon barrel of crude oil refined yielded an average of about 20.2 gallons of gasoline, 11.7 gallons of middle distillates, 1/ and 3.4 gallons of residual fuel oil. This production is equivalent to average yields of 48 percent, 28 percent, and 8 percent, respectively, for these principal petroleum products. 2/

Distillate fuel oils are the principal middle distillate products and are subject to the greatest seasonal production and inventory variations. During the summer months, U.S. refiners traditionally take advantage of distillate fuel oils which are produced with gasoline and which exceed the low summer distillate demand to build distillate inventories for the winter. During the peak winter distillate demand season, generally October through March, these inventories plus distillate imports supplement domestic refiners' distillate fuel oils production.

The level of distillate supplies stored at refineries, in pipelines, and at large petroleum terminals is viewed by some as an indicator of the Nation's readiness to meet distillate demand during the winter heating season. Statistics reported by the Department of Energy's (DOE's) Energy Information Administration (EIA) indicate that, as of November 26, 1982, about 178 million

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1/This middle distillate production estimate represents the combined production of distillate fuel oils, jet fuel, and kerosene.

2/Production of petroleum gases, coke, asphalt, waxes, and other products make up 20 percent of refining production. Total refinery production adds to 104 percent of crude oil volume because heat, pressure, and/or chemical reactions associated with refinery processes increase the volume of petroleum products derived from crude oil.

barrels of distillate stocks were at these primary storage facilities in preparation for the 1982-83 winter. This is about 11 percent lower than the 200 million barrels of distillate stocks in these facilities at the same time last year. According to vice-presidents of oil companies we contacted, high interest rates, decreases in petroleum demand, and refiners' expectations that they can meet the 1982-83 winter demand without high stocks appear to be the reasons for these lower stock levels.

OBJECTIVES, SCOPE, AND METHODOLOGY

This report is in response to a request by the Chairman, Subcommittee on Oversight and Investigations, House Committee on Energy and Commerce to review the potential for middle distillate shortages during the next 2 to 10 years. As agreed during meetings with the Chairman's office, the report discusses

- --the potential for a shortage of distillate fuel oils during the 1982-83 winter heating season,
- --the potential for an imbalance between the demand and supply of middle distillates during the 1980s, and
- --the Federal Government's monitoring of short- and long-term trends in middle distillate demand and supply.

Our report is based on information obtained from DOE, prominent non-governmental organizations engaged in forecasting energy demand and supply trends, oil companies, and trade groups, as of November 5, 1982. A list of the companies contacted during the review is presented in appendix I.

To assess the potential for a shortage of distillate fuel oil during the 1982-83 winter, we reviewed several series of EIA petroleum reports. These include EIA's July 1982 Petroleum Supply Annual for 1981, its Petroleum Supply Monthly reports issued between March 1982 and September 1982, and its Weekly Petroleum Status Reports issued through December 3, 1982. The latest supply and demand information on a monthly basis available through these publications is as of July 31, 1982. Preliminary weekly information is available as of November 26, 1982. We also reviewed EIA's August 1982 Short-Term Energy Outlook, which includes EIA's projections of distillate fuel oil demand and supply by calendar year quarter for the third quarter of 1982 through the end of 1983, and EIA's methodology for preparing these projections as published in its August 1980 and November 1981 Short-Term Energy Outlooks. We then compared EIA's distillate fuel oil demand projections with projections prepared in May 1982 by the Independent Petroleum Association of America and in June 1982 by Data Resources Incorporated (DRI) of Cambridge, Massachusetts. These organizations are recognized as major energy forecasters. We did not assess the reasonableness of these organizations' methodology for developing energy projections.

We supplemented information obtained from these studies with interviews of officials from EIA, from the Washington, D.C.-based National Oil Jobbers Council (a trade group representing about 22,000 of the 24,000 petroleum products distributors in the U.S.) and from 14 distillate producing and distributing companies. Of the 14 companies contacted, 7 represented companies producing and selling distillate fuel oil throughout the United States, 4 represented distributors in the Midwest, and 3 represented distributors in the Northeast. We selected the seven distillate-producing companies based on middle distillate production statistics for January 1981 through May 1982 which showed that during this 17-month period, these companies produced about half of the middle distillates produced in the Nation. The seven distillate distributing companies we contacted were identified at our request by the National Oil Jobbers Council as being representative of average companies supplying heating oil to consumers in the Northeast and Midwest. During 1981, these two geographical areas represented 66 percent of the U.S. distillate fuel oil demand.

To assess the potential for imbalances developing between the demand and supply of middle distillates after the 1982-83 winter through the end of the 1980s, we compared oil companies' projection of 1984 refinery capacity for those refineries operable as of July 1, 1982, 1/ with National Petroleum Council (NPC) projections of 1985 and 1990 refinery equipment requirements. These equipment projections were published in NPC's 1980 Refinery Flexibility report.

We supplemented the information from these sources with interviews of DOE, NPC, National Petroleum Refinery Association, and American Petroleum Institute (API) officials. We also obtained long-term supply and demand projections and information on refinery equipment changes now underway from the seven distillate-producing companies we contacted during the review.

The projections we reviewed represent approximations of what may happen during the 1980s based on assumptions concerning petroleum prices, weather, domestic economic growth, and other variables. To assess the reasonableness of key weather and economic assumptions used in EIA's short-term distillate forecast, we compared these assumptions with historical information and current trends. We did the same type of comparison to test the reasonableness of NPC's equipment requirement projections. For example, NPC's projections are predicated on anticipated 1985 and 1990 petroleum demand. We compared these demand projections with projections reported by EIA in its 1981 Annual Report to Congress, by DRI in its Winter 1981 and Summer 1982 Energy Review, and by Chase Manhattan Bank officials in speeches during 1982 before the Financial Analysts Federation and the National

1/EIA defines operable refineries as those which are either operating or capable of being placed in operation within approximately 90 days.

Petroleum Refiners Association. The demand projections prepared by these organizations are discussed in chapter 3. This represents the limit of our testing of assumptions and projections used in the various studies. As agreed with the Chairman's office, we did not independently develop assumptions or projections concerning short- or long-term middle distillate supply and demand.

To identify the scope of current DOE efforts to collect, monitor, and report middle distillate information to the Congress and how these efforts might change during fiscal year 1983, we interviewed officials of EIA and DOE's Office of the Deputy Assistant Secretary for Energy Emergencies. We also reviewed the 1982 Professional Audit Review Team report "Performance Evaluation of the Energy Information Administration"; EIA's 1981 and 1982 Directory of the Energy Data Collection Forms; DOE's February 1982 report on the first 5 years of the agency operations; DOE's fiscal year 1983 budget proposal; and EIA plans to consolidate energy data collection forms.

Our review was conducted in accordance with generally accepted government audit standards. As agreed with the Chairman, we did not verify EIA's statistics nor did we evaluate the economy, efficiency, and effectiveness of DOE's distillate data collection, monitoring, and reporting.

At our request, the Department of Energy reviewed copies of the draft report. In general, the Department concurred with our analysis and conclusions and suggested minor changes to the draft. (See app. II.) DOE's comments and suggested changes were incorporated in the final report as deemed appropriate.

CHAPTER 2

ANTICIPATED 1982-83 WINTER DEMAND AND SUPPLY OF DISTILLATE FUEL OILS

Our analysis of projected distillate fuel oil demand and U.S. refineries' production capabilities indicates little likelihood that nationwide distillate shortages will occur during the 1982-83 winter heating season. Based on EIA's projections which assume a continued supply of crude oil to refine, colder-than-normal winter temperatures, and gradual domestic economic growth, U.S. refiners will be able to meet the Nation's winter demand for these fuels. However, low primary stocks of distillate fuel oils at the beginning of the winter season raise the possibility of temporary, local shortages of these fuels near the end of winter. This is especially true for the Northeast section of the country.

NATIONWIDE SUPPLIES ARE EXPECTED TO BE ADEQUATE TO MEET TOTAL U.S. DEMAND

In its August 1982 forecast of the anticipated demand and supply of petroleum products, coal, and natural gas during the next 15 months, EIA projected that the average daily demand for distillate fuel oils during the 1982-83 winter will be slightly higher than the average demand last winter. With lower distillate fuel oil stocks available to supplement distillate production, EIA projected that U.S. refineries will meet the higher distillate demand by increasing both winter domestic refinery production and imports. Domestic production, however, is expected to remain the key element in sustaining the winter's distillate supply.

From a total equipment standpoint, U.S. refiners are in a good position to meet this anticipated winter distillate production requirement. U.S. refineries have the capacity to produce more distillate fuel oil than EIA's projected refinery output assuming a 5-percent colder-than-normal winter, a mild U.S. economic recovery, and nearly constant crude oil prices. U.S. refineries also have the option of changing the product slate by slightly increasing the normal winter percentage of distillate fuel oils produced from crude oil to meet unanticipated increases in distillate demand.

EIA 1982-83 winter distillate projections

In its August 1982 forecast, EIA projected distillate fuel oil demand and supply based on low, medium, and high estimates of 1982 and 1983 world oil prices and alternative economic and weather assumptions. Table 1 presents EIA's distillate fuel oil medium price, or base case projections, for the 1982-83 winter heating season and compares these projections with EIA statistics for the previous winter.

Table 1

Distillate Fuel Oil Demand and Supply
for 1981-82 (Actual) and 1982-83 (Expected) Winter Season

	1981-82 winter season	1982-83 winter season	Percent change
	(millions of barrels per day)		
Demand	3.06	3.21	+ 4.9
Supply			
Winter refinery output	2.57	2.74	+ 6.6
Primary stock drawdown	.44	.37	- 15.9
Net imports	.05	.10	+100.0
Total supplies	3.06	3.21	

Source: Short-Term Energy Outlook, EIA, August 1982.

As table 1 shows, EIA is projecting that, during the 1982-83 winter season, winter production by U.S. refineries will continue to account for the bulk of the season's distillate supply. The projected 2.74-million-barrels-per-day refinery production during the coming winter is equivalent to about 85 percent of projected supply, with the remaining 15 percent expected to come from primary stocks and imports.

EIA's base case projections assume (1) world crude oil prices remain constant during 1982 at July 1982 prices and rise at the rate of inflation during 1983; (2) the Nation's gross national product will increase by 1.5 percent this winter to about $1.5 trillion, compared to a 2.6-percent decrease last winter; 1/ and (3) 1982-83 winter temperatures will equal winter temperatures averaged over 30 years. EIA's supply projections assume that refiners will follow seasonal equipment utilization and product yield trends.

EIA also projected distillate fuel oil supplies assuming (1) a 1.4-percent increase in the Nation's gross national product during the winter and (2) 5 percent colder-than-normal average winter temperatures. As shown in table 2, these assumptions result in lower and higher projections, respectively, of the winter's average distillate demand and total distillate supply.

1/In its August 1982 forecast, EIA expressed all assumptions and statistics concerning the Nation's gross national product in 1972 dollars.

Table 2

Alternative EIA 1982-83 Winter
Distillate Demand and Supply Projections

	Case 1 (EIA's base case)	Case 2 (EIA's lower economic growth case)	Case 3 (EIA's colder weather case)
	---(millions of barrels per day)---		
Demand	3.21	3.17	3.27
Supply			
Winter refinery output	2.74	2.71	2.80
Primary stock drawdown	.37	.37	.37
Net imports	.10	.09	.10
Total supplies	3.21	3.17	3.27

Source: Short-Term Energy Outlook, EIA, August 1982.

Under each alternative, the relative percentage of winter refinery output, stock withdrawals, and distillate imports remain about the same. The projected 2.71-million-barrels-per day refinery output under EIA's lower economic assumptions and 2.80-million-barrels-per-day under EIA's colder weather assumptions represent about 85 percent and 86 percent, respectively, of total distillate supply projected under each case. This is equal to or only slightly greater than the 85 percent represented under the base case assumptions. Similarly, the projected contribution of stocks and distillate imports changes by no more than 1 percent from the base case projections.

These three alternative scenarios represent a reasonable range of possible demand and supply combinations which might occur this winter. However, actual winter distillate demand, refinery output, stock withdrawals, and imports may vary from table 2's projections for several reasons. EIA's distillate demand projections are based on the historical relationship among demand, weather, the economy, and distillate prices. Its projections do not reflect the demand which might occur if distillate stocks normally held by distributors and users are lower than normal and these groups decide to replenish their supplies. However, because of the limited data available on distributors' and users' stocks, it is difficult to project the additional demand which might occur under these conditions. In testimony given before the Subcommittee on Fossil and Synthetic Fuels, House Committee on Energy and Commerce, on June 9, 1982, EIA's

Administrator stated that, although the capacity of these other-than-primary distillate fuel oil storage facilities is approximately equivalent to the size of primary distillate stocks, the volume of distillate stored at a specific time is unknown.

EIA's projections also do not reflect potential changes in refinery operating costs, the costs of storing gasoline produced in excess of winter demand when distillates are produced, or other economic factors affecting the relative profitability of distillates, gasoline, and other products. To the extent that these economic factors may encourage less distillate production than during past winters, refiners this winter may decide to rely more on primary stocks withdrawals and imports than EIA projects. However, based on the relative magnitude of projected refinery production during the coming winter, we expect that U.S. refiners will continue to provide the bulk of the season's distillate needs through daily refinery production.

Industry's capabilities to produce distillate fuel oils

According to EIA statistics on U.S. refinery capacity, U.S. refiners have underutilized refinery equipment which would be available during the winter to meet the Nation's demands for gasoline, distillate fuel oils, and other petroleum products. Domestic refiners could use this available equipment, and either maintain or increase current distillate fuel oil yields to meet the winter's distillate needs. 1/

To demonstrate the capacity which U.S. refiners have available to meet these needs, we estimated refinery equipment utilization for EIA's base case and two alternative cases of distillate supply projections. Table 3 compares these projected equipment utilization rates, distillate yields, and total distillate production with preliminary September 1982 EIA statistics.

1/Refinery equipment utilization and product yields are indicators of refinery production capabilities. They are measured based on the volume of crude oil processed, equipment capacity, and the volume and type of petroleum products produced. Equipment utilization equals the daily volume of crude oil refined divided by crude oil distillation capacity. Product yields equal the volume of distillate fuel oils or other products refined from crude oil divided by the total volume of crude oil processed.

Table 3

EIA September 1982 and Expected 1982-83 Winter
Refinery Equipment Utilization and Distillate Yield Rates

	Equipment utilization (note a)	Distillate yield	Total distillate production
	(in percent)		(in millions of barrels per day)
September 1982	73	21	2.60
1982-83 winter estimates			
Base case	77	21	2.74
Lower economic growth alternative	76	21	2.71
Colder weather alternative	78	21	2.80

a/EIA projected 1982-83 winter refinery equipment utilization based on 18.0 million barrels per day operable U.S. refinery capacity. We have adjusted EIA's projected refinery utilization to reflect its current 17.0-million-barrels-per-day estimate. This was done by dividing EIA's projected distillate production by its projected distillate yield rates to obtain total projected refinery output, and dividing this number by 17.0-million-barrels-per-day refinery capacity.

As table 3 shows, U.S. refiners can meet EIA's projected 1982-83 winter base case distillate production levels by increasing equipment utilization from September 1982's 73 percent to about 77 percent, and maintaining September's 21-percent distillate yield rate. 1/ U.S. refiners need to increase equipment usage by only an additional 1 percent to increase distillate production to EIA's estimated production levels, assuming a 5-percent colder-than-normal winter.

These utilization rates are lower than the rates achieved during 1978-79. During that period, monthly refinery utilization rates varied from 83 percent to 91 percent. The overall rate for the 2 years averaged about 87 percent. During 1980, decreases in monthly petroleum production due in part to decreases in petroleum demand resulted in monthly utilization rates which averaged only about 76 percent.

1/The September 1982 21-percent distillate yield rate compares with an average 20.6-percent distillate production rate achieved during the first 6 months of 1982.

Table 3 assumes that during the winter months (1) operable U.S. crude oil distillation capacity decreases slightly from 17.1 million barrels per day to an average of about 17.0 million barrels per day, and (2) refiners would meet alternative distillate production requirements by changing equipment utilization rather than distillate yields. Refineries also have the option of adjusting distillate yield rates to respond to demand changes. Vice-presidents of oil companies we contacted indicated that, during the winter months, they have the flexibility to increase distillate yields by at least 4 to 6 percent over winter yield rates by changing the mix of crude oil going into the refinery and/or adjusting refinery processes.

Table 4 illustrates the potential increases in winter distillate fuel oil production if U.S. refineries exercised three hypothetical options. Option A corresponds to changing refinery distillate yields from 21 percent to 25 percent, while maintaining equipment utilization at the September 1982 rate of 73 percent. This 4-percent increase in distillate yield reflects oil companies' minimum estimate of refinery yield flexibility. Option B corresponds to increasing average refinery utilization to the 1978 through 1979 average 87-percent rate, while maintaining distillate yields. Option C corresponds to a more conservative combination of these two options and represents the distillate production which could be achieved assuming a compromise 80-percent utilization rate and a 23-percent distillate yield. Each option assumes an average 17.0 million barrels per day of operable refinery crude oil distillation capacity.

Table 4

Estimated Effect of Increasing Winter Refinery Utilization and Distillate Production Yields

	Equipment utilization	Distillate yield	Daily distillate production	Daily production as percent of base case production
	(in percent)		(millions of barrels)	
EIA's base case	77	21	2.74	100
Option A--Increase distillate yield by 4 percent	73	25	3.10	113
Option B--Increase utilization to 1978-1979 average	87	21	3.11	114
Option C--Increase utilization and distillate yield	80	23	3.13	114

The daily refinery distillate production estimates presented in table 4 are about 13 percent to 14 percent above EIA's 1982-1983 winter base case refinery output projections. They are also about 11 percent above EIA's 2.8-million-barrels-per-day projected output for the 1982-83 winter, assuming winter temperatures 5 percent colder-than-normal.

Refinery economics will determine the magnitude of changes, if any, in equipment utilization and product yields which refiners might make to meet potential increases in the winter's distillate production requirements. However, the options presented in table 4 illustrate that the 17.0-million-barrels-per-day U.S. refinery capacity which EIA expects to be available during the winter is sufficient to provide a cushion against potential nationwide shortages of distillate fuel oils.

DOE officials expressed some concern over projecting a potential national middle distillate yield of 25 percent over a 6 months period. They noted that for the 4 weeks ending October 29, 1982, average U.S. distillate yield increased to about 23 percent. For the 4 weeks ending November 26, 1982, average U.S. distillate yield equaled 25 percent. DOE officials pointed out that based on historical yields, a 25-percent distillate yield rate sustained for several months is unusually high. They did not, however, state that a sustained 25-percent average yield is beyond refiners' capabilities.

LOGISTICS PROBLEMS COULD CAUSE TEMPORARY LOCAL SUPPLY PROBLEMS

Although refiners' capabilities on a nationwide basis to produce additional supplies of distillate fuel oils to meet winter demand is encouraging, this additional production may not be available when and where it is most needed. Supplies of distillate fuel oils used to meet local demands generally come from three sources--production of area refineries, withdrawals from the area's primary stocks, and shipments from refineries outside the area. In the case of the Northeast and other East Coast States, these outside supplies include shipments from Gulf Coast refineries and imports from Caribbean and other foreign refineries.

EIA maintains data on distillate fuel oil production, use, and shipment by Petroleum Administration for Defense (PAD) Districts. Table 5 shows this data for 1981.

Table 5

1981 Distillate Fuel Oil Production, Use, and Shipments by Petroleum Administration for Defense (PAD) District

	PAD I (East Coast)	PAD III (Gulf Coast)	Other PAD districts	Total U.S.
	(in millions of barrels)			
Production within PAD district	108.6	439.5	405.6	953.7
Withdrawal of district's primary stocks	2.9	4.3	6.6	13.8
Net receipts from other PAD districts (note a)	215.8	-260.5	44.7	0.0
Net imports	59.2	2.0	.1	61.3
Totals (note b)	386.5	185.3	457.0	1,028.8

a/Negatives represent net shipments to other PAD districts.

b/Totals do not include fuel used by refiners. Refinery distillate fuel oil use is significant only in PAD district V (the West Coast), which during 1891 used 3.6 million barrels.

Source: EIA's Petroleum Supply Annual, 1981.

As shown by the table, PAD I, which includes the Northeast, other East Coast States, the District of Columbia, Pennsylvania, and West Virginia is the largest user of distillate fuel oils produced outside its district. In 1981, about 216 million of

the 386 million barrels used within the district were shipped from U.S. refineries in other PAD districts. This is equivalent to about 56 percent of the district's yearly distillate consumption. Of this, about 190 million barrels were shipped through pipelines from PAD III Gulf Coast refineries.

The most critical places and time for a potential distillate shortage are areas within the Northeast region at the end of the winter season. The Northeast is the most distant point from the Gulf Coast refineries, which are its major source of supply. According to the oil company officials we contacted, it would take about 3 weeks for distillates produced by Gulf Coast refineries to reach the Northeast by pipeline in the event of an unanticipated increase in demand. Oil tanker deliveries to the Northeast from Gulf Coast and Caribbean refineries can be made in 3 to 5 days if tankers are available when needed--an assumption that DOE officials do not believe is realistic since most tankers are booked months in advance. After delivery to Northeast port terminals, trucks, rail cars, and/or barges would also have to be readily available to move the fuel supplies inland. During this time, unanticipated increases in demand within the district would be met mainly by withdrawals from primary stocks and increased production from local refineries.

EIA statistics indicate that, as of November 26, 1982, about 84 million barrels of distillate fuel oil stocks were in PAD I's primary storage facilities. This is about 12 percent less than the district's primary stocks at the same time last year. Based on the district's 1981 average demand, the 84 million barrels represent about a 80-day supply. In commenting on this report, DOE officials stated, however, that at peak demand consumption rates, these stocks shrink to about a 30-day supply. Furthermore, they noted that only a portion of these stocks can be withdrawn for distribution to consumers. The remaining stocks represent fuel oil in pipelines and storage tank bottoms which cannot be withdrawn.

The volume of PAD I's primary stocks during February through April 1983 of this winter remains to be seen. Refiners, however, begin to significantly decrease the volume of distillates in primary stocks during January and February of each heating season. As a result, primary stocks are usually at their lowest during March and April. For example, on March 1, 1980, and March 1, 1981, PAD I's primary distillate stocks had decreased to about 78 million barrels, respectively, from about 90.3 million barrels in primary storage as of the end of the previous December of both years. By April 1, 1980 and 1981, they had decreased to about 67 million barrels and 65 million barrels, respectively. If similar primary distillate stock decreases occur this winter in the Northeast and unanticipated cold weather or any other factor increases the end-of-winter demand, primary stocks in some local areas may be too low to avoid shortages. Stocks could be redistributed within the district, or additional distillate supplies could be delivered from other PAD districts and foreign refineries. With favorable weather conditions and the availability of transportation, these

additional supplies could meet demand and replenish local inventories in a few days. If weather or delivery problems delay these additional deliveries, however, supply problems could occur. The 3 weeks needed to transport additional distillates via pipeline from Gulf Coast refineries to the area would preclude these refineries from helping to meet unanticipated end-of-winter demand through normal distribution channels.

CONCLUSIONS

EIA projections of U.S. refining capacity and distillate fuel oil demand during the coming winter suggest that, barring an interruption in crude oil supplies, total nationwide supplies of distillate fuel oils will equal total demand. However, local shortages of distillate fuel oils are possible. Because of its distance from the Gulf Coast refineries which supply most of its distillate needs, the Northeast is particularly vulnerable to short end-of-winter distillate supply problems.

CHAPTER 3

U.S. REFINERS' CAPABILITY TO MEET 1982-90

MIDDLE DISTILLATE DEMAND APPEARS PROMISING

Refiners' capabilities for meeting consumer needs for middle distillates and other petroleum products after the 1982-83 winter season will depend on the quality of crude oil and on the availability of equipment to refine this oil. Although the present outlook for meeting future demand appears favorable, a long-term shortage of middle distillates could develop if one or more of the following events occurred: (1) the demand for middle distillates increased significantly from the September 1982 average of about 3.9 million barrels per day; 1/ (2) the quality of crude oil began to deteriorate rapidly; or (3) U.S. refineries were unable to modernize their equipment to keep pace with demand and crude oil changes.

In December 1980, NPC issued a study of U.S. refiners' 1982-90 capabilities to meet domestic petroleum product needs. The study concluded that, although crude oil distillation capacity appeared adequate for the decade, substantial additional downstream processing 2/ capacity will be needed to meet projected demand. Since that study was issued, however, U.S. petroleum product demand has dropped, and 1982 through 1990 demand projections have been revised. U.S. refiners have also expanded downstream processing capabilities. As a result, U.S. refiners appear to be in a much better position to meet middle distillate demand during the next 8 years than they were 2 years ago.

This chapter discusses current projections of 1982-90 demand for middle distillates and other petroleum products, projected crude oil quality changes, and refinery capacity needed to meet these projected demand and crude oil quality changes.

GRADUAL CHANGES PROJECTED IN 1982-90 PETROLEUM PRODUCT DEMAND AND CRUDE OIL QUALITY

Government and non-Government organizations which forecast petroleum products supply and demand and the seven major oil companies we visited agreed that during the next 8 years, the Nation's relative demand for gasoline, middle distillates, and other petroleum products will change. The Nation's demand for gasoline

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1/This represents EIA's estimated average demand for distillate fuel oils, jet fuel, and kerosene during the 4 weeks ending October 1, 1982.

2/Downstream processes are refinery processes which occur after initial distillation to increase yields of gasoline, distillate fuel oils, and other high-demand products. See page 20 for a description of some of these processes.

and residual fuels is projected to decrease, while demand for middle distillates is projected to increase. Crude oil available to U.S. refiners is also projected to become heavier and higher in sulfur content, making it more difficult for refiners to produce the lighter, low-sulfur gasoline and distillate fuels with existing equipment. However, based on the projections we have reviewed, the change in demand and crude oil quality will be gradual. This should provide U.S. refiners time to adjust production decisions and, if necessary, crude oil processing capacities to meet the anticipated changes.

Projected changes in petroleum demand

Table 6 presents 1982, 1985, and 1990 projections of petroleum products demand based on six studies which we reviewed. 1/

Table 6

Projections of 1982, 1985, and 1990 Petroleum Product Demand

Petroleum products	1982 (note a)	1985 (note b)	1990 (note b)	Annual percentage change 1982-90 (note c)
	-----(in millions of barrels per day)-----			-----(in percent)-----
Motor gasoline	6.6	6.0- 6.5	5.1- 6.0	(1 to 3)
Middle distillates	3.8	4.5- 4.6	4.8- 4.8	3
Residual fuels	1.7	1.1- 2.0	1.0- 1.5	(1 to 5)
Other	d/ 3.4	3.8- 4.2	4.2- 4.5	3 to 4
Total	15.5	15.4-17.3	15.1-16.8	
Gasoline to middle distillates ratio	1.7	1.3- 1.4	1.1- 1.3	

a/Derived from EIA's August 1982 Short-Term Energy Outlook.

b/Derived from EIA's 1981 Annual Report to the Congress, February 1982 and NPC's Refinery Flexibility, 1980. These projections reflect the estimated product demands which when added together generally represent the lowest and highest projections of total petroleum demand forecasted by four organizations: EIA, Data Resources Incorporated, Chase Manhattan Bank, and NPC. Of the four organizations, EIA and Data Resources Incorporated are projecting the lowest 1985 and 1990 demand, while Chase Manhattan Bank and NPC are projecting the highest.

c/Parenthesis denotes decreases in projected demand.

d/Includes a negative adjustment of about 320,000 barrels per day which EIA applies to data collected or forecasted after 1981.

There are varied reasons for the changes in gasoline, middle distillate, and residual fuel demand which these organizations anticipate. The projected decrease in gasoline demand, for example, reflects the increasing number of new, more fuel-efficient automobiles which replace older cars in the Nation's fleet. The

1/These include (1) EIA's August 1982 Short-Term Energy Outlook, (2) EIA's 1981 Annual Report to Congress, (3) Data Resources Incorporated's Summer 1982 Energy Review, (4) the May 1982 report of the supply and demand committee of the Independent Petroleum Association of America, (5) NPC's 1980 Refinery Flexibility report, and (6) March 1982 Chase Manhattan Bank projections of world petroleum supply and demand.

projected increase in middle distillate demand is a result of two partially offsetting trends. The demand for diesel fuel is expected to increase as more consumers buy diesel-powered cars and trucking activities expand to keep pace with a growing economy. Some of the increase, however, is expected to be offset by a projected decrease in the demand for heating oil, as existing customers continue to conserve on the use of heating oil and new buildings are equipped with other types of heat.

In addition to these projected changes in gasoline and middle distillate demand, U.S. refiners are expected to face a decreased demand for residual fuel oils. These heavy fuels represent fuel oil primarily used by (1) electric utilities to power electric generating plants, (2) ships as a transportation fuel, and (3) industry as a source of heat. The expected decrease in demand results from users converting to coal, natural gas, electricity, or other energy sources.

Oil companies we contacted see the same type of changes in petroleum product demands as depicted in table 6. Six of the seven companies we contacted expect gasoline demand to decrease and distillate demand to stay the same or increase during the 1980s. The six companies projected an annual decline in gasoline demand ranging from about 1 percent to about 3 percent of 1981 demand, with projected increases in distillate demand ranging from about 2 percent to about 5 percent. One of the seven companies projected that distillate demand during the decade will increase, while gasoline demand will remain the same.

The projected trends in gasoline and middle distillate demand result in middle distillates becoming an increasing proportion of the products manufactured by U.S. refineries. Traditionally, gasoline demand in the Nation has been higher than the demand for any other product. As table 7 shows, however, the projected demand for these two products is moving closer together.

Table 7

Relative Product Demand Projected for 1982-90 (note a)

Petroleum products	1982	1985	1990
	----------(in percent)----------		
Motor gasoline	43	39- 37	34- 36
Middle distillates	24	29- 27	32- 28
Residual fuels	11	7- 12	7- 9
Others	22	25- 24	27- 27
Total	100	100 100	100 100

a/Derived for each low and high projection shown in table 6 on page 16 by dividing petroleum product barrel-per-day demand by total projected demand.

Anticipated changes in crude oil quality

Sulfur content and weight are two of the major quality characteristics which are used to distinguish between different types of crude oil. According to NPC projections, the quality of crude oil during the 1980s as measured by these indicators is expected to decrease. This projected decrease in crude oil quality may act against refiners in their efforts to increase middle distillate yields.

In its 1980 Refinery Flexibility report, NPC projected that during the 1980s, historical trends toward decreasing crude oil quality would either continue at about the same rate, or intensify. Between 1969 and 1978, the ratio of low- and high-sulfur oil 1/ processed by U.S. refiners changed from 65 percent and 35 percent, respectively, to 55 percent and 45 percent. NPC projected that if this trend continues through 1990, the mix of low- and high-sulfur crude oil processed by U.S. refiners will have reversed itself, changing to 45 percent and 55 percent. Higher volumes of domestic and foreign high-sulfur crude oil production during the 1980s and the introduction of synthetic oil from coal and oil shale could increase the volume of high-sulfur oil processed by U.S. refiners to as much as 60 percent of total U.S. crude oil supplies.

1/NPC defined low-sulfur crude oil as having less than 0.5 percent sulfur. High-sulfur oil was defined as having more than 0.5 percent sulfur.

In addition to changes projected for the mix of low- and high-sulfur oil, NPC projected that during the 1980s, oil would also become heavier. NPC reported that in 1978, about 77 percent of the crude oils processed by U.S. refineries were light 1/ crude oils and 23 percent were heavy oils. Assuming crude oil production during the 1980s follows historical patterns, NPC projected that, by 1990, the percentage of heavier crude oils would increase to about 26 percent. Assuming increased worldwide production of high-sulfur oil, NPC projected the percentage of heavier crude oils would increase to about 28 percent.

During a decade when middle distillate demand is projected to increase, these trends toward heavier, high-sulfur crude oils suggest a decreasing refinery yield of middle distillates. Refiners generally use a variety of temperatures, pressures, and chemicals to produce gasoline, middle distillates, and other products from different types of crude oils. Under the same refining temperatures and pressures, middle distillate yields are the highest when refining light, low-sulfur crude oil and the lowest when refining heavier, high-sulfur oil. For example, when boiling crude oil at 1,050 degrees Fahrenheit and atmospheric pressure, 2/ middle distillate yields can vary from about 39 percent for a light, low-sulfur oil such as Nigeria's Bonny Light to about 24 percent for heavier, higher sulfur crude oil such as Alaska North Slope oil. Additional refining and use of desulfurization equipment can increase the yield of low-sulfur middle distillate products from these crude oil types.

LITTLE ADDITIONAL REFINERY EQUIPMENT NEEDED TO MEET ANTICIPATED DEMAND

Refinery equipment capacity is generally expressed in terms of barrels-per-day capacity of crude oil distillation and downstream processing units. Crude oil distillation is the first, fundamental step in refining and involves boiling crude oil under atmospheric pressure. After crude oil is distilled, downstream processes are used to increase the yield of gasoline, distillate fuel oils, and other high-demand products. These downstream processes include:

1/In their study, NPC defined weight by the percentage of heavy residual products produced by refining oil at 1,050 degrees Fahrenheit--the approximate temperature achieved during the refining process known as catalytic cracking. It defined light oils as those having less than 15 percent residuals when refined at these temperatures and heavy oils as having more than 15 percent residuals.

2/Atmospheric pressure is equal to about 15 pounds per square inch at sea level.

--vacuum distillation, which involves boiling under less-than-atmospheric pressure the residual petroleum products which will not boil under atmospheric pressure;

--thermal, catalytic, and hydrocracking processes, which use other combinations of heat and pressure, chemicals, and/or hydrogen to alter the size or structure of molecules present in heavier petroleum products;

--catalytic reforming, which uses heat, pressure, and catalysts to combine or rearrange molecules of light-weight petroleum products into gasoline-blending ingredients and petrochemicals; and

--hydrotreating and hydrorefining, which involve using hydrogen or chemicals to remove sulfur, nitrogen, lead, and other impurities from petroleum products.

Faced with gradually changing demand patterns and crude oil quality, it appears that 1984 crude oil distillation and downstream capacity will be enough to meet the projected 1985 and 1990 demand. Based on our analysis, if U.S. refiners expand capacities as they reported to EIA at the beginning of 1982, it appears that with few exceptions, the Nation's refiners will, in total, have the needed equipment capacities to meet 1985 demand. Furthermore, although additional equipment capacity is needed to meet projected 1990 demand, the requirements for expanded capacities appear to be small.

Projected 1984 refinery capacity

Table 8 compares refiners' estimates of 1984 capacities for those refineries operable as of July 1, 1982, with actual capacity statistics for January 1978 and January 1982.

Table 8

Comparison of 1978, 1982, and Projected 1984
Refinery Equipment Capacities

Refinery processes	Jan. 1978 actual	Jan. 1982 actual	Jan. 1984 projected	Percentage difference 1978 to 1982	Percentage difference 1982 to 1984
	(in millions of barrels per stream day) (note a)			---------(in percent)----------	
Crude oil distillation	18.0	19.0	18.4	6	b/(3)
Vacuum distillation	6.1	7.2	7.3	18	1
Thermal cracking	1.5	1.8	1.9	20	6
Catalytic cracking	4.9	6.0	6.0	22	0
Catalytic reforming	3.7	4.0	4.1	8	3
Catalytic hydrocracking	0.8	0.9	1.0	13	11
Hydrotreating and hydrorefining	7.0	8.5	8.8	21	4

a/Barrels per stream day represents the volume of crude oil or unfinished petroleum products which a unit can process running at full capacity under optimum crude and product mix conditions.

b/Parenthesis denotes percentage decreases in capacity.

Source: Derived from NPC's Refinery Flexibility, December 1980; and Petroleum Supply Annual, 1981, U.S. EIA, July 1981, and interviews with EIA officials.

As table 8 shows, during 1982 and 1983, U.S. refiners expect to make only minor additions to existing capacities. By 1984, total U.S. crude oil distillation capacity is projected to be only about 3 percent less than on January 1, 1982. However, downstream hydrocracking capacity is expected to increase by about 11 percent. This is the largest capacity increase projected for the period. U.S. refiners expect to maintain or increase by the 1982 capacities for other downstream processes by at most 6 percent.

The relatively small projected changes in the capabilities of refinery processes are in large part due to U.S. refiners' expansion efforts started during the late 1970s, and the 1980-81 drop in petroleum demand. Because it often takes 2 to 4 years to expand refinery processes, U.S. refineries began building during the late 1970s to meet the petroleum demands of the 1980s. These expansion activities increased thermal, catalytic, and hydrocracking capacities by 13 percent to 22 percent above 1978 levels. However, with the 14-percent decline in petroleum demand between January 1980 and January 1982, refiners have reduced their expansion efforts and for the time being intend to use existing equipment to meet petroleum demands.

Projected capacities approximate estimated 1985 and 1990 equipment needs

To estimate the relative balance between equipment capacities and requirements during the 1980s, we compared refiners' estimated 1984 capacities with NPC estimates of 1985 and 1990 equipment

capacities needed to meet projected petroleum product demands. Table 9 summarizes this comparison.

Table 9

Comparison of Planned 1984 Capacity With Projected 1985 and 1990 Capacity Needs (note a)

	Planned 1984 capacity	Projected 1985 total capacity needed	Projected 1990 total capacity needed	Additional capacity needed by 1985	Additional capacity needed by 1990
	(in millions of barrels per stream day) (note b)				
Crude oil distillation	18.4	18.0	18.0	0	0
Vacuum distillation	7.3	6.1	6.1	0	0
Thermal cracking	1.9	1.9	2.0 - 2.1	0	.1 - .2
Catalytic cracking	6.0	4.9 - 5.0	4.9 - 5.0	0	0
Catalytic reforming	4.1	4.4	4.9	.3	.8
Catalytic hydrocracking	1.0	.8	.9	0	0
Hydrotreating and hydrorefining	9.8	8.2 - 8.3	8.9 - 9.1	0	.1 - .3

a/Projected capacity needs are based on NPC's low demand projections and its two combinations of low- and high-sulfur crude oils which might be available to U.S. refiners in 1985 and 1990. In almost all cases, capacity needs are slightly different for each of the two crude oil quality combinations. After rounding, however, in most cases these capacity needs become identical.

b/Barrels per stream day represents the volume of crude oil or unfinished petroleum products which a unit can process running at full capacity under optimum crude and product mix conditions.

Source: Petroleum Supply Annual, 1981, EIA, July 1981; Refinery Flexibility NPC, December 1980; and GAO computations. U.S. refiners' planned 1984 capacity was derived by adding refiners' projected changes during 1983 as reported to EIA during the beginning of 1982, to EIA's projected January 1, 1983, refinery capacity. NPC's projected 1985 and 1990 capacity requirements were derived from NPC's 1980 report by adding NPC's 1978 refinery capacity statistics to its projections of additional capacities needed to meet projected 1985 and 1990 demand.

In its 1980 Refinery Flexibility study, NPC projected 1982, 1985, and 1990 refinery equipment needs based on (1) high, medium, and low projections of petroleum product demand; (2) the projected range of historic and heavier-than-historical crude oil quality combinations discussed earlier; and (3) an industry model of refinery technology and operations. Table 9 represents NPC's estimate of refinery capacity requirements for their low demand case. In its 1982 Environmental Conservation: The Oil and Gas Industries, NPC stated that these low-demand projections represented their current assessment of supply and demand trends in the United States. As noted in the beginning of this chapter, EIA and Data Resources Incorporated are projecting lower petroleum demand in 1990 than even NPC's low-demand case.

As table 9 shows, U.S. refiners' projected 1984 crude oil distillation and downstream capacities exceed NPC's projected 1985 equipment requirements in all cases except catalytic reforming. To meet projected 1985 gasoline and petrochemical requirements, U.S. refiners would have to add about 300,000 barrels per day of reforming capacity to the planned 1984 capacity. This is equivalent to an increase of about 7 percent over projected 1984 capacity.

Based on projected 1984 capacity, to meet NPC's projected 1990 capacity requirements, U.S. refiners will have to add about 800,000 barrels per day of reforming capacity, about 100,000 to 300,000 barrels per day of hydrotreating and hydrorefining capacity, and at most 200,000 barrels per day of thermal cracking capacity. This is equivalent to increases during the 6 years of 19 percent, 2 to 4 percent, and 10 percent of projected 1984 capacity for each of these processes.

CONCLUSIONS

The projections discussed above suggest that U.S. refinery capacity will be adequate to meet anticipated 1985 petroleum product demands and almost adequate, with some minor exceptions, to meet anticipated product demands through the end of the decade. However, these projections are based on several assumptions concerning the Nation's economic growth, the rate at which crude oil quality changes, and refineries' expansions. If events in each of these areas unfold differently than projected, the expected balances between refinery capacity and needs may change.

Even with adequate or almost adequate refinery capacity, however, shortages of middle distillates and other petroleum products could still occur. Equipment capacities limit the maximum volume of crude oil and unfinished petroleum products which can be processed by U.S. refiners. The precise volume and mix of products that companies will produce within these limits will depend on crude oil costs and availability, refinery economics, and other factors. In addition, regional shortages of distillates could occur during the decade because of logistics problems.

AGENCY COMMENTS

In general, DOE concurred with our analysis of U.S. refinery capacity needs. DOE also did not rule out the possibility that middle distillate shortages could occur. However, based on the availability of excess domestic and foreign refining capacity and crude oil supplies, it believes such shortages are unlikely. DOE believes that U.S. refiners will be able to adequately anticipate changing market conditions and will adjust domestic refinery production, product imports, and refinery equipment expenditures to meet middle distillate demand.

CHAPTER 4

FEDERAL RESPONSIBILITIES FOR MIDDLE DISTILLATE DATA COLLECTION AND MONITORING

EIA and DOE's Office of the Deputy Assistant Secretary for Energy Emergencies (Energy Emergencies) are the focal points of the Federal collection and monitoring of middle distillate data. The scope of their activities is different, however, because of differences in the two organizations' responsibilities and missions. EIA collects and publishes a wide range of national and regional petroleum supply and demand historical statistics and prepares forecasts of the Nation's production and consumption of petroleum products through the year 2020. Energy Emergencies has an overall mission to reduce the U.S. vulnerability to energy supply disruptions by planning for and responding to severe national energy emergencies. Within the context of these responsibilities, Energy Emergencies maintains an awareness of current trends in distillates' and other petroleum products' supply and demand by monitoring data from EIA, the American Petroleum Institute, and oil industry periodicals, and through informal contact with oil industry representatives and staff analyses.

The Reagan administration has proposed fiscal year 1983 budget cuts of 31 percent for EIA and 47 percent for Energy Emergencies. The proposed budget cuts would eliminate EIA's long-term energy forecasts. However, because middle distillate monitoring and reporting is a small part of the organizations' petroleum activities, the proposed budget reduction will have a limited effect on their middle-distillate-related activities.

EIA MAINTAINS PRIMARY RESPONSIBILITY TO COLLECT, ANALYZE, AND REPORT DISTILLATE DATA

EIA was established in 1977 by the Department of Energy Organization Act (P.L. 95-91) to serve as an independent, central source of energy information. To carry out its mission, EIA collects, analyzes, and reports data on reserves, production, and demand for coal, petroleum, natural gas, electricity, nuclear, solar, and alternative energy sources. EIA's activities related to petroleum are authorized by the DOE Organization Act and other legislation which either authorize petroleum data collection or require it to carry out specific legislative mandates.

EIA collects and analyzes information on the production, transportation, sale, and use of various petroleum products. This information is reported in two general types of publications

--statistical periodicals which provide historical supply and demand data and

--forecast publications which project trends based on world oil prices, economics, and other assumptions.

Historical data are reported on a weekly, monthly, and annual basis

The major statistical petroleum publications which contain historic information on middle distillate and other petroleum products are the Weekly Petroleum Status Report; the Petroleum Supply Monthly; and the Annual Report to Congress, Volume Two. These publications differ in the degree of detail of information presented, timeliness of data, and data collection method. EIA's Prices and Margins of No. 2 Distillate Fuel Oil and State Energy Data Report provide data on distillates which are not contained in the other publications.

The Weekly Petroleum Status Report (Weekly) provides data on three major product categories--motor gasoline, middle distillates, and residual fuel oil. Information is provided on (1) production; imports, product supplied, and spot market and average retail selling prices of each of the three major products; (2) refinery capacity utilization and crude oil inputs to refineries; and (3) primary stocks of crude oil, gasoline, distillate fuel oil, and residual fuel oil. These historical data highlight trends seen in production and allow the reader to analyze short-term trends in distillate production over the past 2 years and to determine whether the ratio of distillates to other petroleum products is changing. Information on petroleum product stocks is presented for the U.S. and by PAD district. National stock statistics are compared with the 1979 NPC estimate of the industry's minimum operating inventory 1/ and with seasonal ranges developed by DOE from historic data.

The Petroleum Supply Monthly (Monthly) expands the volume and time frame of information provided in the Weekly. The Monthly provides production, imports, stock level, export, and amount supplied for the entire slate of products, rather than just the three major product categories. This provides a more detailed breakdown of the relationship between finished petroleum products than is available in the Weekly. For example, production, imports, stock withdrawals, exports, and product supplied are summarized for distillate fuel oil showing monthly averages for the past 2 years and yearly averages for 7 years before that. This provides the reader with a better historical base than the Weekly from which to view trends in distillate production, imports, and stock withdrawals and the relationship of distillate production and use to other petroleum products.

The Monthly also provides information on the supply and disposition of petroleum products within PAD districts and the movement of these products between PAD districts. This information is not contained in the Weekly, except for stock levels maintained in each PAD district. These data provide a regional

1/NPC is currently considering a request by DOE to reevaluate the minimum operating level.

perspective on the distillate situation by detailing where the product is produced; the volume distributed by pipeline, tanker, or barge from one PAD district to another; and where the supply within each district is obtained for a given month.

One aspect of the Monthly which is unique to this publication is its series of articles on various aspects of the petroleum industry. Since March 1982, when DOE consolidated several monthly publications to create the Petroleum Supply Monthly, it has contained discussions of topics such as the outlook for motor gasoline for summer 1982 and related gasoline articles, a summary of the results of EIA's annual refinery survey on capacity changes, and petroleum imports and exports. The recently issued September 1982 Monthly discusses the availability of heating oil for the upcoming winter season and recent trends in refinery closings.

The petroleum section of EIA's Annual Report to Congress, Volume Two provides information on both the domestic and international situation for the Nation as a whole. As a yearly publication, it does not contain information by PAD district or on a month-to-month basis. Rather, data are reported on an annual basis for the current year and for each year up to 30 years prior to that. This provides a broader historical perspective in which to view the evolution of current petroleum product supply and demand than the Monthly.

The Annual Report also provides information in certain categories not contained in the Weekly or Monthly. Data on the international supply and disposition of petroleum for selected countries are used to show trends in production, imports, exports, and costs of crude oil, and total refined petroleum products. However, the report does not provide specific international information on distillates.

The information contained in these three publications is obtained from the same sources within the petroleum industry. EIA's universe for petroleum data includes all (1) petroleum refineries in the United States and its territories, (2) domestic bulk terminal facilities with a minimum of 50,000-barrel storage capacity, (3) pipeline companies that carry petroleum products, (4) storage operators with 1,000 barrels or more of crude oil, (5) importers of crude oil and petroleum products, and (6) companies and plants that have custody of crude oil and petroleum products transported by tanker and barge between PAD districts.

For the Weekly, EIA chooses a sample of companies in each of the above categories. Of that universe, the current sample obtains data from the following percentage of companies: 45 percent of refiners; 62 percent of refineries; 54 percent of bulk terminals; 100 percent of pipeline operators; 38 percent of crude oil stockholders; and 6 percent of importers. Data collected on a weekly basis are extrapolated to prepare estimates of the Nation's refinery production, crude oil and product stocks, and imports. According to EIA's October 1, 1981, Weekly, the response rate for published estimates is usually about 95 percent.

Obtaining data from a sample of the EIA's petroleum universe enables the Weekly to provide data on a more timely basis than the Monthly or Annual. For example, data for the week ending September 17, 1982, were reported to EIA on September 20 and contained in the Weekly report published September 24. In contrast, the monthly data are published 60 days after the report month. Monthly data for September 1982, for example, were not reported to EIA until October 20 and were not published until the end of November 1982 in the November 1982 Monthly.

EIA publishes two other reports which provide additional information on historical distillate fuel oil trends. The monthly Prices and Margins of No. 2 Distillate Fuel Oil report provides estimates of the average monthly residential No. 2 fuel oil prices and the average gross margins 1/ for the Nation, the 10 Federal regions, and estimates of fuel oil prices for selected States. The State Energy Data Report presents annual consumption statistics for distillate fuel oil and other products in each State by fuel type and by major end-use sectors of the economy. The most recent July 1982 report presented statistics for 1960 to 1980.

Secondary and tertiary distillate stock information is limited

EIA's historical publications provide distillate inventory information at primary storage facilities. EIA does not collect information on distillate stocks held by distributors or consumers. Without this information, EIA cannot detect or anticipate local distillate fuel oil problems.

In testimony given before the Subcommittee on Fossil and Synthetic Fuels, House Committee on Energy and Commerce, on June 9, 1982, EIA's Administrator stated that EIA's policy is to focus on national information trends and relationships. He added that to develop a thorough understanding of the local supply and demand situation would be expensive and impractical. Collecting national statistics on distributors' and consumers' distillate stocks would be an integral part of developing this type of understanding of local situations.

We did not evaluate the costs and benefits associated with timely collection and reporting of distributors' and consumers' distillate stock information. However, it appears that EIA's position against collecting this information is predicated on the difficulty in obtaining responses from distributors and consumers throughout the Nation and the perceived costs of implementing a nationwide data collection and reporting system.

Based on our analysis, the Northeast is the area most susceptible to potential distillate fuel oil shortages. Therefore,

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1/EIA defines average gross margin as the average selling price minus the average product purchase cost.

distributors and consumers in this region might be more responsive to providing stock data than distributors and consumers in other parts of the country. Also, the costs and benefits of a regional data collection effort may be different from those of a national system.

Forecast publications project trends for short-, mid-, and long-term

EIA is legislatively mandated to maintain a capability to forecast and analyze relationships among energy supply, demand, prices, and other variables such as weather and the economy. EIA's major forecasting publications are the Short-Term Energy Outlook and the Annual Report to Congress, Volume Three.

The Short-Term Energy Outlook is published quarterly and provides 18-month projections of nationwide supply, demand, and average prices for petroleum products, coal, and natural gas. We used EIA's August 1982 Outlook extensively in our analysis discussed in chapter 2. For petroleum, it forecasts refinery production, imports, exports, and net withdrawal from primary stocks of distillate fuel oil, gasoline, and other products. As discussed in chapter 2, estimates are prepared for a base-case using assumptions concerning world crude oil prices, weather, and economic activity. Key assumptions such as weather and economic growth rates are then varied to determine the effect on supply and demand of petroleum products.

In addition to the quarterly Short-Term Outlook, EIA publishes mid- and long-term forecasts of energy production, consumption, and price in its Annual Report to Congress, Volume Three. The report provides projections of domestic production and consumption of coal, petroleum, natural gas, and electricity through 2020, and international production and consumption of these fuels through 1995.

These EIA forecasts can suggest trends in distillate supply and demand for the short-, mid-, and long-term. However, because of the uncertainties which exist in any forecast, they should not be taken as unqualified statements about the future. The forecasts are based on assumptions concerning world oil prices, domestic economic activities, and other variables which may not be realized, models which may misrepresent the market, and historic data which may not be accurate. The uncertainty of these factors becomes more evident the further from the base year the projections go, causing short-term projections to be more certain than long-term.

Proposed 1983 budget does not adversely affect distillate information available from EIA

Based on its budget proposal, during fiscal year 1983 EIA will retain its overall capability to provide national and PAD district middle distillate information to the Congress and other decisionmakers. However, the budget proposal calls for a $15.7-million reduction in EIA's $50.4-million fiscal year 1982

activities. The proposed reduction in funds would be achieved through elimination and/or consolidation of various programs. A major portion of the reduction comes from realigning EIA's mid- and long-term energy forecasts.

EIA will continue to collect and publish national and PAD district information on distillate fuel oil production, stocks, imports, and prices as part of its overall petroleum data collection and reporting activities. EIA's publications related to distillates will continue with some minor modifications because of changes in or consolidation of some of the collection forms. For example, beginning January 1983, the Prices and Margins Report will be discontinued as a separate publication. EIA will publish the report's distillate price statistics in another publication, but will not collect or publish statistics on distillate margins. EIA will also continue collecting national and PAD district distillate inventory information, but will not collect local stock statistics. Based on the limited changes EIA proposes, we believe that its historic publications will continue to provide an overall picture of national and regional distillate supply and demand.

DOE's fiscal year 1983 budget, however, proposes major changes to EIA's forecast reports. According to the budget proposal, EIA would discontinue developing long-term forecasts of energy supply and demand as of October 1, 1982. 1/ To partially offset this, the Short-Term Energy Outlook will be expanded from 18 months to 5 years. As of November 5, 1982, no action has been taken by the House or Senate on EIA's fiscal year 1983 appropriation request. EIA is operating at last year's funding level through December 15, 1982, on a continuing resolution.

DISTILLATE MONITORING IS A PART OF DOE'S OFFICE OF ENERGY EMERGENCIES' OVERALL PROGRAM

The Office of the Deputy Assistant Secretary for Energy Emergencies is primarily responsible for being prepared to respond to emergencies created by shortages of petroleum, petroleum products, coal, or other energy sources. To accomplish this overall mission, Energy Emergencies is responsible for developing and implementing emergency action plans and for reviewing and analyzing energy data, including petroleum products such as distillates, in order to anticipate an energy emergency and to determine its potential risks.

1/The requirement to report EIA's long-term forecasts would be eliminated by the "Congressional Reports Elimination Act of 1982" (S. 2442). The bill was referred to the Senate Committee on Governmental Affairs on April 27, 1982, and to the Senate Committee on the Budget on May 19, 1982. A similar bill passed the House of Representatives on September 29, 1982, and was referred to the Senate Committee on Governmental Affairs. As of November 5, 1982, neither committee had acted on the legislation.

The Deputy Assistant Secretary considers distillate monitoring to be included within Energy Emergencies' overall responsibilities. This monitoring is accomplished primarily by relying on statistical data from a variety of EIA and API petroleum publications, staff analysis of the supply and demand situation, and informal contacts with petroleum industry officials to maintain an awareness of current energy activities and to assess upcoming trends. For example, for the 1982-83 winter season, Energy Emergencies has analyzed the potential for a shortage of heating oil and is reviewing options for obtaining additional supplies if they are needed to avoid shortages.

Energy Emergencies' data gathering and monitoring efforts

Energy Emergencies uses a computerized energy data system called the Energy Situation Report to summarize available EIA and API statistics and industry contacts and to highlight recent events which may influence energy supply and demand. It is distributed daily to selected staff within Energy Emergencies and on a weekly basis to DOE's Under Secretary and on request to others in DOE. 1/

For middle distillates, the Situation Report provides a summary of EIA's most recently published weekly statistics on national-level distillate fuel oil stock levels, production, product supplied, and a comparison to the data for the previous week. The report also provides weekly API statistics showing refinery output; stocks; and imports of jet fuel, kerosene, and distillate fuel oil by refinery district.

In addition to this type of statistical data, the Situation Report also provides nonstatistical information and DOE staff analysis. For example, the July 22, 1982, report contained excerpts from "Platts Oilgram," a trade publication, which discussed domestic and international petroleum supply and demand development and a comparison by DOE staff of EIA distillate fuel oil statistics with historic trends. The DOE staff analysis concluded that at that time, based on projected demand, crude supplies, and refinery utilization, industry could build adequate stocks for the 1982-83 heating season.

To stay informed about events in the petroleum industry or to gather information on a particular situation, Energy Emergencies contacts officials in the petroleum industry and State and local governments. For example, based on reports of a spring 1982 gasoline and distillate shortage in the Midwest, Energy Emergencies, on May 28, 1982, put together an ad hoc group of about six staff members to contact representatives from different sectors of the energy industry for additional information. During this 1-day

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1/DOE has classified the Situation Report "for official use only" and does not release its contents to the public.

effort, DOE staff telephoned officials of 4 State Energy offices, 9 refiners, 12 pipeline companies, 11 trucking companies, 9 trade groups, and 10 Federal agencies. According to DOE staff, the contacts indicated that spring gasoline and distillate supplies in the Midwest had been tight, and some distributors had depleted their stocks. However, in almost all cases, farmers and truckers obtained supplies from other distributors. The information gathered by DOE was used to respond to inquiries from the Congress and affected States.

Informal attempts to solve temporary shortage situation

Energy Emergencies' officials informed us they intend to continue monitoring trends in the distillate market and that they will prepare themselves to assist States in case a shortage should occur by exploring options for increasing distillate supplies and sharing distillate information.

According to DOE's Deputy Assistant Secretary for Energy Emergencies, a staff analysis conducted during the summer indicated that, in total, an adequate supply of oil will be available to meet this winter's heating oil demand. However, they recognize that low pre-winter distillate fuel oil stocks could increase the probability of spot shortages in the Northeast. Therefore, Energy Emergencies staff have expanded their day-to-day monitoring efforts to options for moving heating oil to and within the Northeast region if a short-term supply problem occurs. For example, DOE staff have studied the number and availability of tankers needed to bring products to the Northeast's coastal region, and the availability of excess temporary storage capacity. In addition, they have contacted oil companies to obtain their views on options for increasing supplies to the Northeast if needed.

In the event of a shortage this winter, Energy Emergencies would informally contact companies which supply the affected or nearby areas to solicit their help in obtaining additional supplies, and would discuss alternatives informally with concerned States. DOE has completed and uses a two-way computerized telephone communication system connecting it with each State to facilitate this type of voluntary interaction. According to DOE's Associate Director for Energy Emergencies, DOE recently used the communication system during September 1982 to inform States about the impact a nationwide rail strike would have on coal shipments to utilities.

Energy Emergencies' proposed fiscal year 1983 budget reduction

DOE's proposed fiscal year 1983 budget calls for $5.4 million for Energy Emergencies' activities. This is equivalent to a 47-percent proposed reduction from its fiscal year 1982 budget of $10.2 million. These proposed reductions would primarily eliminate several national Energy Emergency preparedness planning efforts. However, these efforts do not affect Energy Emergencies' plans or

activities related to middle distillates. DOE proposes to continue the daily Situation Report, distillate-monitoring efforts by the six to eight staff assigned during fiscal year 1982 to monitor petroleum information, and the voluntary communication link with States.

CONCLUSIONS

EIA's petroleum demand and supply statistics and forecasts provide the Congress and other decisionmakers with the capability to monitor middle distillate trends nationwide. These trends can highlight potential problems in refineries' supplies of petroleum products, the timing and location of primary stock buildups, and import levels. DOE collects limited data, however, on current aspects of supply and demand at the State and local level such as secondary and tertiary inventories.

As discussed in chapter 2, although projected supplies of distillate fuel oils are expected to be adequate to meet this winter's demand, local problems could occur. Since information is not available at this level, DOE is not in a position to anticipate these local shortages but must react to them after the fact.

In case of a middle distillate shortage, depending on the severity and cause of the situation, Energy Emergencies' response would be an informal, ad hoc effort to learn the scope and causes of the problem and to work with Federal, State, and industry representatives to resolve the situation. However, it remains to be seen how effective such an approach would be.

EIA's proposed fiscal year 1983 budget would have a limited effect on its national-level information gathering and reporting capabilities for middle distillats but would preclude EIA from collecting and reporting secondary and tertiary stock information without reducing or eliminating other programs. The proposed 31-percent budget reduction would primarily eliminate long-term supply and demand forecasts. As of November 5, 1982, the Congress had not acted on the proposal.

Energy Emergencies' proposed fiscal year 1983 budget calls for even greater budget reductions--an almost 50-percent reduction. Middle distillate activities are a small part of the organization's total petroleum monitoring and contengency planning activities. Therefore, although the proposed budget reductions are a large percentage of the organization's total budget, they apparently will have limited effect on its middle-distillate-monitoring activities.

APPENDIX I

COMPANIES CONTACTED BY GAO

DISTILLATE PRODUCERS

Standard Oil of Indiana
Chicago, Illinois

Mobil Oil Corporation
Fairfax, Virginia

Atlantic Richfield Company
Los Angeles, California

Chevron USA
San Francisco, California

Gulf Refining and Marketing
Houston, Texas

Texaco Incorporated
Houston, Texas

Exxon Company, USA
Houston, Texas

DISTILLATE MARKETERS/DISTRIBUTORS

Midwest

Lykins Oil Col.
Milford, Ohio

Waggoner Fuels
South Bend, Indiana

Gallup-Silkworth Company
Ann Arbor, Michigan

Christner Oil Company, Inc.
Nappanee, Indiana

Northeast

Belcher Company of New York/Belcher New England
Maspeth, New York

Public Fuel Service, Inc.
New York, New York

Mennan Oil Co., Inc.
Syosset, New York

APPENDIX II

Department of Energy
Washington, D.C. 20585

DEC 10 1982

Mr. J. Dexter Peach
Director, Resources,
Community and Economic
Development Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Peach:

The Department of Energy (DOE) appreciates the opportunity to review and comment on the General Accounting Office (GAO) draft report, "Potential Middle Distillates Supply and Demand: 1982 Through 1990 (Code 306287)." In general, we concur with the analysis in the draft report. We have enclosed comments that could be helpful in preparing the final report, and have made some minor changes and corrections on the manuscript.

Sincerely,

Martha O. Hesse
Assistant Secretary for
Management and Administration

2 Enclosures

GAO note: Page references in DOE's comments have been changed to refer to the final report.

APPENDIX II

DOE Comments on the GAO Proposed Report: "Potential Middle Distillates Supply and Demand: 1982 through 1990" (Code 306287)

I. Overview - A Dynamic Market Analysis Framework

1. Background

The Report entitled "Potential Middle Distillates Supply and Demand: 1982 through 1990" concludes that shortages of distillates are possible throughout the period examined. This conclusion is put forth even though information contained in the body of the report, about expected trends in refining capacity, and product demand and supply, clearly indicates that severe shortages of middle distillates are highly improbable. The report is based on a generally static view of the refining industry's ability to respond to changing demand and supply conditions. Indeed, the conclusions of the report might be significantly different if a more dynamic framework were used to determine whether refiners should anticipate and make the adjustments needed to meet near-term increases in the demand for middle distillates, or, in the long-term, to increase distillate yields from lower quality crude oils.

2. Excess Refining Capacity

If there is not an interruption of crude oil supplies during the next few years, excess refining capacity in the United States and throughout the world will be readily available to offset potential shortages of middle distillates in this country. By limiting its examination only to the flexibility of domestic refiners to increase distillate output, the report neglects the fact that the United States imports significant quantities of distillates at economic prices from offshore refineries. These refineries have the capability to increase distillate yields significantly.

The findings of the report also appear to reflect an underlying assumption that refiners will not respond to circumstances, such as low regional inventory levels, that may tend to increase the risk of a distillate shortage. The length of time required to refine crude oil and transport distillates to the East Coast from offshore refineries (3 days) and Gulf Coast refineries (15 days) is referenced in the report to show how reliance on refining capacity can contibute to a shortage. But, the report gives no consideration to whether refiners are reasonably likely to anticipate conditions which may lead to a shortage and increase distillate output and deliveries to the East Coast far enough in advance to prevent a shortage from actually occurring. It is important to note that

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refiners are accustomed to anticipating demand fluctuations. Indeed, one of the primary uses of product inventories is to meet sudden changes in demand. Although inventory management decisions have changed somewhat due to reduced demand and excess refining capacity, this does not mean that refiners no longer plan or prepare for abnormal demand fluctuations. In addition, the report overlooks the role of the world spot market in providing an almost immediate source of additional supplies to domestic areas experiencing rising prices caused by product shortages.

3. Economics of Inventory Management

The report does not appear to fully appreciate the economic implications of excess refining capacity and lower product inventory levels. After allowing for the time required to refine and transport products, excess refining capacity is directly substitutable for regional product inventories. It is economically efficient for refiners to seek to avoid the high variable costs of holding inventories and to rely instead on idle refining capacity, for which the fixed costs are unavoidable, to meet demand fluctuations. Consumers benefit from lower product prices that reflect refiners efforts to minimize their costs by holding lower inventories. Although, to some extent, refiners replace product inventories with crude oil inventories, this too contributes to economic efficiency because; it is possible to incur the real resource costs of refining crude oil closer to when the products are actually consumed; and it increases the flexibility of refiners to maximize the yield of those products needed most by consumers. Of course, decisions by refiners about how to coordinate the use of large amounts of excess refining capacity with product inventory withdrawals are unique and unlikely to follow historical patterns. Thus, the report's use of the rate at which distillate inventories have been released in the past to estimate how rapidly inventories may be depleted in the future is not a good indicator of whether a distillate shortage may occur this winter.

4. Long-term Shortages of Middle Distillates

Although the report concludes that shortages of middle distillates may occur later in this decade if refiners underinvest in new processing capacity, the report acknowledges that most estimates of future product demand, trends in crude oil quality, and planned additions to processing capacity indicate that a long-term distillate shortage should not occur. Nonetheless, the report speculates that rapid and unanticipated changes in demand

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or crude oil quality could catch the refining industry unprepared and distillate shortages could result. From a public policy point of view, the gradual degradation of the quality of crude oil that should induce gradual modification of refinery facilities presents no problem requiring government intervention. The technology for processing low quality crudes is well known, currently in use, and available to any refiner who wishes to install it. Expanding the capacity of refineries to process heavy, high sulfur content crude should present the refining industry a much less severe investment scheduling problem over the next two decades than was met and resolved in the fifties and sixties when refineries were expanding output and the quality of that output (higher octane gasoline and more jet fuel per barrel of throughput). There is no compelling reason to believe that in the future refiners will no longer anticipate or be slow to adjust to changes in market conditions. Moreover, installing new refinery equipment does not take a long period of time. Three years is generally considered the average construction time necessary to accomplish almost any desired refinery reconfiguration, once necessary permits have been obtained.

Economics provide the incentive to adapt refinery configuration to changing market conditions. At any given time, refinery configuration is fixed and reflects the intersection of market demand and refining costs for all products. If a relative shortage or surplus of any one product should develop, this will be immediately reflected in the price differentials between that product and others. Even expected future shortages of some products will be reflected in current product price differentials. An increase in the difference between current and future period prices of a product due to an expected shortage of the product and limited refinery capacity will cause an increase in current period prices as the market responds to the incentive to increase supplies of the product available in future periods. If the increased price differential among products is projected to persist over time (i.e., if the shortage is not just a temporary phenomenon), there is likely to be additional capital investment which will enable a refiner to produce less of the relatively abundant product and more of the relatively scarce one if the additional revenues will provide an adequate rate of return on the investment.

5. Summary

Excess refining capacity, a slack crude oil market and the natural dynamics of market adjustments make severe middle distillate shortages highly improbable. Of course, it certainly is not impossible that shortages may occur. It is unclear, however, that the conclusions of the report will be useful in developing good public policy. Since the report is not specific with respect to how likely and severe potential distillate shortages are, the Congress may have difficulty determining if the expected costs of distillate shortages warrant any government action.

In the next few years, middle distillate shortages are unlikely primarily because of the availability of excess domestic refining capacity and sufficient crude oil supplies. Excess refining capacity abroad and supplies of distillate available from the world spot market further reduce the likelihood and potential severity of temporary domestic distillate shortages in the near term. In addition, excess refining capacity can be used to substitute for product inventories. Thus, current low distillate inventory levels do not make distillate shortages appreciably more likely. Finally, from now until 1990, there is little reason to believe that the refining industry will not adequately anticipate, or will not be able to adjust quickly and efficiently to changing market conditions.

GAO note: Our review did not identify any study which projected the specific probability and duration of potential middle distillate shortages. As agreed with the Chairman's office, we agreed not to develop projections of middle distillate supply and demand.

The report incorporates DOE's comments concerning the unlikely potential for middle distillate shortages. DOE's conclusions are similar to those of the report, except that the report raises the possibility of shortages as a caveat to its refinery equipment analysis.

II. General Comments

1. Emergency Planning Programs

The report casts the Office of Energy Emergencies (EE) in a strictly reactive role, responding to problems after they develop. The report does not recognize that EE has also played a predictive role, i.e., has seen potential problems developing, warned of their development and has acted to mitigate their effects before they became unmanageable. The Office of Energy Emergency Operations (OEEO) actions

this past spring, with respect to middle distillates, is a good example of this activity. Furthermore, the Energy Situation Report is considered an "Early Warning" system, functioning to alert key officials of the development of possible problems.

OEEO's problem resolution function does not seem to be adequately recognized by the report. This office's activities do not end after the analysis and assessments are completed. If and when warranted, OEEO has become involved by talking to parties on an informal basis and has been quite successful, on occasion, in resolving problems at the "molehill" stage, before they became "mountains."

GAO note: Energy Emergencies' actions this spring is not a good example of its predictive, warning, and mitigating action role. Although Energy Emergencies was aware of the situation, and contacted a variety of organizations to obtain additional information, it (1) communicated results of the information gathering survey primarily only to those requesting additional information and (2) did not take any mitigating action because the problem was perceived as temporary and self-correcting. The office's information gathering effort is discussed on pages 30 and 31 of the report.

Page 31 of the report also discusses Energy Emergencies' informal approach to resolving potential energy supply problems.

2. Current Distillate Supply

The report should be revised to reflect the most current data available from EIA. Middle distillate supplies have increased by over 10 million barrels above the October 1, 1982 data used in the report.

GAO note: Middle distillate statistics in the report were updated as of November 26, 1982.

3. Other Issues

Though properly focused on middle distillates, the report fails to recognize other related problems and issues that could have significant indirect impacts on supplies of middle distillates. Issues such as phasedown of gasoline lead content, middle distillate exports, kerosene supplies and quality, Cetane ratings for diesel fuel and the use of residual fuel oil as refinery feedstock do not appear to have been addressed by the report.

GAO note: We agree these issues and factors may have an indirect effect on middle distillate supplies. They are not necessarily new issues, however, and to some extent were incorporated into the 1980 NPC refinery equipment analysis discussed in chapter 3.

III. Specific Comments

1. Chapter 1

Page 1, Paragraph 1:

Uses for middle distillates should be expanded to include other major consumers such as planes, locomotives and ships.

Page 1, Paragraph 2:

The definition of middle distillates in the draft report includes jet fuels and kerosene. Data reports published by the Energy Information Administration (EIA) consider jet fuels and kerosene to be separate commodities. Associated with these differences in definitions, refinery yields shown in the draft report do not agree with published EIA data.

Page 2, Paragraph 4:

While GAO named several EIA reports that could be used to assess supplies of distillate fuel oil for the 1982-83 winter, additional germane data are available from Form EIA-25 reports. These reports provide monthly deliveries of selected petroleum products, including distillate fuel oil on a State basis.

Page 3, Paragraph 1:

The contact with the National Oil Jobbers Council is not noted in Appendix I.

2. Chapter 2

Page 5, Paragraph 2:

Middle distillates demand may not necessarily be higher this winter, even if more severe weather occurs, due to conservation and significant use of alternative sources of fuel for heating such as wood stoves and kerosene heaters.

Page 9, Table 3:

Twenty-one percent middle distillate yield is probably too low; recent yields (October 29, 1982) approached 23 percent.

Page 10, Paragraph 2 and Page 11, Table 4:

The report states that national average distillate yields could be increased to 25 percent. This is an unusually high distillate yield and should be so noted.

Page 13, Paragraph 2:

Three- to five-day delivery time from the Gulf Coast to the Northeast using tankers assumes that tankers are instantly available, which they are not. Most are booked months in advance.

Page 13, Paragraph 2:

With respect to the analysis of days of distillate supply in PAD I, it should be noted that only a portion of those stocks can be withdrawn. The remaining stocks represent pipeline fill and storage tank bottoms. The 60-day supply number is misleading. In addition, the 60-day supply of middle distillates in PAD I is in relation to current demand. In a peak demand period such as January, the supply would shrink sharply to about 30 days.

Page 13, Paragraph 3:

This paragraph should mention that EIA collects data on distillate stock levels at refineries and storage terminals at the State level, and pipeline stocks at the PAD level.

GAO note: The paragraph discussed was deleted from the final report.

3. Chapter 4

Page 25, Paragraph 1:

EIA's Quarterly Report: Energy Information, and International Energy Annual should be included in the list of EIA publications that contain historic information on distillates and other petroleum products.

Page 25, Paragraph 2:

The report's summary of the Weekly Petroleum Status Report should note that imports and product supplied data are provided for motor gasoline, middle distillates, and residual fuel oil in addition to the variables mentioned.

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Page 26, Paragraph 3:

This paragraph should be amended to show that the State Energy Data Report contains data on petroleum products by economic sectors, rather than the Annual Report to Congress.

Page 26, Paragraph 6:

The discussion of EIA's respondent coverage for the Weekly Petroleum Status Report should indicate that the sample provides 90 percent or greater coverage for each data item that is published.

Page 27, Paragraph 2:

The draft report notes that the July 1982 State Energy Data Report, contains petroleum data for the period 1960 through 1980 and that this information is outdated. However, the EIA Petroleum Supply Annual is the primary source for distillate fuel oil deliveries in the State Energy Data Report, and the July 1982 publication provides 1981 data.

Page 27, Paragraph 3:

Information down to the specific state level is critical in being able to manage middle distillate supply.

Page 27, Paragraph 5:

The GAO draft states the major reason for EIA not collecting distributor and consumer distillate stocks information is predicated on the perceived costs and neglects to mention that a major difficulty confronting any collection of secondary and tertiary middle distillate stock information is the reluctance of the respondents to respond.

Page 29, Paragraph 2:

GAO's comments on the proposed 1983 budget should show that EIA plans to continue to collect State-level stock statistics at petroleum refineries and bulk terminals, but not at pipeline terminals.

Page 30, Paragraph 2:

Insert in the third line from the bottom: Energy Emergencies used an Official Use Only data system... .

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Appendix I (List of GAO contacts):

Suggest that the New England Fuel Institute (Charles Burkhart) and the Deepwater Terminal Operators Assn. also be contacted.

(306287)

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