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Morning Session						
9:00	Registration and Reception	2:15	Break	2:30	Concurrent Panel Discussions	Winter 1991-1992: Forecasting the Gulf War
8:30	Welcome and Opening Remarks	Cavin A. Kent, Ph.D.	W. Calvin Krigor	Moderators:	Diane Liguori, EIA Daniel A. Dryfus, Gas Research Institute Bruce Henning, American Gas Association	Panelists: Guy Caruso, Office of Energy Emergency Policy and Evaluation, DOE Asa Jannay, ICFA Resources Edward N. Krapple, Energy Security Analysis John Sauer, Conoco Inc.
9:00	How Energy Forecasting Fared	2:30	Concurrent Panel Discussions	7) Forecasting Petroleum Prices	Moderators: Mark Rodekohr, EIA Adam Sieminski, Washington Analysis Corporation	Panelists: William Veno, DRIMcGraw-Hill Philip Verheger, Institute for International Economics Economics Diane Liguori, EIA Daniel A. Dryfus, Gas Research Institute Bruce Henning, American Gas Association
9:15	Winter 1991-1992: Forecasting the Oil Market	2:30	Concurrent Panel Discussions	2) Forecasting Natural Gas Prices	Moderators: Diane Liguori, EIA Daniel A. Dryfus, Gas Research Institute Bruce Henning, American Gas Association	Panelists: Guy Caruso, Office of Energy Emergency Policy and Evaluation, DOE Asa Jannay, ICFA Resources Edward N. Krapple, Energy Security Analysis John Sauer, Conoco Inc.
10:30	Break	2:30	Concurrent Panel Discussions	3) Short-Term Energy Model Development	Moderators: David Costello, EIA Timothy Considine, Pennsylvania State University G.S. Maddala, University of Florida Pennsylvania State University Timothy Mount, Cornell University Evlyn Amerchik Energy Information Administration (202) 586-8760	Panelists: Michael T. Woo U.S. House of Representatives Committee on Energy and Commerce Larry Makovich, DRIMcGraw-Hill Jerry Karagakis, National Coal Association David DeAngelo, Pennsylvania Power & Light Russell Tucker, Edison Electric Institute Paul Surgoan, Ziegler Coal Company Larry Makovich, DRIMcGraw-Hill Jerry Karagakis, National Coal Association David DeAngelo, Pennsylvania Power & Light Russell Tucker, Edison Electric Institute
10:45	Keynote Speaker:	4:00	Conference Concludes	Electric Power Forecasting Issues	Moderator: Mary Hutzler, EIA	Panelists: David DeAngelo, Pennsylvania Power & Light Jerry Karagakis, National Coal Association David DeAngelo, Pennsylvania Power & Light Russell Tucker, Edison Electric Institute Paul Surgoan, Ziegler Coal Company Larry Makovich, DRIMcGraw-Hill Jerry Karagakis, National Coal Association David DeAngelo, Pennsylvania Power & Light Russell Tucker, Edison Electric Institute
11:30	Lunch Break	4:00	Conference Concludes			

The focus of the symposium is to provide an opportunity for users of the Short-Term Energy Outlook and market developments and emerging issues having an impact on short-term energy markets. Guest speakers from government and industry will discuss their forecasting methods and compare their results with the projections presented in the fourth quarter Short-Term Energy Outlook. It is anticipated that input from outside experts will enhance the understanding and ability of EIA staff to provide short-term energy forecasts for the energy industry. The symposium will also feature insights into ongoing energy analysis and forecasts. Attendance for the symposium is free, but reservations must be made in advance to reserve a place.

November 21, 1991
Crystal Gateway Marriott
Arlington, VA

Symposium on Short-Term Energy Forecasting

The Energy Information Administration
is pleased to announce the

Short-Term Energy Outlook

Quarterly Projections

Fourth Quarter 1991

Energy Information Administration
Office of Energy Markets and End Use
U.S. Department of Energy
Washington, DC 20585

This report was prepared by the Energy Information Administration, the independent statistical and analytical agency within the Department of Energy. The information contained herein should not be construed as advocating or reflecting any policy position of the Department of Energy or any other organization.

Domestic crude oil production figures are provided by the EIA Dallas Field Office, under the supervision of John H. Wood. Nuclear electricity generation is provided by Besty O'Brien (202/254-5490); hydroelectric generation, electric utility imports, and exports are provided by Byung Doo Hong (202/254-5365)—all of the EIA Office and coal production, imports, and exports are provided by Robin Reichenbach (202/254-5353); and coal production, imports, and exports are provided by Karen E. Blawie (202/586-2867) of Coal, Nuclear, Electric and Alternative Fuels.

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Macroeconomic	Kay A. Smith (202/586-1455)
Energy Product Prices	Neil Ganson (202/586-2418)
Petroleum Demands	Michael Morris (202/586-1199)
Petroleum Supply/Integration	Elias Johnson (202/586-7277)
Natural Gas	Evelyn Americh (202/586-8760)
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The Short-Term Energy Outlook is prepared by the Energy Information Administration (EIA), Office of Energy Markets and End Use (EMEU). General questions concerning the content of the report may be referred to W. Calvin Kilkinger (202/586-1617), Director of EMEU; Arthur Andressen (202/586-1441), Director of Energy Markets and Contracting Branch; Information Division; or Derniel Cato (202/586-6574), Chief of the Short-Term Forecasting and Contracting Branch. Detailed questions may be addressed to David Costello (202/586-1468) or the following analysts:

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PREFACE

The Energy Information Administration (EIA) presents future cases of quarterly short-term energy supply, demand, and prices for publication in February, May, August, and November in the Short-Term Energy Supply Outlook (Outlook). An annual supplement analyzes the performance of previous forecasts, compares recent cases with those of other forecasters, and discusses current topics related to the short-term energy markets. (See *Short-Term Energy Forecasting Services*, and *Annual Supplement*, DOE/EIA-0202.) The principal users of the Outlook are managers and energy analysts in private industry and government.

The cases are produced using the Short-Term Integrated Forecasting System (STFS). The STFS model is driven principally by the following sets of assumptions or inputs: estimates of key macroeconomic variables, world oil price assumptions about the severity of weather, DRI/McGraw-Hill, but are adjusted by EIA to reflect EIA assumptions about the world price of crude oil, energy product prices, and other assumptions which may affect the macroeconomic outlook. (The EIA model is available on computer tape from the National Technical Information Service.)

The cases and historical data are based on EIA data published in the Monthly Energy Review, Petroleum Supply Monthly, and other EIA publications. All percentage changes are calculated from the values in the tables rather than from any rounded numbers cited in the text. Data in this Outlook are due to independent rounding. All percentage changes between the data in those publications and the historical last fall by the National Petroleum Council. The results of the review were published in "Short Term Petroleum Outlook: An Examination of Issues and Projections." An Emergency Preparedness Report of the National Petroleum Council, January 1991. Key petroleum product price equations (for motor gasoline and distillate fuel) have been upgraded to include important demand/supply interaction terms which allow for a more realistic representation of price movements in sensitivity analysis.

A new routine to solve for electric utility fuel shares by region has been added which improves the reasonableness and defensibility of the projected impact of electricity growth on fossil fuel demands. More information on these and other methodological improvements to the STFS will be available in the forthcoming *Short-Term Energy Outlook Annual Supplement 1991*, DOE/EIA-0202(91).

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Note: The data referenced may be found in Table I or in the tables located in the back of this report.

Coal production is expected to decrease by 2.3 percent for all of 1991 compared to last year's record level, mainly because of lower consumption and the aftermath of a significant secondary stock build-up in 1990. The 1991 total should still remain above the 1 billion ton level. Coal production is expected to rise 2.7 percent next year with higher demand and exports.

Electricity demand should also increase in 1992 if the economy turns around.

In 1991, despite the economic recession, because temperatures were above normal during this past spring and summer and heating requirements are assumed to be higher this coming fall than in the mild fourth quarter 1990.

Growth in total electricity sales is expected to average more than 2 percent

in 1991 (expected if weather conditions are normal for the rest of this year).

Total natural gas demand in 1992 is projected to total about 18.7 trillion cubic feet. Thus, 1992 is expected to bring the highest annual level for gas cubic feet. Since 1981, as the economy recovers and assumes normal weather use since 1981, as the economy recovers and assumes normal weather conditions increase demand in all major sectors. The expected increase next year would follow upon little if any change in total consumption between 1990 and 1991 (expected if weather conditions are normal for the rest of this year).

In contrast to recent improvements in domestic crude oil production, declines in daily average output of between 230,000 and 430,000 barrels per day are expected for 1992. Signs of a turn downward, reflecting modest declines in a year-over-year basis.

Strong growth in domestic petroleum use is expected during the current winter quarter, particularly in terms of year-over-year increases. However, the domestic petroleum industry appears to be adequately prepared to meet most expected demand increases in the near term. A high growth scenario combined with extremely cold temperatures could generate a challenge to the fuel distribution system. Going into the fourth quarter 1991, propane stocks are well below normal and could pose a problem. Overall increases in U.S. oil demand for 1992 are expected to average between 0.8 and 2.3 percent, depending on oil prices.

In 1992, a rebound in the economies of the industrialized countries is expected to drive a worldwide increase in petroleum demand of 750,000 barrels per day (1.2 percent). For the countries of the Organization for Economic Cooperation and Development (OECD), a total increase of 550,000 barrels per day in 1992 is anticipated. The United States is expected to account for one-half of the OECD increase, while Europe and Japan will each account for about one-fifth.

Coal Production Retreats from Record Levels

Economic Recession Expected this Year Despite Electric Demand Growth

Firm Gains in 1992 Natural Gas Demand Posts

U.S. Petroleum Output Resumes Decline in 1992, As Price Outlook Remains Moderate

U.S. Petroleum Demand Increases; Ample Supplies for Upcoming Heating Season

World Oil Demand Increases Next Year if Economies Improve

Highlights

U. S. Energy Supply and Demand Summary									
	Price	Range ^e	Year	1989	1990	1991	1992	1989-1990	1990-1991
Real Gross National Product	(billion 1982 dollars)	Mid	4120	4157	4147	4263	0.9	-0.2	2.8
Imported Crude Oil Price (nominal dollars per barrel)	Low	18.09	21.77	19.11	20.00	20.3	-14.6	7.3	4.7
Crude Oil Production ^f (million barrels per day)	Low	7.34	6.91	7.36	7.36	7.04	-3.3	0.0	-4.3
Petroleum Supply	Net Petroleum Imports, including SPR (million barrels per day)	Mid	7.20	7.16	6.70	7.33	-0.6	-6.4	12.5
Energy Demand	Total Petroleum Product Supplied (million barrels per day)	Low	17.33	16.99	16.65	16.92	-2.0	-2.0	1.6
Natural Gas Consumption (trillion cubic feet)	Low	18.80	18.84	18.68	19.33	-1.1	3.7	3.7	4.8
Coal Consumption (million short tons)	Mid	18.80	18.84	18.68	19.33	-1.1	3.7	3.7	4.8
Electricity Sales ^g (billion kilowatthours)	Mid	2647	2705	2771	2859	2.2	2.4	3.2	3.2
Gross Energy Consumption ^h (quadrillion Btu)	Mid	81.3	81.4	81.0	83.6	0.1	-0.4	3.1	3.1
Household Btu/1982 Dollar of GNP	Mid	19.73	19.58	19.56	19.61	-0.8	-0.1	0.3	0.3
SPR: Strategic Petroleum Reserve	The conversion from physical units to Btu is calculated using a subset of Monthly Energy Review (MER) conversion factors. Consequently, the historical data may not precisely match that published in the MER.								
Notes: Minor discrepancies with other published data are due to independent rounding. Historical values are printed in boldface, forecasts in italics.	"Price Range" refers to the imported refiners' acquisition cost of crude oil assumed for the scenario depicted. In all cases for this table, the mid-case macroeconomic outlook is assumed, and whether is assumed to be normal.								
Sources: Historical data: Energy Information Administration, Monthly Energy Review, DOE/EIA-0340(g)(1); Natural Gas Monthly, DOE/EIA-0130(g)(1/10); Petroleum Supply Monthly, DOE/EIA-0226(g)(1/10); and Quarterly Coal Report, DOE/EIA-0121(g)(2C). Macroeconomic projections are based on DR/McGraw-Hill Forecast Control 1991.	The forecasts were generated by the following supply systems of the demand and supply subsystems of the Short-Term Integrated Forecasting System: DOE/EIA-B1; 092691BB13:49 for the low oil price case; and DOE/EIA-0190(g)(1/10); 100991BB14:39 for the middle oil price case; and 100991BB14:37 for the high oil price case.								
Historical EIA publications, but much information is not available annually totals reported in EIA's Electric Power Monthly, DOE/EIA-0226.	"Total annual electricity sales for historical periods are derived from the sum of monthly sales figures based on submissions by electric utilities of Form EIA-826."								
"Monthly utility sales and Revenue Report with State Distributions." These historical values differ from annual sales totals based on Form EIA-861, reported in several EIA publications.	"Initial annual electricity sales for historical periods are derived from the sum of monthly sales figures based on submissions by electric utilities of Form EIA-826."								

Table 1. U. S. Energy Supply and Demand Summary

Assumptions

World Oil Prices

The world oil price is affected by three factors, each subject to substantial uncertainty. These three factors are oil supply, oil demand, and the amount of excess petroleum stocks relative to petroleum demand (as measured in days of forward consumption).

Oil supply factors appear to be subject to the most uncertainty over the forecast period, with considerable uncertainty surrounding both oil exports from the Union of Soviet Socialist Republics (U.S.S.R.) and oil production from the Organization of Petroleum Exporting Countries (OPEC). Oil exports from the U.S.S.R. will be determined by the relative decline rates of both Soviet oil production and consumption and the competing need for hard currency, each of which is highly uncertain at this time. Oil production by the OPEC will be determined by OPEC oil production capacity and by the actual production rates of the member countries, both of which are also subject to significant uncertainty. The OPEC oil production capacity will be affected primarily by the speed with which Iraq and Kuwait are able to restore their oil production facilities. While Kuwait will probably increase production as capacity is restored, Iraq's actual production will be affected by other uncertain factors. These will include whether Iraq will accept the United Nations oil export scheme, whether that scheme will be extended beyond the initial 6-month term and at what amounts, and how quickly Iraq will be able to repair its oil export facilities. Aggregate OPEC production will also be affected by the willingness of other OPEC member countries to restrain their production, if necessary, to accommodate increased exports from Iraq and Kuwait.

On the oil demand side, the two key uncertainties are the severity of winter weather and the magnitude of economic growth, especially in the United States and in the other countries that comprise the Organization for Economic Cooperation and Development (OECD). There is also uncertainty currently about the amount of excess petroleum stocks available relative to demand. An abnormally high level of petroleum stocks could prove useful this winter because it would offset, at least partially, the upward pressures on the world oil price from low levels of excess OPEC oil production capacity.

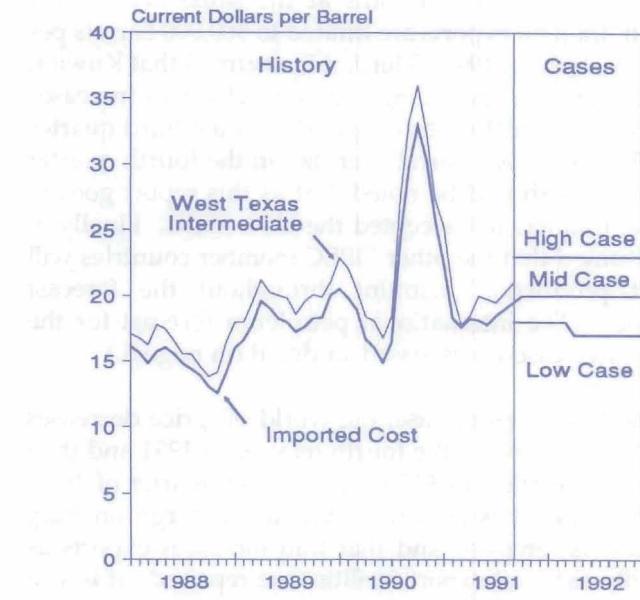


Figure 1. Crude Oil Prices

Note: Imported prices are defined as the cost of imported crude oil to U.S. refiners.

Sources: History: Energy Information Administration, *Monthly Energy Review* (October 1991); and *Oil and Gas Journal Energy Database*. Cases: Table 4.

Because of these uncertainties, three different world oil price cases are employed (Figure 1 and Table 1). These cases are used to develop a mid-price case projection and alternative projections for domestic petroleum supply and demand.

The three world oil price cases are meant to represent the range over which prices could vary during the forecast period. Given the uncertainties in the world oil market, the world oil price could be more toward the upper end of the range in the fourth quarter of 1991 and in the first and fourth quarters of 1992 and tend toward the lower end of the range in the second quarter of 1992.

In the mid-price case, the world oil price increases from an estimated \$19 per barrel in the third quarter of 1991

to \$20 in the fourth quarter and throughout 1992. This case is based on the following assumptions. First, oil exports from the U.S.S.R. are assumed to be 20 percent lower in the fourth quarter of 1991 than in the same period of 1990 and about 25 percent lower in 1992 than in 1991. Second, it is assumed that Iraq accepts the United Nations oil export scheme, that Iraqi exports begin in January 1992, and that the scheme is extended for an additional 6 months at the same rate. As a result, Iraqi oil exports are limited to 500,000 barrels per day throughout 1992. Third, it is assumed that Kuwaiti oil production (excluding the Neutral Zone) increases from about 150,000 barrels per day in the third quarter of 1991 to 800,000 barrels per day in the fourth quarter of 1992. It should be noted that as this report goes to press, Iraq has not accepted the U.N. terms. Finally, it is assumed that the other OPEC member countries will exert production restraint throughout the forecast period. (The international petroleum forecast for the mid-price case is discussed in detail on page 5.)

In the low oil price case, the world oil price decreases to \$18 per barrel in the fourth quarter of 1991 and then decreases further to \$17 in the second quarter of 1992. In this case, it is assumed that the embargo on Iraqi exports is removed and that Iraq increases exports as rapidly as its oil export facilities are repaired. It is also assumed that OPEC production restraint is weak so that other OPEC member countries do not reduce production as Iraqi and Kuwaiti exports increase. At the same time, other factors are assumed to contribute to lower prices, including higher exports from the U.S.S.R. and lower economic growth by the OECD countries than assumed in the mid-price case, as well as mild winter weather.

In the high oil price case, the world oil price increases to \$23 per barrel in the fourth quarter of 1991 and throughout 1992. In this case, it is assumed that there are no Iraqi oil exports throughout 1992 and that winter weather is abnormally cold. Also, it is assumed that oil production from Kuwait and oil exports from the U.S.S.R. are lower than in the mid-price case, and that other OPEC countries hold production down in order to push oil prices higher.

Macroeconomic Activity

After 2 consecutive years of weak economic growth, the economy is expected to recover, albeit modestly, in 1992. Gross national product (GNP) is expected to attain 2.8 percent growth (Table 2). Even though this recovery will be modest in contrast to past recoveries, it will have a similar pattern. Increases in business

investment will begin the 1992 growth of the economy. Investment spending will rebound, increasing by 13 percent, compared to the previous year's decline of 8 percent. Decreases in interest rates and growth in both exports and consumption will increase investments in late 1991 and early 1992. Consumer spending will begin to grow during the latter part of 1991, as increases in both consumer confidence and employment will lead to 1992 growth in consumption of 2.1 percent. The trade balance will serve as a check to GNP growth in 1992. Imports will increase more than exports, as consumers begin to increase spending and the exchange rate appreciates.

The economic recovery will be modest for several reasons. First, sectors that usually grow relatively quickly after recessions, the housing sector and residential construction, still suffer from overcapacity. Second, consumption will be held in check, compared to past recoveries, because of remaining high levels of consumer debt. Third, because of weaker capital positions, higher Federal Deposit Insurance Corporation premiums, and large loan losses, changes in monetary policy will not provide as much investment stimulus as in the past recoveries. Finally, since both the Federal and State budgets are under pressure, the government will not provide a spending stimulus for the economy.

For all of 1991, real GNP is expected to show a very modest decline of 0.2 percent. The recovery begins modestly in the third quarter of 1991 (Figure 2). Quarterly growth in GNP will remain in the 2.8- to 3-percent range through the rest of 1991 and the early part of 1992. Consumption begins to increase in the second half of 1991 with investment showing improvement in the third quarter in response to falling interest rates. Interest rates, falling in response to declines in output and slack investment demand, begin to increase in the fourth quarter of 1991, leading investment growth to level off in the last 2 quarters of 1992. The trade balance has improved in 1991, primarily due to a fall in imports rather than increases in exports. Export growth in 1992 will improve, but imports post higher growth, resulting in the real trade balance deteriorating slightly in 1992.

Manufacturing production will recover in 1992, showing 4.4-percent growth, compared to the 1991 decline of 1.9 percent. Improvements in business investment and exports explain much of the production sector's improvement. In 1992, real disposable income increases by 1.9 percent after the 1991 decline of 0.5 percent. The rate of inflation is expected to slow in 1992 as expected wage increases lessen in response to the increased unemployment experienced in 1991.

In the second quarter of this year, utility fuel prices for both natural gas and residual fuel oil have continued to compete with each other at levels close to \$2.00 per million Btu (Figure 5). It is interesting to note that far more being positively affected by a very warm spring and summer, oil and gas (and coal) have yielded shares and 82 percent in July, on a national average basis, further improvements of this type are not envisaged for the near future, implying that utility fossil fuel use (and fuel prices) should pick up if electric power output recovers over the next 2 quarters.

Natural gas wellhead spot prices have been on a downward trend since March of 1990. Several warm winters in a row and a weak economy have continued to hamper gas prices. However, recent spot price movements and higher futures prices for the heating season (November 1991 through March 1992) indicate possible price increases for natural gas in the near future. In September, spot prices rose by 13 cents per million Btu over the August price.² Although this figure is still below the August price, spot prices this year were about 6 cents lower than in the previous year.

Residual fuel oil prices (average of all sulfur contents) in June reached their lowest levels since 1986 bottoming out at \$12.39 per barrel. A weak economy and depressed natural gas prices have kept residual crude oil prices down. They have rebounded by a few dollars per barrel since June, commensurate with the rise in crude oil prices.

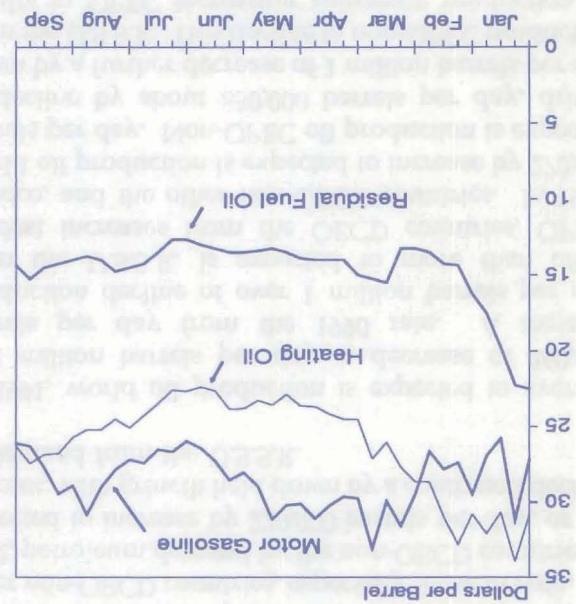
Residential heating oil prices have fallen each month from January through July decreasing by 30 cents (Figure 4). More than one-third of this drop is attributed to the correction in crude oil price (Figure 4). Normal seasonal price patterns for more than half of the change, while unusually high distillate fuel costs which have fallen by about 10 cents per gallon, are attributed to the correction in crude oil price (Figure 4). Oil stocks since April account for the remainder.

Motor gasoline spot prices peaked for this year at \$1.30 per gallon in January during the height of the Persian Gulf Crisis (Figure 4). In both May and June, prices reached \$1.20 per gallon in, climbing 5 cents over April levels in response to very low inventories (Figure 5). Since June, the average price has fallen a few cents per gallon as gasoline stocks have increased.

Steadily, though gradually, the world crude oil price has been increasing in response to higher world demand for oil for the upcoming winter and to a general, albeit slow, improvement in the world economy which has been sluggish for nearly a year. In addition, there has been some concern regarding takover first hit, but then eased back down to pre-coup levels within a few days, as the coup quickly unraveled. Since June, however, the world crude oil price has been steadily, though gradually, increasing in response to higher world demand for oil for the upcoming winter and to a general, albeit slow, improvement in the world economy which has been sluggish for nearly a year. In

Sources: Energy Information Administration, Monthly Petroleum Status Report; September 20, 1991.

Figure 3. New York Harbor Petroleum Spot Prices, 1991 Weekly



Mid-Price Case. As crude oil prices are expected to be about \$19 per barrel on average in 1991 and then increase slightly to \$20 per barrel in 1992, petroleum product prices are expected to follow the same price pattern. Motor gasoline prices are projected to fall slightly in 1991, then increase by 4 cents per gallon, or double the assumed crude oil price increase for 1992. This additional increase is expected to come from additional State and local taxes, as well as rising supply costs associated with the portions of the Clean Air Act that becomes effective in the latter half of the year. Diesel fuel prices should follow gasoline prices. Higher-than-average stock levels of distillate fuel in the heating season should help keep heating oil costs at moderate levels for the remainder of the year. Average annual prices for the residential heating season should be lower than in 1991 if weather is normal for the fourth quarter. Underground storage levels have been high while demand for gas in 1991 has been flat overall. If the winter weather is mild once more, prices could be further depressed. On the other hand, a severe and prolonged cold spell, particularly on the East Coast could put upward pressure on prices. In 1992, an improved economy and a slight rise in oil prices should boost wellhead gas prices back to about 1990 levels.

Natural gas wellhead prices are expected to average about 5 percent below 1990 levels in 1991 if weather is normal for the fourth quarter. Undergrund storage levels have been high while demand for gas in 1991 has been flat overall. If the winter weather is mild once more, prices could be further depressed. On the other hand, a severe and prolonged cold spell, particularly on the East Coast could put upward pressure on prices. In 1992, an improved economy and a slight rise in oil prices should boost wellhead gas prices back to about 1990 levels.

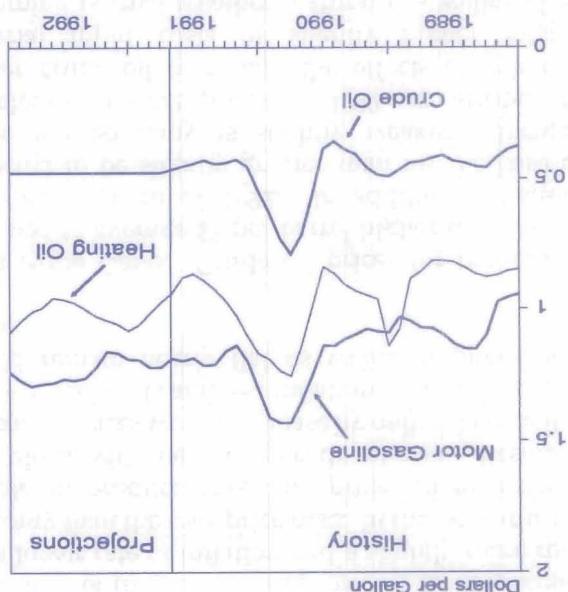
High-Price Case. As crude oil prices are expected to be about \$25 per barrel on average in 1991 and then increase slightly to \$26 per barrel in 1992, petroleum product prices are expected to follow the same price pattern. Motor gasoline prices are projected to fall slightly in 1991, then increase by 6 cents per gallon, or double the assumed crude oil price increase for 1992. This additional increase is expected to come from additional State and local taxes, as well as rising supply costs associated with the portions of the Clean Air Act that becomes effective in the latter half of the year. Diesel fuel prices should follow gasoline prices. Higher-than-average stock levels of distillate fuel in the heating season should help keep heating oil costs at moderate levels for the remainder of the year. Average annual prices for the residential heating season should be lower than in 1991 if weather is normal for the fourth quarter. Underground storage levels have been high while demand for gas in 1991 has been flat overall. If the winter weather is mild once more, prices could be further depressed. On the other hand, a severe and prolonged cold spell, particularly on the East Coast could put upward pressure on prices. In 1992, an improved economy and a slight rise in oil prices should boost wellhead gas prices back to about 1990 levels.

Winter Fuels Outlook on page 15. The coming heating season is contined in "1991-92 the coming heating season of these factors. A special analysis of unexpected rapid surge in overall economic activity, prices of fuel oil and natural gas to a severe winter, and possibilities concerns the vulnerability of supply and natural gas). A much more important set of well as increases in other energy sources (electricity products (gasoline and heating oil) are possible in 1992, increases of 8 to 10 cents per gallon for consumer range of \$17 to \$23 per barrel through 1992, average next several quarters. With crude oil prices in the petroleum product prices should remain stable over the oil price cases (Table 4). The variation among crude energy product prices, given the three assumed crude following discussion provides projections for the following discussions.

Price Outlook

Sources: History: Energy Information Administration, Monthly Energy Review (October 1991). Projections: Table 4.

Figure 4. Crude Oil and Product Prices



LOW Price Case. This scenario assumes crude oil prices holding at \$18 per barrel in the fourth quarter 1991 and first quarter 1992, then dropping to \$17 for the remainder of the year. Also projected for this scenario are a lower rate of inflation and a slightly more robust economy than the mid-price case. In this scenario, petroleum product prices are projected to decline in 1992 along the falling crude oil costs. Residential electricity prices would increase by only 1.3 percent due to lower fuel costs and less inflation. Natural gas prices would remain nearly flat as well. Headline prices move.

HIGH Price Case. Crude oil prices for this case are assumed to average \$3 per barrel higher than the mid-price case for all of 1992. In addition, inflation is expected to be slightly greater than for the base case while the economy is slightly weaker. Increased use prices would normal weather, natural gas wellhead prices assumed to be competitive relative to the mid-price case as the company's cost of service increases. Coal prices to electric utilities would increase from oil prices as well. Assumptions regarding normal weather, natural gas wellhead prices, crude oil costs and the effects on labor and materials input costs of slightly higher inflation, higher crude oil costs and the effects on labor and petroleum product prices in 1992 are attributed to while the economy is slightly weaker. Increased use prices would probably rise relative to the mid-price case as the company's cost of service increases. Coal prices to electric utilities would increase from oil prices as well. Assumptions regarding normal weather, natural gas wellhead prices, crude oil costs and the effects on labor and materials input costs of slightly higher inflation, higher crude oil costs and the effects on labor and

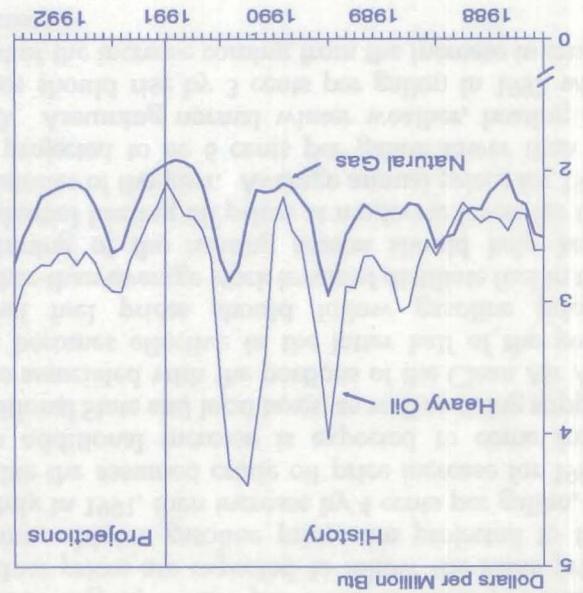
petroleum product prices would increase by only 1.3 percent due to lower fuel costs and less inflation. Natural gas prices would remain nearly flat as well. Headline prices move.

FIGURE 5

This figure shows projected utility oil and natural gas prices for the fourth quarter of 1991 through the fourth quarter of 1992. The projections are based on a scenario of relatively high oil and natural gas prices. The projections assume that oil prices will decline from \$35 per barrel in the fourth quarter of 1991 to \$27 per barrel in the fourth quarter of 1992. Natural gas prices are projected to decline from \$2.00 per million Btu in the fourth quarter of 1991 to \$1.75 per million Btu in the fourth quarter of 1992. The projections also assume that the economy will grow at a rate of 2.5 percent per year.

Sources: History: Energy Information Administration, Monthly Energy Review (October 1991). Projections: Table 4.

Figure 5. Electric Utility Oil and Natural Gas Prices



U.S. Petroleum Outlook

Overview

Since last fall, much has happened concerning domestic and world petroleum markets. The war in the Persian Gulf has been fought and won. The economic recession has continued, but guarded optimism that recovery is underway seems to hold sway among economic analysts. The fourth quarter of this year offers to bring several changes in the pattern of domestic petroleum demand and supply that have characterized the first 3 quarters. Petroleum demand is expected to rise in the fourth quarter of 1991, compared to a decline a year-ago, as the economy is expected to be on its way to recovery and a normal pattern of colder weather is assumed to appear. While remaining moderate throughout most of 1991, crude oil prices this fall are expected to average \$10 per barrel below fourth quarter 1990 levels in the mid-price case. Domestic crude oil production, which remained stable for the first 9 months of 1991 or actually increased compared to 1990 levels, is expected to decline slightly in the fourth quarter and to slip further for the remainder of the forecast. As a result of these developments, total net imports of crude oil and petroleum products in the mid-price case are expected to increase by more than 1 million barrels per day in the fourth quarter of this year compared to the same period in 1990. An average decline of more than 1 million barrels per day in total net imports characterized the first three quarters of this year.

Total Demand

Despite the obvious differences expected in the overall domestic petroleum market balance from a year ago, a relatively tranquil scene for the winter is envisioned in the mid-price case, barring any extremely severe weather patterns. The situation for petroleum (and other fuels markets) in the case of a severe winter is examined in "1991-92 Winter Fuels Outlook" on page 15. In the mid-price case, petroleum demand for the fourth quarter of 1991 is expected to average 17.06 million barrels per day, up 350,000 barrels per day from the fourth quarter 1990, but still well below the remarkably high level of shipments in the fourth quarter 1989. Even this increase for the winter could be in serious doubt if the expected recovery does not develop. Signs are not uniformly positive regarding the

onset of steady, moderate economic growth at this time.⁵ If crude oil prices remain stable or low, it is expected that year-over-year increases in petroleum demand will continue throughout the forecast. In 1992, domestic demand is expected to increase by about 270,000 barrels per day compared to average 1991 levels. Much of that anticipated growth is in the first quarter 1992, as the effects of normally cold weather will contrast sharply with the mild conditions in early 1991. Accordingly, some of the largest gains in shipments will be in the distillate and residual fuel oil sectors. Despite the recovery expected for 1992, demand next year is still likely to fall below 1990 levels.

The uncertainty surrounding the mid-price case is principally a function of the uncertainty surrounding crude oil prices and macroeconomic growth, in addition to the uncertainty surrounding weather conditions. The uncertainty surrounding crude oil prices is not insignificant, but is relatively small compared to the possibilities which arise when alternatives are considered for macroeconomic growth and weather. Tables 5 through 7 detail the range of domestic petroleum demand and supply results when a mid-case economic scenario is combined with normal weather and the range of oil prices shown in Figure 1. Figure 6 overlays expected alternative petroleum demand paths when extreme weather and macroeconomic assumptions are incorporated. Figures 7 and 8 provide a view of petroleum supply and imports variability under various world oil price assumptions.

An extreme weather case, particularly if combined with a very high economic growth scenario for the winter, could lead to petroleum demand in the first quarter of next year of 17.78 million barrels per day, 1.35 million barrels per day above the same period in 1990. The question of whether or not this scenario could pose a problem for domestic petroleum supply at peak periods during the winter is addressed in some detail in the "1991-92 Winter Fuels Outlook" on page 15. The factors which seem to be working against such a situation occurring probably outweigh the factors which might foster it. In particular, the apparently low probability of the economy accelerating at a rate much above the mid-price case, significant conversions to natural gas from heating oil since 1989,⁶ and the generally ample supplies of natural gas (which would tend to lessen the likelihood of gas interruptions creating severe additional pressure on supply and prices of fuel oil), all

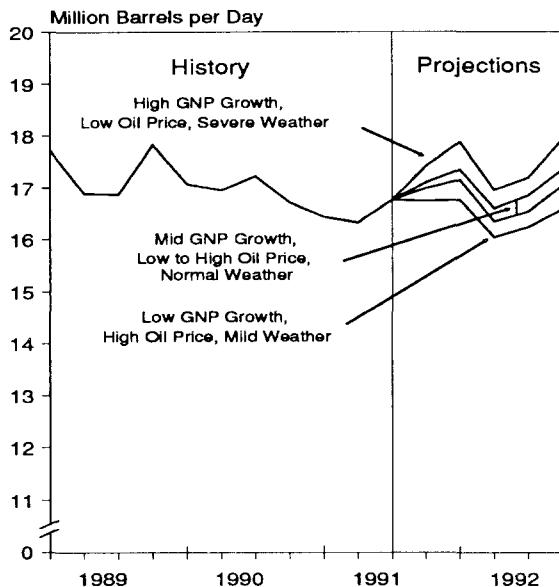


Figure 6. Total Petroleum Demand

Sources: History: Energy Information Administration, *Petroleum Supply Annual 1989*, and *Petroleum Supply Monthly* (October 1991). Projections: Tables 5, 6, and 7 and internal model calculations from the Short-Term Integrated Forecasting System.

make the prospects for supply shortages this winter somewhat remote. It should be noted that the occurrence of weather as cold as that seen for the month of December 1989 is an event expected approximately once in every one hundred years.⁷

In order to provide broader information on the significance for the U.S. petroleum demand and supply outlook presented in this report to varying assumptions about prices, the economy, and weather, a summary of petroleum demand and production sensitivities is presented below.

Total Product Supplied and Production Sensitivities

The petroleum demand and supply outlook for the mid-price case is based on normal temperatures and a particular set of macroeconomic assumptions. In order to widen the usefulness of the basic projections provided in the *Outlook*, Table 8 provides a range of possible outcomes and sensitivities when alternative macroeconomic, price, and weather assumptions are used.

The petroleum price sensitivity assumes that non-petroleum prices remain constant. Weather sensitivities are based on assumed deviations from normal temperatures which correspond to one-half the greatest quarterly variances in weather observed during the past 15 years.

Average petroleum sensitivity factors for 1992 for this *Outlook* are summarized below:⁸

- A 1-percent increase in real GNP raises petroleum product supplied by about 119,000 barrels per day;
- A \$1-increase in crude oil prices, assuming no price response from non-oil energy sources, reduces product supplied by about 48,000 barrels per day;
- A \$1-increase in crude oil prices, increases domestic oil supply (crude oil and natural gas liquids production) by 42,000 barrels per day;
- A 1-percent increase in heating degree-days increases product supplied by about 34,000 barrels per day; a 1-percent increase in cooling degree-days increases petroleum product supplied by about 12,000 barrels per day.

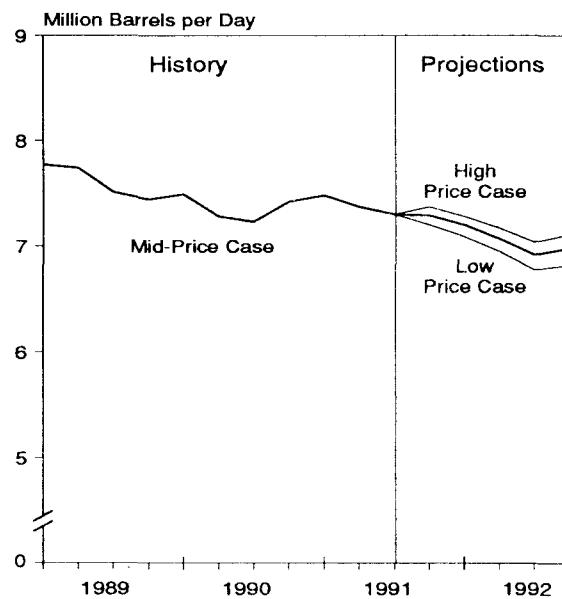


Figure 7. U.S. Crude Oil Production

Sources: History: Energy Information Administration, *Petroleum Supply Annual 1989*, *Petroleum Supply Monthly* (October 1991), and *Weekly Petroleum Status Report* (91-37,38,42). Projections: Tables 5, 6, and 7.

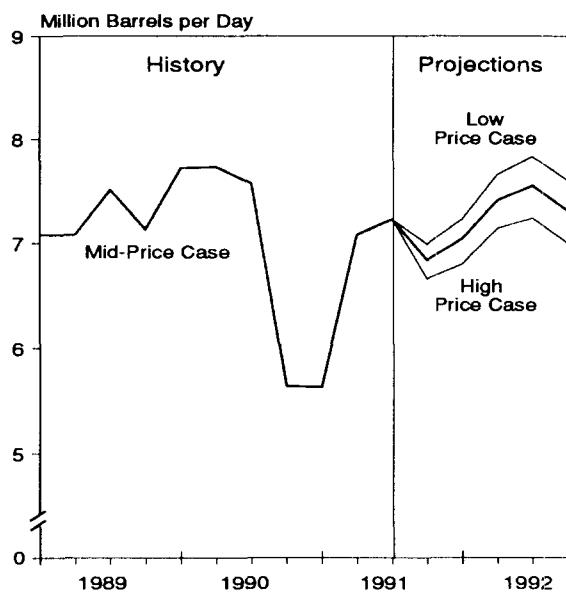


Figure 8. Total Net Petroleum Imports

Note: Crude oil production includes lease condensate.
 Sources: History: Energy Information Administration, *Petroleum Supply Annual 1989*, *Petroleum Supply Monthly* (October 1991), *Weekly Petroleum Status Report* (91-37,38,42). Projections: Tables 5, 6, and 7.

Total Petroleum Supply

In the base case, domestic crude oil production is expected to drop off slightly in the fourth quarter of 1991, leaving the expected annual production level for 1991 essentially unchanged from the 1990 level, with a drop of 320,000 barrels per day expected for 1992 (Table 6 and Figure 7). In 1991, Alaskan production increased enough to offset a small decline in the lower-48 States. This increase was caused by expanded gas handling facilities in the Prudhoe Bay field in the latter part of 1990, allowing higher rates of oil production to be achieved by the end of the year. Production from this field has apparently begun to decline again, but the higher level of output achieved in late 1990 and early 1991 has resulted in an expected higher annual average in 1991. In 1992, the lower-48 States are expected to show a greater decline than in 1991, and Alaskan production is expected to fall below 1.7 million barrels per day. According to the Baker-Hughes rotary rig count, the total rotary rigs in operation fell below 900 in April of 1991, and averaged just over 800 in August. For the mid-price case of \$20 per barrel for crude oil,

the rig count for 1991 and 1992 is expected to be below the 1990 level.

Domestic crude oil production could fall as low as 6.91 million barrels per day in 1992 under the low world oil price case (Table 5), or could average 7.15 million barrels per day in 1992 in the high world oil price case (Table 7). These estimates contain an element of uncertainty which goes beyond expected outcomes for various price ranges. This uncertainty, associated with both the current production level and with the timing of expected events, accounts for approximately 47 percent of the range of production in the fourth quarter of 1992 between the low and the high oil price cases (Tables 5 and 7). The difference between low and high price projections of 290,000 barrels per day in the fourth quarter of 1992 contains 150,000 barrels per day attributable to the price impact (Table 9).

Throughout the summer, the domestic refining industry has been geared to supplying the seasonal demand for motor gasoline. Primary stocks of finished motor gasoline were only slightly above 170 million barrels at the end of the first quarter of this year, due to a lack of the usual winter motor gasoline stock build. With two different kinds of gasoline quality regulation taking effect during the course of the year (the summer Reid Vapor Pressure limitations and the winter oxygenates restrictions in some locales), this much flatter stock profile appears to be the new seasonal pattern for the near future. According to the most recent data from the EIA *Petroleum Supply Monthly*, the amount of liquefied petroleum gases, pentanes plus, and other motor gasoline blending components blended to motor gasoline was 760,000 barrels per day from October 1990 through January 1991 and 550,000 barrels per day from February through July 1991. With less crude oil and unfinished oil, refinery inputs for the first 4 months of this period (13.49 million barrels per day in October through January, versus 14.15 otherwise), a different formulation of motor gasoline product emerges in the winter when compared to the summer. Refinery yields (the portions of refinery output going to particular products expressed as a percent of crude oil and unfinished oil refinery inputs), still turn from motor gasoline to distillate fuel oil in the winter. However, the amount of distillate fuel oil produced is more a function of the level of refinery inputs than of altering the product mix. As a result, product stocks of distillate are currently plentiful, as refinery inputs have been high during the summer, and demand for distillate has generally been weak.

With refinery outputs accounting for most of the domestic petroleum product supply, there is less need

for petroleum product imports, and in fact, a greater amount of products have lately been exported. Thus, the forecast for net imports of petroleum products continues to remain low, near 1.1 million barrels per day in 1992 in the base case. Net crude oil imports increase in 1992 as demand rises and domestic production falls, increasing net import dependence to just under 42 percent in 1992, after falling back to 40 percent in 1991.

Motor Gasoline

Demand for motor gasoline in the mid-price case is projected to decline by 0.3 percent in 1991 and in 1992 (Table 6). Through September 1991, demand fell by an average of 1.3 percent. Anticipation of a noticeable year-to-year increase in the fourth quarter follows the expectation of sharply lower prices for gasoline and the onset of an economic recovery. Last year's decline reflects the combined impact of the slowing economy and the fuel price hikes brought about by the Persian Gulf conflict. In 1990, highway travel activity grew by 2.0 percent, less than half the growth rate of the previous year and the smallest increase since the recession of the early 1980's. Apparent fuel efficiency increased by a substantial 3.3 percent in 1990 (Figure 9), more than offsetting the impact of the increase in highway travel. In that year, however, shipments were apparently depressed by large drawdowns in secondary stocks. As a result, data on product supplied for 1990 may have understated actual consumption, thereby overstating underlying fuel efficiency increases.

In 1991, the decline in economic activity as well as continued efficiency gains are expected to bring about another annual decline in gasoline demand (Figure 9). For the mid-price case, vehicle-miles traveled, which remained flat for the first 7 months of the year compared to the same period last year, are projected to rise only 1 percent for the year. Fuel efficiencies are projected to rise a more moderate 1.3 percent. Secondary stocks, which were drawn down substantially during the previous 2 years, were replenished earlier this year, indicating that the decline in actual consumption may be even greater than implied by the deliveries data. As a result, fuel economy growth based on actual consumption may be somewhat greater than indicated by primary shipments. Motor gasoline shipments are expected to decline slightly in 1992. The projected efficiency increase of 2.4 percent is expected to offset the impact of a 2.1-percent increase in highway travel activity on motor gasoline demand.

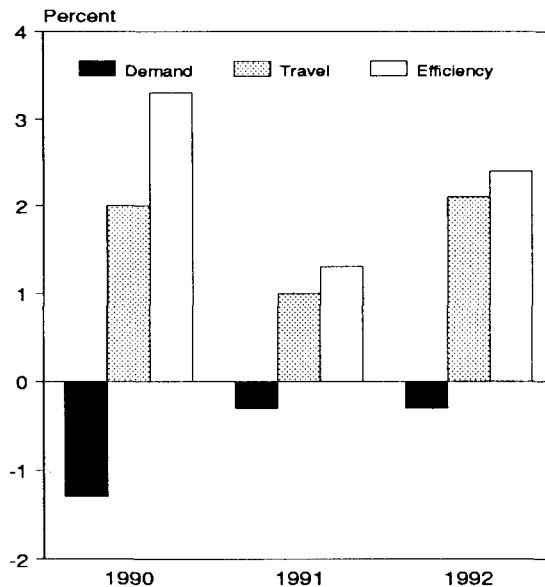


Figure 9. Annual Change in Motor Gasoline Demand Components

Sources: History: Energy Information Administration, *Petroleum Supply Monthly* (October 1991); and Federal Highway Administration, *Traffic Volume Trends*. Projections: Table 6 and internal calculations from the Short-Term Integrated Forecasting System.

Fuel shares by gasoline grade continue to respond slowly to the decline in prices resulting from the end of Persian Gulf hostilities (Figure 10). As a result, regular unleaded gasoline's share, which reached a record 71 percent of the market last October, has gradually fallen to 67 percent by July, somewhat above the pre-Gulf crisis level of 63 percent. Premium gasoline's share, which had slid from 23 percent before the Persian Gulf conflict to 17 percent by January, recovered slightly to 19 percent. Midgrade gasoline's market share, having remained stable for several months, has displayed small increases, reaching a record 10.3 percent in July. Regular leaded gasoline's share, whose rate of decline has slowed markedly since the beginning of 1990, continues to hold just over 3 percent of the domestic gasoline market.

Jet Fuel

Jet fuel demand rose by an average rate of 2.2 percent in 1990 from that of the previous year. A sharp slowdown in civilian air travel growth was partly offset

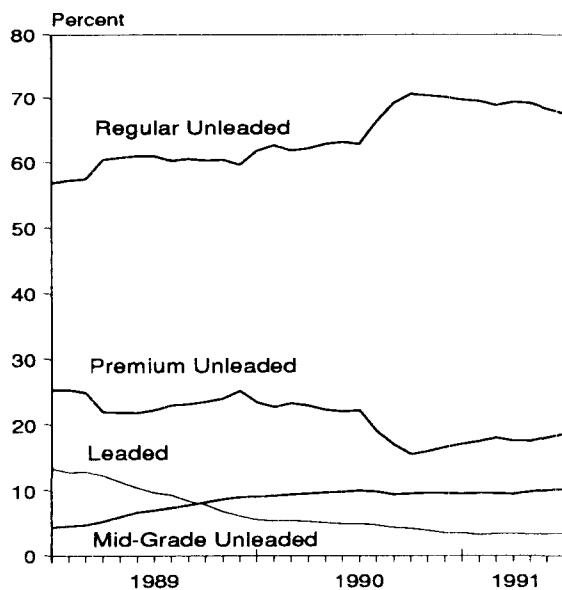


Figure 10. Motor Gasoline Market Shares

Sources: History: Energy Information Administration, *Petroleum Marketing Monthly* (October 1991).

by increases in Persian-Gulf related military travel. For 1991, the combination of an economic recession, the end of Persian Gulf hostilities, and continuing increases in fuel efficiency is projected to bring about a 3.3-percent decline in jet fuel demand, the first year-to-year decline in 10 years (Figure 11). This performance follows upon modest growth in 1990. Air travel activity posted sizeable year-to-year declines during the first half of 1991. Available data for the third quarter suggest only a slow recovery in travel activity despite substantial promotional air fare discounts. For the year, revenue ton-miles (a measure of air travel demand) are projected to decline by 2.5 percent.

The economic recovery is projected to increase jet fuel demand by 1.4 percent in 1992; this growth rate lags behind that of travel activity due to increases in both fuel efficiency and average load factors. Revenue ton-miles are projected to increase by 5.6 percent; increases in load factor are expected to constrain the increase in available capacity to 4.1 percent.

Distillate Fuel Oil

Distillate fuel oil demand is expected to lead petroleum markets out of the slump which developed this year as

a result of the recession and mild weather. Total distillate is expected to be about 250,000 barrels per day above 1990 levels in the fourth quarter of this year and as much as 400,000 barrels per day stronger in the first quarter 1992 compared to the same period in 1991 (Table 6). Much of this growth will result from anticipated increases in economic growth, but much of it depends on the weather and the precise interplay of markets for competing fuels.

With natural gas prices still struggling to pull out of the slump caused by the sluggish economy and consecutive mild winter quarters, it is expected that any recovery in the industrial market (or other markets with the ability to switch between natural gas and other fuels) will induce higher gas consumption rather than fuel oil use, even though most switching has already occurred. Higher diesel fuel consumption hinges mainly on an upsurge in truck traffic which will undoubtedly accompany higher industrial and commercial activity as the economy rebounds. While a normally cold winter probably guarantees a solid gain for distillate fuel in the heating oil market, a very cold winter could yield increases well beyond the requirements for increased space heating. In early 1991, mild winter temperatures left significant excess gas available to industrial and electric utility users who would normally have expected to reduce gas use. The first quarter of 1992 should bring sharp year-over-year gains in industrial fuel oil use even if temperatures only get back to long-term average levels. This would reflect the return to more normal patterns of winter natural gas availability. A more detailed look at the implications for fuel oil markets of various economic growth and weather scenarios is presented in "1991-92 Winter Fuels Outlook" on page 15.

Residual Fuel Oil

While total demand for residual fuel oil is expected to remain below or even with 1990 levels for the rest of this year (and for the year as a whole), the first quarter of 1992 is expected to bring a sizeable recovery in product supplied (Table 6). Electric utility shipments during the winter, which were depressed last year, are expected to be particularly strong as 1992 begins. On average, total residual fuel oil demand is expected to increase by about 160,000 barrels per day for the first 3 months of 1992 compared to the same period 1991.

While the electric utility sector is likely to see some gains in residual fuel oil use throughout 1992, total residual fuel oil demand in 1992 in the mid-price and high-price cases will not grow significantly because of

Other Petroleum Products

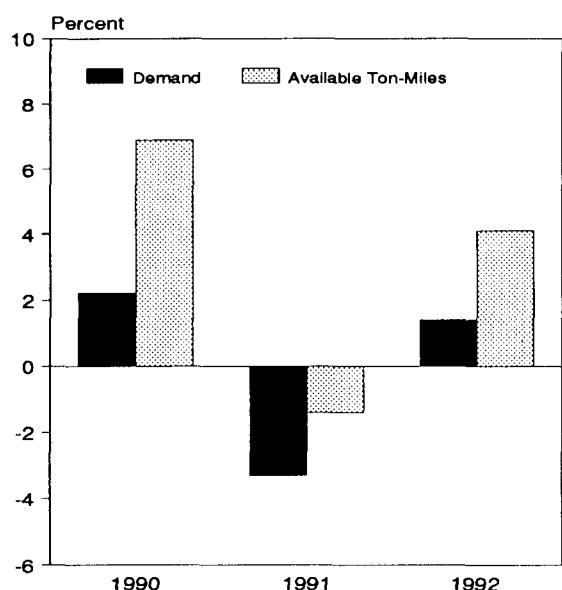


Figure 11. Annual Change In Jet Fuel Demand and Travel

Sources: History: Energy Information Administration, *Petroleum Supply Monthly* (October 1991); and Federal Aviation Administration, Form 41. Projections: Table 6 and internal calculations from the Short-Term Integrated Forecasting System.

efficiency trends and the continuing substitution of other fuels, especially in the nonutility sector. For the low price case, demand is expected to rise somewhat in 1992 (Table 5). Driving this increase in demand is the lower, and therefore more competitive, residual fuel oil price against natural gas and coal.

Demand for minor petroleum products declined by 0.6 percent in 1990 (Table 6). The impact of increases in industrial and petrochemical activity was offset by the milder-than-average weather in the first quarter of the year. In addition, demand for liquefied petroleum gases (LPG) in 1990 was dampened by price shifts during the first half of the year when oil prices declined, boosting demand for oil-based feedstocks.

In 1991, other petroleum products' demand is projected to decline by 3.0 percent in the mid-price case (Table 6). LPG demand, however, is projected to rise 7.3 percent despite the mild first quarter. That substantial increase is brought about by a recovery in petrochemical activity that started earlier in the year and a sizeable replenishment of secondary stocks from primary inventories, which has contributed to the recent dampening of the normal seasonal buildup of primary stocks. In addition, the decline of oil prices from their Persian Gulf-related peaks of the previous year is expected to boost demand for oil-based feedstocks in 1991. Increases in LPG and feedstock demand, however, are more than offset by a projected 10.8-percent decline in miscellaneous products consumption. Among the factors accounting for that decline are: declines in still gas output due to reduced refinery runs, reduced asphalt and road oil demand stemming from budgetary constraints as well as a weak housing market, and reduced kerosene demand due to mild weather.

The assumed return to normal weather patterns and the onset of an economic recovery are expected to boost demand for minor petroleum products in 1992 by 3.4 percent in the mid-price case. LPG demand is projected to rise by 2.0 percent; oil-based feedstocks are expected to rise by 2.4 percent, and miscellaneous products are projected to rise by 4.3 percent.

1991-92 Winter Fuels Outlook

Supplies of heating oil and natural gas are expected to meet the anticipated winter peak demand. Propane, however, may pose a problem because stocks are low as the heating season approaches. The assumption of normal weather is projected to bring about an increase in demand for heating fuels from that of last winter, which was substantially warmer than normal. Nonetheless, heating oil and natural gas supplies would be able to meet the demand of a colder-than-average winter. Propane inventories, however, are lower than those of last year. They would therefore pose a potential problem should a cold snap similar to that of December 1989 reoccur. The resulting tightness in supply would be especially acute if increases in domestic production and imports are insufficient to meet the high demand for propane.

Heating Oil

Demand for distillate fuel oil is projected to increase by 330,000 barrels per day, or 9.2 percent, to 3.36 million barrels per day during the winter season, defined as the period from October 1, 1991, to March 31, 1992. The assumption of normal weather patterns, which contrasts with a season that was 9.2 percent warmer than normal in 1990-91, accounts for part of the increase, including about 80,000 barrels per day in the residential/commercial sector, despite continued erosion of market share to natural gas. Transportation and industrial demand is expected to increase by about 240,000 barrels per day as a result of the ongoing recovery in industrial production as well as a substantial decline in fuel prices from last season's high levels brought about by events in the Persian Gulf.

Domestic refinery production is expected to account for 3.07 million barrels per day, or 91.1 percent of winter distillate requirements, compared to 2.89 million barrels per day during the same period last year. This is based on a refinery utilization rate of 88.5 percent and an average distillate yield of 22.3 percent. These rates contrast with last winter's rates of 83.4 and 21.5 percent, respectively. Net imports are projected to average 97,000 barrels per day, or 2.9 percent of demand, compared to net exports of 65,000 barrels per day last winter. Primary inventory drawdown is projected to account for 202,000 barrels per day, or 6.0 percent of winter demand, similar to last year's stock draw of 207,000 barrels per day.

A severe winter could be met by additional supplies from each of the three sources: production, imports, and inventories. "Severe" refers to a winter whose heating-degree days for each month equal the 10-year high for that month. In such a winter, heating-degree days would be 18.7 percent higher than normal, resulting in an additional 235,000 barrels-per-day, or 7.8 percent, increase in total winter distillate requirements. In previous winters, refinery utilization and yields for any given winter quarter have been as high as 86.5 percent and 23.8 percent, respectively. Since these would be regarded as indicators of sustainable refinery distillate production for an entire winter, refinery output could reach 3.275 million barrels per day, sufficient to meet 92.3 percent of the requirements of a severe winter and 98.9 percent of normal demand. Moreover, short-term, or monthly, refinery production has exceeded those estimates, indicating that refineries can produce additional quantities to meet unanticipated peak requirements.

Even though refineries are able to respond quickly to meet additional demand, imports have usually provided the bulk of additional requirements brought about by severe winter weather. Net imports of distillate have averaged as much as 314,000 barrels per day in previous winter quarters. In addition, it is estimated that more than three-quarters of the exports (or 120,000 barrels per day projected for this season) could be diverted to domestic consumption.

Inventories are an additional source of distillate requirements, especially in the short term. The end-of-September estimate for primary inventories is 140 million barrels, 4 million barrels more than a year ago. Although a stock draw of 202,000 barrels per day is projected during the winter months, a withdrawal rate averaging 301,000 barrels per day can be sustained without inventories falling below the threshold of 85 million barrels regarded as the minimum required to avoid spot shortages.

The table, "Winter 1991-92 Distillate Supply/Demand Balances," summarizes the relevant range of heating oil availability by major source for the upcoming winter season. It shows that availability would be more than sufficient to meet the requirements of a severe winter.

Winter 1991-92 Distillate Supply/Demand Balances
(Million Barrels Per Day)

Source	Outlook Forecast	Severe Winter	Potential Availability
Refineries	3.066	3.257	3.275
Net Imports	0.097	0.111	*0.411
Inventories	0.202	0.232	0.301
Total	3.365	3.600	3.987
Demand	3.365	3.600	--

*Includes curtailment of 97,000 barrels per day of exports.

Despite the apparent adequacy of supplies, several problems could arise. First, higher-than-projected economic growth would boost distillate demand. It is estimated that a 1-percent increase in economic growth would boost distillate consumption by an estimated 50,000 barrels per day during the winter season. Although that additional requirement could easily be met from existing sources, the combination of robust economic growth and a severe winter might result in occasional spot shortages if colder-than-average weather persisted for the whole season.

Second, a severe winter may result in substantial increases in petroleum product prices. In particular, the interruptibility of gas supplies to industrial and utility customers may be an additional source of price pressure. Under these conditions, it is estimated that as much as 0.60 trillion cubic feet of interruptible gas above historical averages could raise petroleum products' demand by as much as 280,000 barrels per day during periods of severe weather.⁹

Third, recent substantial declines in secondary storage capacity could create spot shortages during a severe winter, even if primary inventories were ample. Much of that decline has resulted from recently enacted pollution control requirements and liability concerns on the part of both secondary storage holders and transportation operators.

Natural Gas

Total natural gas demand for the winter months is projected to be 11.28 trillion cubic feet, an increase of

0.37 trillion cubic feet from the same period a year ago. Residential and commercial demand, however, is projected to increase by 0.30 trillion cubic feet, or 5.9 percent, under assumptions of a normal winter. Utility demand is projected to increase by 0.05 trillion cubic feet, or 4.8 percent. Industrial demand, despite the ongoing economic recovery, is projected to fall 0.08 trillion cubic feet, largely as a result of fuel switching induced by the precipitous decline in petroleum prices from those of the previous winter.

As in the heating oil case, supplies should be more than adequate to meet the requirements of a severe winter. The table, "Winter 1991-92 Natural Gas Supply/Demand Balances," summarizes the base case projections for potential gas availability.

Winter 1991-92 Natural Gas Supply/Demand Balances
(Trillion Cubic Feet)

Source	Outlook Forecast	Severe Winter
Production*	9.237	9.473
Net Imports	0.833	0.833
Inventories	1.494	1.593
Discrepancy**	-0.299	0.162
Total	11.277	12.011
Consumption	11.277	12.011

*Includes supplementals of 0.057 trillion cubic feet.

**Statistical discrepancy between calculated demand and supply.

The table indicates that natural gas demand would increase by an additional 0.73 trillion cubic feet in the event of a severe winter. Production and inventory changes are expected to meet the increased demand, while net imports are assumed to remain constant.

Potential availability of natural gas, however, exceeds that demand projected in the *Outlook* under assumptions of normal weather by a wide margin. Potential domestic production, including supplemental gas, is estimated to be 11.4 trillion cubic feet. This estimate exceeds the *Outlook* consumption volume for this winter by more than 2 trillion cubic feet.¹⁰

Supplying this volume to end-users depends on both avoiding a recurrence of production problems that may arise under severe weather conditions, and the ability of the transmission and distribution network to move the gas from the production fields. In severe circumstances, higher flows of net imports are probable, but a specific estimate of incremental supplies is highly uncertain because the conditions affecting the availability of additional supplies from foreign sources may vary greatly in any likely scenario.

Supplies from net imports (including interruptible exports) could increase significantly depending on the circumstances. For the first 7 months of 1991, total net imports of natural gas increased by 10.4 percent compared to the same period a year ago.¹¹ However, because it is possible that cold weather conditions could negatively affect availability of Canadian imports, it is assumed that little or no availability from imports above the base case level would exist in any severe weather situation. While under 1.6 trillion cubic feet of winter gas supplies from primary storage is anticipated for the winter even in a severe weather case, much more gas from inventories could theoretically be made available.

The maximum potential primary stock draw for the whole winter would be 3.42 trillion cubic feet assuming a complete drawdown of working gas during the winter from end-of-September levels. It is unlikely that the maximum draw rate would be observed. It should be noted that the distribution system accommodated a monthly record withdrawal of 0.821 trillion cubic feet in December 1989.¹² This indicates that a drawdown of working gas storage to levels below the previous low of 1.57 trillion cubic feet recorded in the first quarter of 1984 represents a substantial source of additional potential supply if needed.

Propane

Liquefied petroleum gas (LPG) demand for the winter months is projected to be 1.87 million barrels per day, an increase of 70,000 barrels per day, or 3.9 percent, from that of the previous winter. Although the *Outlook* does not provide separate projections for each LPG product, it is assumed that propane accounts for the bulk of weather-related fluctuations in LPG demand.

It is estimated that a severe winter would result in an increase of 130,000 barrels per day in propane demand. Increases in domestic refinery throughput as a result of cold weather would boost crude oil-related propane production by as much as 70,000 barrels per day. In addition, increases in gas plant processing supplies would boost potential propane supplies from that source by as much as 50,000 barrels per day. Although net imports have declined in recent years (averaging just over 50,000 barrels per day in 1991), they were a record 142,000 barrels per day during the first quarter of 1990, having reached 186,000 barrels per day in January of that year.

Inventories, however, are the most problematical source of propane availability. The end-of-September primary inventories are estimated to be 53 million barrels, 4.3 million barrels below that of the previous year. The traditional seasonal buildup of inventories was constrained by higher-than-expected petrochemical demand due to propane's favorable economics resulting from low natural gas prices and by lower imports. The cold temperatures in December 1989 highlighted the vulnerability of propane inventories to an unanticipated increase in demand. Although inventories were considered to be adequate at the beginning of that winter season, the conditions in December revealed limits to the deliverability of the distribution system that may be a constraint on inventory supplies if additional supplies from domestic production and imports are not forthcoming.

Outlook for Other Major Energy Sources

Natural Gas

Natural gas consumption in 1991 is expected to be 18.7 trillion cubic feet in the mid-price case, somewhat lower than the 1990 level, due mainly to the effects of mild weather in first quarter 1991 and the economic recession. Residential and commercial sector demand increases due to the assumed return to normal winter weather patterns in fourth quarter 1991 serve to counterbalance declining demand in the industrial and electric utility sectors. In 1992, however, total natural gas demand is projected to rise by 4.6 percent to 19.6 trillion cubic feet, the highest annual level for gas use since 1981, as economic recovery increases demand in all major sectors (Table 10).

Lower industrial gas use in 1991 follows from weaker industrial output and rising gas prices by late 1991. With significant recovery in the industrial sector not expected until late this year, and with stable prices and plentiful supplies of fuel oil expected for the rest of 1991, industrial gas use should not improve again until second quarter 1992. In 1992, the economic recovery causes overall industrial gas use to rise by 4.7 percent. Electric utility demand for gas in 1992 increases by 3.2 percent as electricity output increases and as available non-fossil fuel electric power sources level off. Residential and commercial sector demand rises faster in 1992 as higher heating degree-days push up demand for gas for heating.

The continuing weakness in natural gas prices is due to a combination of low residual fuel oil prices, abnormally mild winter weather for the past 2 years, and resulting high gas inventories. Natural gas prices in 1991 are expected to remain below 1990 levels as gas in storage is at a 6-year high, keeping downward pressure on prices (Figure 12). The abnormally mild weather in first quarter 1991 has served to reinforce this situation by restricting inventory drawdown. Gas prices at the wellhead are expected to recover by more than 4 percent in 1992, however, as the economic recovery spurs demand.

Coal

Coal production in 1991 is expected to decrease from last year's record level by 2.3 percent (Table 11), but

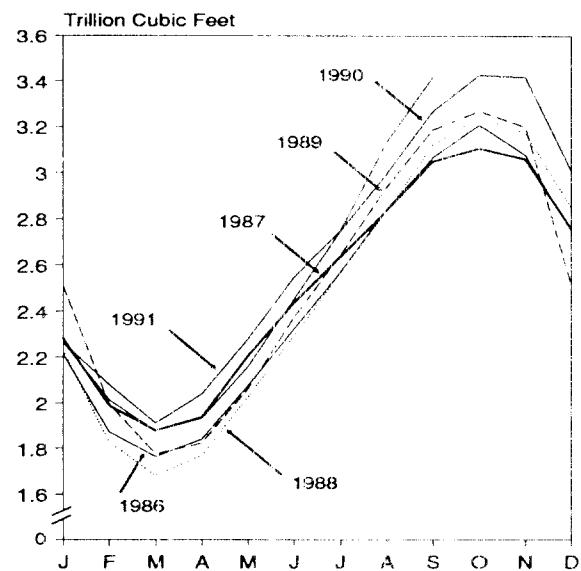


Figure 12. Natural Gas Stocks

Source: Energy Information Administration, *Natural Gas Monthly* (October 1991).

should still remain above the 1 billion ton level. Lower nonutility consumption, reduced exports, and a significant secondary stock build in 1990 contribute to the expected decline in production in 1991. Increases in demand in all sectors lead to a production increase of 2.7 percent in 1992.

Although demand other than electric utility use decreases by roughly 5 percent, total coal consumption will remain virtually flat in 1991 (Table 11). The economic growth projected for 1992 will foster growth in all sectors. Total consumption is expected to increase by 4.2 percent in 1992.

Coal consumption at electric utilities has grown slowly this year and is projected to post a 1.3-percent growth rate for 1991 (Figure 13). In 1992, a stronger economy and declining nuclear generation will cause electric utility coal demand to increase by 4.3 percent.

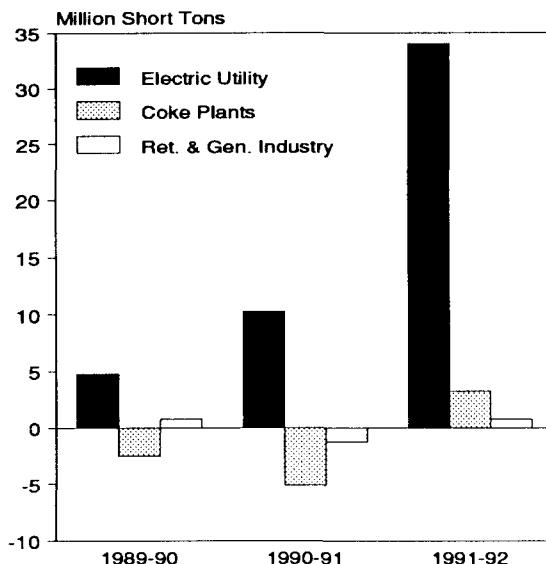


Figure 13. Annual Change In Coal Consumption

Sources: History: Energy Information Administration, *Quarterly Coal Report* (Second Quarter 1991). Projections: Table 11.

The decline in economic activity in 1991 has caused a substantial reduction in the production of raw steel, resulting in a lower demand for coking coal.¹³ The expected decrease in coking coal consumption is 12.8 percent for all of 1991. A stronger economy, including increased steel demand and production, will cause coalconsumption at coke plants to increase by 8.8 percent in 1992.

Consumption of coal in the retail and general industry sectors is also expected to decline slightly in 1991, a result of the weak economy this year. Retail and general industry coal consumption will grow by 1.2 percent in 1992.

Electricity

Demand

Total electricity sales are expected to increase by 3.2 percent in 1992 (Table 12). A modest improvement in the economy and a return to normal, colder weather in the first quarter are the cause of this increase (Table 2). Growth in total sales is expected to be strong in 1991

also, despite the economic recession, because of above normal spring and summer temperatures. The annual increase for this year is expected to be 2.4 percent. If weather had been normal earlier this year and returns to normal for the remainder of the forecast period, electricity sales growth would be expected to be 1.4 percent in 1991 and 3.4 percent in 1992.¹⁴

Growth in electricity demand in the individual sectors should be fairly consistent in 1992 (Figure 14). In contrast, much variance in growth across sectors is anticipated for 1991: the residential sector is expected to be somewhat insulated from the economic recession, sales to the industrial sector decline due to sluggish manufacturing output, and the commercial sector falls somewhere in between with modest growth.

Supply

Growth in total generation differs from total sales by patterns in nonutility supply and net imports. These two sources are expected to continue increasing through 1992 (Table 12). Nonutility supply growth should maintain a steady pace, while net imports should rebound substantially from the low 1990 level. Increases in nonutility sales are based on recent growth trends and announced orders of nonutility generators.

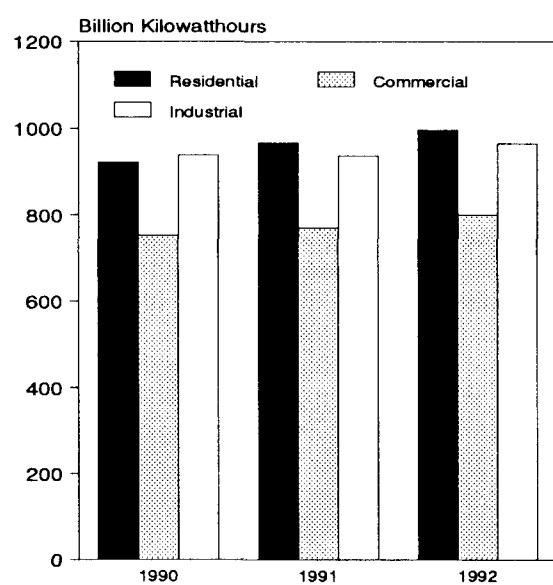


Figure 14. Electricity Sales by Sector

Sources: History: Energy Information Administration, *Electric Power Monthly* (October 1991). Projections: Table 12.

Imports are not expected to rise as rapidly in 1992 as previously thought. This change is caused by the cancellation of a new contract between Central Maine Power and New Brunswick Electric Power Commission and expected lower demand for imported power, particularly in the Northeast where the economy has slowed considerably.

Increases in generation in 1992 are expected to come primarily from coal. One reason for this is that additional coal capacity is expected to come on line.¹⁵ Nuclear power is expected to decline, and oil and gas are expected to pick up only some of the additional electricity demand. Hydroelectric power is expected to increase in 1992 (based on the assumption of normal precipitation), as regions continue to recover from dry conditions. However, because of the severity of the drought in a number of regions, such as California, it will take a number of years of normal rainfall or significantly higher than normal rainfall in 1991 before water conditions fully recover. The expected decline in nuclear power is caused by normal refueling and

maintenance shutdowns which allow for fewer hours of operation in 1992 than in 1991. This is also reflected in the capacity factors, which were at historical highs during 1991 but are assumed to be slightly lower in 1992.

This situation is somewhat of a contrast to that expected for 1991. Lower expectations for total electricity should put less demand on all sources of generation. Nuclear availability was 68 percent during the first half of 1991, on average. Hydroelectric power availability is expected to increase modestly in 1991 as a number of regions of the country continue to recover from low water conditions. However, because below normal water conditions exist in the Northeast, the Great Plains, and the West, hydroelectric generation will not have reached its full potential. Coal generation should pick up the remaining demand. Thus, the more expensive alternatives, oil and natural gas, are not needed and are expected to decline from 1990 levels in 1991.

References and Notes

1. Energy Information Administration. *Weekly Petroleum Status Report*. DOE/EIA-0208(91-45). (Washington, DC.) Table 13.
2. "Spot Market Report." *Natural Gas Intelligence*. (Washington, DC, September 23, 1991.) Page 4.
3. "Spot Market Report." *Natural Gas Intelligence*. (Washington, DC, September 23, 1991.) Page 4.
4. Energy Information Administration. Form EIA-759. (October 1991.)
5. In August, real personal income fell by 0.2 percent, following recent gains. Housing starts were up sharply in August, while retail sales faltered. Consumer confidence dipped in August after falling in July. Finally, the index of offending economic indicators was flat in August after rising from February through July. (Source: The Economic Bulletin, Board of the U.S. Department of Commerce, Summary Table of Current Business Conditions.)
6. *Energy Report*. (August 26, 1991.)
7. The deviation from the average December heating degree-days for the Northeast in December 1989 was 2.32 times the standard deviation for December. Assuming a normal distribution, this implies a probability of equalling or exceeding the December 1989 record of about 1 percent.
8. The oil demand sensitivity factors were derived from internal calculations of the Demand Models of the Short-Term Integrated Forecasting System. The oil supply sensitivity was derived implicitly from Tables 5 and 7 and includes uncertainty components not strictly related to price variation.
9. Based on information provided in the following service report. Energy Information Administration. "Effects of Interruptible Natural Gas Service: Winter 1989-1990." DOE/EIA-SR/OG/91-01. (Washington, DC, July 1991.)
10. Energy Information Administration. *Natural Gas Productive Capacity for the Lower 48 States, 1980 through 1991*. DOE/EIA-0542. (Washington, DC, January 1991.) Table 2. The estimate includes 0.110 and 0.057 trillion cubic feet for Alaskan and supplemental production, respectively, to facilitate comparison with the supply/demand balances presented in the table.
11. Energy Information Administration. *Monthly Energy Review*. DOE/EIA-0035. (Washington, DC.) Table 4.2.
12. Energy Information Administration. *Natural Gas Monthly*. DOE/EIA-0130. (Washington, DC, various issues.) Table 2.
13. Steel production forecasts are produced by a sub-model in the Coking Coal Demand Model of the Short-Term Integrated Forecasting System.
14. Based on internal calculations from the Electricity Model of the Short-Term Integrated Forecasting System.
15. Based on internal calculations from the Electricity Model of the Short-Term Integrated Forecasting System.

Table 8. Petroleum Demand Sensitivities

Demand Determinant	1991	1992
	One Quarter	Four Quarters
Economic Activity		
Level of GNP ^a	4,164 - 4,203	4,186 - 4,339
Resulting Petroleum Demand Difference ^b01	.43
Energy Prices		
Crude Oil ^c	\$18 - \$23	\$17.25 - \$23
Resulting Petroleum Demand Difference ^b06	.18
All Energy Prices Change12	.28
Only Oil Prices Change		
Weather		
Heating Degree Days ^d	1,371 - 2,043	3,969 - 5,645
Cooling Degree Days ^d	49 - 87	991 - 1,411
Resulting Petroleum Demand Difference ^b46	.39

^aReal gross national product, in billions of 1982 dollars per year.

^bPetroleum demand ranges associated with varying each demand determinant (or set of demand determinants), holding other things equal, in million barrels per day.

^cRefiners' acquisition cost of import oil, in current dollars per barrel.

^dHeating and cooling degree days shown are national population-weighted.

Source: Energy Information Administration, Office of Energy Markets and End Use, Short-Term Integrated Forecasting System.

**Table 9. Crude Oil Production Forecast Components
(Million Barrels per Day)**

	High Price Case	Low Price Case	Difference		
			Total	Uncertainty	Price Impact
United States	7.11	6.82	.28	.13	.15
Lower 48 States	5.42	5.18	.24	.11	.13
Alaska	1.68	1.64	.04	.02	.02

Note: Components provided are for the fourth quarter 1992 from tables 5 and 7. Totals may not add to sum of components due to independent rounding.
Source: Energy Information Administration, Office of Oil and Gas, Reserves and Natural Gas Division.

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