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QUARTERLY PROJECTIONS

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Short-Term Energy Outlook

Quarterly Projections

Second Quarter 1992

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

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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 Outlook (Outlook)*. An annual supplement analyzes the performance of previous forecasts, compares recent cases with those of other forecasting services, and discusses current topics related to the short-term energy markets. (See *Short-Term Energy Outlook: Annual Supplement*, DOE/EIA-0202.) The principal users of the *Outlook* are managers and energy analysts in private industry and government.

The forecast period for this issue of the *Outlook* extends from the second quarter of 1992 through the fourth quarter of 1993. Values for the first quarter of 1992, however, are preliminary EIA estimates (for example, some monthly values for petroleum supply and disposition are derived in part from weekly data from the *Weekly Petroleum Status Report*) or are calculated from model simulations using the latest exogenous information available (for example, electricity sales and generation are simulated using actual weather data).

The cases are produced using the Short-Term Integrated Forecasting System (STIFS). The STIFS model is driven principally by the following sets of assumptions or inputs: estimates of key macroeconomic variables, world oil price assumptions, and assumptions about the severity of weather. Macroeconomic estimates are produced by 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 historical energy data are EIA data published in the *Monthly Energy Review*, *Petroleum Supply Monthly*, and other EIA publications. Minor discrepancies between the data in these publications and the historical data in this *Outlook* are due to independent rounding. All percentage changes are calculated from the values in the tables. Some of the macroeconomic data were revised in this issue of the *Outlook*. Variables from the national income accounts, such as gross domestic product and disposable income, were revised and converted from a base year of 1982 to 1987. This resulted in minor revisions to historical growth rates.

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Highlights

World Oil Demand Turns Upward

Economic recovery and continued low oil prices are expected to contribute to an increase in world demand for petroleum products of 1.0 percent in 1992, followed by a larger increase of 1.7 percent in 1993. World oil prices are expected to average between \$16 and \$19 per barrel in 1992 before rising to between \$17 and \$21 per barrel in 1993.

Recovery in U.S. Petroleum Demand Expected Late in 1992

U.S. total petroleum product supplied in 1992 is expected to be about 200,000 barrels per day above 1991 levels (about a 1-percent increase). Distillate is projected to be the major single source of growth in total petroleum product supplied. The assumption of normal weather for the rest of the year accounts for much of the expected growth in 1992. The remainder is caused by continued low prices and an economic recovery.

U.S. Petroleum Output Decline Continues

The outlook for domestic oil production remains bearish. Production is expected to drop by 210,000 barrels per day in 1992 and by 280,000 barrels per day in 1993. U.S. drilling activity continued to decline in the first quarter of 1992. Rig activity is expected to improve during the latter part of 1992 and into 1993, but is not expected to return to 1991 levels.

Growth Not Expected in Product Supplied of Gasoline this Summer

Product supplied of motor gasoline for this summer is expected to decline slightly from the summer of 1991. This prediction is based on the assumption that greater new car sales this year will contribute to continued growth in average total fleet fuel efficiency, which will offset expected growth in travel. Stocks are expected to be plentiful throughout the peak driving season. Given the experience of last summer, the existing requirements for lower Reid Vapor Pressure for summer gasoline should not cause a problem for domestic suppliers.

Oxygenated Gasoline Program Begins November 1, 1992

Between November 1992 and February 1993, about 31 percent of gasoline sold in the United States will be required by law to be oxygenated. Refiners and gasoline blenders have begun stockpiling ethanol and methyl tertiary butyl ether to satisfy the new gasoline oxygen requirements of the Clean Air Act Amendments of 1990. This requirement could lead to an increase of 3 to 5 cents per gallon in average gasoline prices during the winter in affected regions, or 1 to 2 cents on a national average basis.

Natural Gas Prices Weak Until Next Winter

Natural gas prices are not expected to recover until this upcoming winter. In 1993, assuming a normal winter, a strengthening economy, strong gas demand growth, and rising world oil prices should cause a rebound in the wellhead price of 11 percent for the year.

Coal Stocks Affected by UMWA Contract Renegotiations

Coal stocks held by consumers are expected to increase in the fourth quarter of 1992. This increase is anticipated because of the renegotiation next winter of a new contract between the United Mine Workers of America (UMWA) and the Bituminous Coal Operators' Association. The projections do not assume a strike will occur, and therefore reflect only timing shifts from normal patterns for production in late 1992 and early 1993.

Note: The data referenced may be found in Table 1 or in the tables located in the back of this report.

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

	Price Case*	Year				Annual Percentage Change		
		1990	1991	1992	1993	1990-1991	1991-1992	1992-1993
Real Gross Domestic Product (GDP) (billion 1987 dollars)	Mid	4885	4848	4933	5096	-0.8	1.8	3.3
Imported Crude Oil Price (nominal dollars per barrel)	Low			16.04	17.00		-14.2	6.0
	Mid	21.76	18.70	17.59	19.00	-14.1	-5.9	8.0
	High			19.02	21.00		2.3	9.8
Petroleum Supply								
Crude Oil Production ^b (million barrels per day)	Low			7.04	6.64		-4.5	-5.7
	Mid	7.36	7.37	7.16	6.88	0.1	-2.8	-3.9
	High			7.25	7.08		-1.6	-2.3
Total Petroleum Net Imports (including SPR) (million barrels per day)	Low			7.31	8.00		11.3	9.4
	Mid	7.16	6.57	7.12	7.65	-8.2	8.4	7.4
	High			6.94	7.31		5.6	5.3
Energy Demand								
Total Petroleum Product Supplied (million barrels per day)	Low			16.90	17.25		1.6	2.1
	Mid	16.99	16.64	16.84	17.14	-2.1	1.2	1.8
	High			16.76	16.99		0.7	1.4
Total Natural Gas Consumption (trillion cubic feet)	Low			19.45	20.48		0.1	5.3
	Mid	18.72	19.43	19.62	20.67	3.8	1.0	5.4
	High			19.78	20.92		1.8	5.8
Total Coal Consumption (million short tons)	Mid	896	888	899	928	-0.9	1.2	3.2
Total Electric Utility Sales ^c (billion kilowatthours)	Mid	2713	2760	2790	2883	1.7	1.1	3.3
Gross Energy Consumption ^d (quadrillion Btu)	Mid	81.3	81.7	82.8	85.3	0.5	1.3	3.0
Thousand Btu per 1987 Dollar of GDP	Mid	16.61	16.81	16.76	16.69	1.2	-0.3	-0.4

*Refers to the imported cost of crude oil to U.S. refiners assumed for the scenario depicted. In all cases on this table, the mid macroeconomic case and normal weather are used.

^bIncludes lease condensate.

^cTotal 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 Electric 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, but match alternate annual totals reported in EIA's *Electric Power Monthly*, DOE/EIA-0226.

^dThe 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.

SPR: Strategic Petroleum Reserve

Notes: Minor discrepancies with other published EIA historical data are due to independent rounding. Historical data are printed in bold, forecasts are in italic. The forecasts were generated by the following simulations of the demand and supply subsystems of the Short-Term Integrated Forecasting System: D040892BBB12:09 and S042792BBB18:56 for the middle oil price case; D040892PSB13:07 and S042792PSB19:04 for the low oil price case; and D040892WGB12:44 and S042792WGB19:11 for the high oil price case.

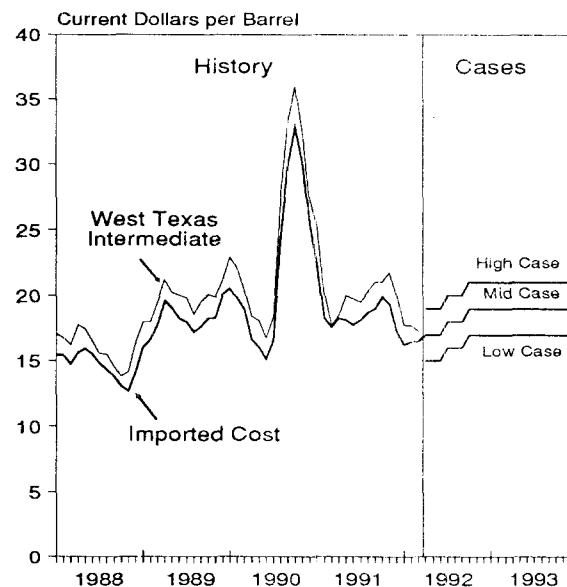
Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(92/04); *Petroleum Supply Monthly*, DOE/EIA-0190(92/02); *Petroleum Supply Annual 1990*, DOE/EIA-0340(90)/1; *Natural Gas Monthly*, DOE/EIA-0130(92/04); *Electric Power Monthly*, DOE/EIA-0226(92/04); and *Quarterly Coal Report*, DOE/EIA-0121(91/4Q). Macroeconomic projections are based on DRI/McGraw-Hill Forecast CONTROL0392.

Introduction

Projections in the *Short-Term Energy Outlook (Outlook)* are influenced by macroeconomic growth assumptions for the United States and other major energy consuming countries and by assumptions for world oil prices. The following discussion provides a summary of the key projections that provide the basis for the forecasts.

World Oil Prices

This *Outlook* focuses on three world oil price cases (Figure 1 and Table 1). Price assumptions for 1992 range from an average of \$16 per barrel in the low-price case to \$19 per barrel in the high-price case. The mid-price case assumes an average of \$17.59 in 1992, about \$1 below the 1991 average. For 1993, average prices range from \$17 per barrel in the low-price case to \$21 per barrel in the high-price case, with a mid-price case assumption of \$19 per barrel.



Macroeconomic Activity and Weather

In 1992, economic growth in countries in the Organization for Economic Cooperation and Development (OECD) is expected to strengthen to an annual rate of 1.8 percent in the mid-price case, reflecting a slow recovery from the recession of 1991 (Table 2). Growth in the OECD countries is expected to accelerate to 3.2 percent in 1993.

Gradual improvement in the U.S. economy began in the first quarter of 1992. Growth in real gross domestic product (GDP) is expected to average 1.8 percent in 1992 and 3.3 percent in 1993, after a decline of 0.8 percent in 1991. The magnitude of change in crucial economic variables is uncertain. Any uncertainty in macroeconomic growth can significantly amplify the uncertainty of the energy forecasts. The possibility of extreme weather also heightens the overall uncertainty of these forecasts. The mid-macroeconomic case and normal weather assumptions are used to generate the mid-price energy forecasts, but the high and low macroeconomic cases and abnormal weather cases are also considered. The range of growth in these macroeconomic cases is represented by a variation in growth in gross domestic product of roughly 1 percentage point above and below the mid-case rate

Figure 1. U.S. 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* (April 1992); and *Oil and Gas Journal Energy Database*. Cases: Table 4.

over the forecast period. The weather cases assume deviations above and below normal that correspond to one-half of the greatest quarterly variances from normal in heating and cooling degree days over the last 15 years. The section titled "Petroleum Product Supplied and Production Sensitivities" summarizes the sensitivity of petroleum demand in the United States to variations in the economy and weather.

The weather for the first quarter of 1992 was almost 13 percent warmer than normal (using leap year normal of 2,425 for heating degree days as a comparison). This caused lower use of energy than anticipated in the last *Outlook*, primarily in the electric utility and residential sectors.

Outlook for Petroleum

Demand

Demand for petroleum, as discussed in this report, is synonymous with "petroleum product supplied," which is basically defined as disappearance from primary supply of petroleum products, such as motor gasoline, heating oil, and other products.¹

Based on supply and demand patterns that reflect the mid-price case, a modest increase in world demand for petroleum products is expected in 1992, followed by a larger increase in 1993. World demand is expected to increase to 66.8 million barrels per day in 1992 and to 67.9 million barrels per day in 1993 (Table 3). The major factors accounting for the growth in 1992 and 1993 are as follows:

- Economic recovery in 1992, which accelerates in 1993
- Only modest increases in the world oil price.

Petroleum demand is expected to increase in all major regions, except the former Soviet Union and the European countries outside the Organization for Economic Cooperation and Development (OECD). In 1992, OECD demand for petroleum is expected to average 38.3 million barrels per day, up 440,000 barrels per day from the 1991 level. This estimate is based on the assumption that OECD economic growth will be 1.8 percent in 1992 (Table 2). About 80 percent of the growth in OECD demand in 1992 is expected to occur in the United States and Europe. In 1993, OECD demand is expected to increase by 590,000 barrels per day, as Japan and Germany join the ranks of OECD countries with recovering economies.

Demand growth in the non-OECD countries is expected to be constrained by declines in demand in the republics of the former Soviet Union of 490,000 barrels per day in 1992 and 390,000 barrels per day in 1993, as well as smaller declines in other non-OECD countries in Europe. Overall, non-OECD demand is expected to increase by 220,000 barrels per day in 1992, to 28.5 million barrels per day, and by 560,000 barrels per day in 1993. This implies larger increases in non-OECD demand excluding the former Soviet Union and Europe, which are expected to exceed demand for growth all OECD countries combined, with increments of about

850,000 barrels per day in 1992 and over 1.0 million barrels per day in 1993.

In the United States, total petroleum product supplied is projected to increase in 1992 and 1993, reversing the decline in 1991. Growth is expected to be modest, however, at 200,000 barrels per day in 1992 and 300,000 barrels per day in 1993 (Table 6). Product supplied in the first quarter of 1992 was lower than anticipated because of warmer-than-normal weather.² Nonetheless, normal weather during the rest of the year is assumed to account for much of the projected growth in 1992. Based on normal weather assumptions, heating degree days for 1992 will be 3.0 percent higher than last year (Table 2). Economic activity, on the other hand, is expected to contribute little to the growth in petroleum deliveries during the year. In the transportation sector, continuing efficiency increases led by a moderate economic recovery and changes in secondary stocks are expected to keep growth in gasoline and jet fuel product supplied to a minimum during the year.

In 1993, improved economic conditions and an assumed return to normal weather are expected to account for the bulk of the growth in petroleum product supplied, although early 1993 is expected to be relatively strong due to normal winter weather assumptions. Transportation fuels, especially jet fuel and diesel fuel, are expected to lead the way, although growth in motor gasoline product supplied is projected to remain minimal (Figure 2). Fuel efficiency growth continues to nearly match that of highway travel. Growth in product supplied of other oils, brought about by sizable increases in petrochemical activity, is expected to account for about one-third of the increase in total petroleum products supplied (Table 6).

In the short term, deviations from normal weather patterns can account for much of the forecasting error for petroleum product supplied. However, the likelihood of particular deviations occurring falls quickly as more and more severe conditions are considered. For example, the probability of the first quarter being 10 percent warmer than normal is 14 percent; the probability of it being 15 percent warmer than normal is 4 percent.³ Should the first quarter of 1993 be 15 percent warmer than normal (15 percent fewer heating degree-days), total petroleum product

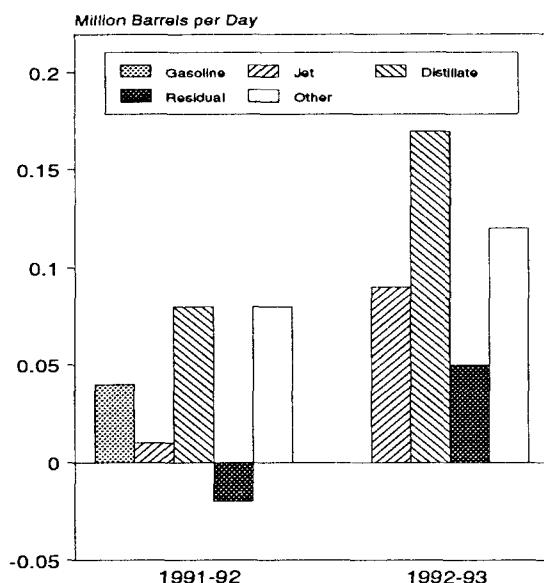


Figure 2. Annual Change in U.S. Petroleum Product Supplied by Fuel

Source: Table 6.

supplied would be about 450,000 barrels per day below the level expected if temperatures are normal.⁴

Variations in economic growth also impact petroleum projections. If economic growth followed the low growth path shown in Table 2, petroleum product supplied in 1993 would be about 270,000 barrels per day below the mid price case average.⁵ When the world oil price is assumed to range from \$16 to \$21 per barrel over the forecast period, the corresponding product supplied ranges related to petroleum price variations are 140,000 and 260,000 barrels per day in the mid-price case for 1992 and 1993, respectively.⁶

Supply

World oil production is expected to fall slightly in 1992 from the 1991 level, which is currently estimated to have averaged 66.4 million barrels per day (Table 3). This minor net change in world oil supply is the result, however, of some significant, offsetting swings in production in major producing regions. A large decline in former Soviet Union (about 1.1 million barrels per

day this year) is expected to be offset by significant increases in Organization of Petroleum Exporting Countries (OPEC) and North Sea production. Renewed declines in oil supply from the United States, following a temporary flattening out in 1991, yields a small net decline in overall world oil supply this year.

Increases in oil production by OPEC lead the way for significant global gains in supply in 1993. World production is expected to increase by 1.3 million barrels per day next year, the result of an increase of 1.7 million barrels per day by OPEC. A decline of 650,000 barrels per day in production in the former Soviet Union will more than offset increases in production from the North Sea, Mexico, and other non-OECD countries.

The outlook for domestic oil production remains bearish with oil production expected to decline at an increasing rate over the forecast period. Production is projected to drop to 7.2 million barrels per day in 1992 and to 6.9 million barrels per day in 1993. Oil production in the lower 48 States is expected to drop by 140,000 barrels per day in 1992 and in 1993. The Point Arguello field in the Pacific Federal Outer Continental Shelf began production during the second quarter of 1991. Its contribution is assumed to be 30,000 barrels per day for the mid-price case. The Point Arguello field could produce at several times this rate if problems involved in transporting oil to the refineries are resolved.

Production in Alaska is expected to decrease by 90,000 barrels per day in 1992 and by 130,000 barrels per day in 1993. This decline in production is primarily associated with the Prudhoe Bay oil field. In addition to the normal decline from this oil field, expected production was adjusted for downtime for maintenance and installation of additional gas handling facilities.

According to the Baker-Hughes rotary rig count, a measure of oil and gas resource development activity and an indicator of prospective well completions, the rig count declined by 15 percent in 1991, averaging 860 for the year.⁷ The rotary rig count continued to decline during the first quarter of 1992, and the average for the first 3 months was about 32 percent below the average for the same period last year. Rig activity is expected to improve during the latter part of 1992 and into 1993, but is not expected to return to 1991 levels.

Net imports of crude oil and petroleum products are expected to increase over the forecast period because of higher product demand and lower domestic crude oil production. While domestic crude oil production is

projected to decline by 490,000 barrels per day between 1991 and 1993, net imports of crude oil are expected to increase by about 860,000 barrels per day over this period (Table 6). Net imports of refined products in 1992 are expected to grow by about 210,000 barrels per day between 1991 and 1993.

World Oil Prices

The world oil price is ultimately affected by supply, demand, and other factors such as expectations of market participants. Each of these factors is subject to substantial uncertainty. The uncertainties concerning oil supply, for example, focus on oil exports from the former Soviet Union and oil production from OPEC.

- In the former Soviet Union, the production and consumption of oil are expected to decline. Export volumes will be determined by the relative decline rates of production and consumption and by the competing need for hard currency in the emerging market economies of the new republics. Oil consumption could drop sharply if domestic prices for oil products are finally decontrolled and allowed to move to world market levels.
- Two OPEC countries, Kuwait and Iraq, are in the process of restoring their pre-war production capacity and export facilities. Kuwait is expected to increase production and exports as capacity is restored. Iraqi production will be constrained as long as the United Nations embargo against exports remains in effect.
- Aggregate OPEC production depends on the willingness of other OPEC members to restrain their production, if necessary, as exports from Kuwait, and possibly Iraq, return to the market. OPEC production could also be affected by domestic political problems in Algeria and Venezuela and by the ongoing dispute between Libya and the United Nations Security Council.

The key uncertainties affecting oil demand over the forecast period are the magnitude of economic growth, especially in the United States, Japan, and Western Europe, and the severity of winter weather.

Two other factors affect the extent to which these supply and demand uncertainties influence oil prices:

- *Excess production capacity.* Excess capacity is expected to increase in 1992 and 1993. Capacity restoration in Kuwait and capacity additions in

some other OPEC countries are expected to more than offset increases in actual OPEC production (Figure 3). Kuwait will have the capacity to produce more than 1.5 million barrels per day (excluding the Neutral Zone) by the end of 1993, but Iraqi capacity will continue to be constrained by the United Nations sanctions.

- *Stocks.* The market economies currently have enough stocks readily available to meet petroleum demand for 29 days (Figure 4), based on anticipated demand levels, identical to the situation at the same time in 1991. This represents usable commercial stocks only, which excludes strategic government stocks of about 860 million barrels and the minimum inventory levels that must be maintained for normal operations of about 3.1 billion barrels.

In the first quarter of 1992, ample stock levels tended to mitigate market concern over the low level of excess capacity. During the forecast period, interaction between the trends in excess oil production capacity and readily available stocks will continue to influence world oil prices.

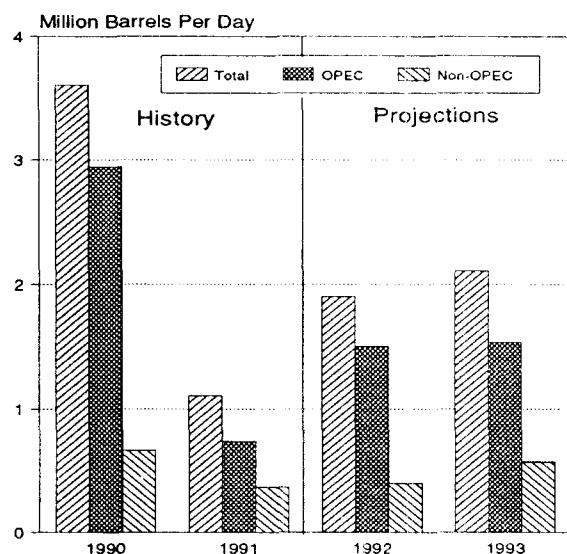


Figure 3. World Excess Oil Production Capacity

Note: Excludes any excess capacity from Iraq.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy Markets and Contingency Information Division.

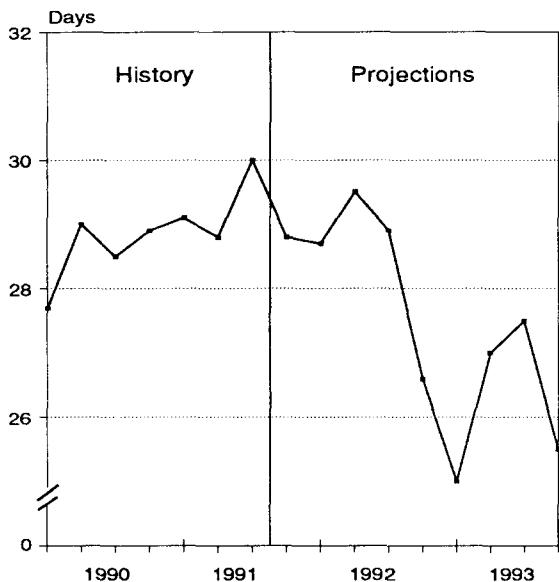


Figure 4. Days Supply of Market Economies Commercial Petroleum Stocks

Note: Represents usable stocks; excludes strategic stocks and minimum operating inventory.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy Markets and Contingency Information Division.

Because of these uncertainties, three world oil price cases are developed (Figure 1 and Table 4). These cases are used to derive 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. In the low-price case, the world oil price is about \$16 per barrel in 1992 and \$17 per barrel in 1993. In the mid-price case, the price is about \$17.50 per barrel in 1992 and \$19 per barrel in 1993. In the high-price case, the world oil price increases to \$19 per barrel in 1992 and to \$21 per barrel in 1993.

The mid-price case is based on the following assumptions:

- Net oil exports from the former Soviet Union will decrease by 630,000 barrels per day in 1992, to 1.5 million barrels per day, and by another 270,000 barrels per day in 1993, as production declines

continue to exceed reductions in oil consumption (Table 3).

- Iraqi production will be limited to domestic requirements plus a small volume of exports to Jordan. This assumes the United Nations embargo against Iraq continues and Iraq does not accept the United Nations terms that would allow limited exports for humanitarian purposes.
- Kuwaiti oil production (excluding the Neutral Zone) will more than double during 1992, from about 500,000 barrels per day in the first quarter of 1992 to about 1.2 million barrels per day in the fourth quarter. By the fourth quarter of 1993, production is expected to exceed 1.5 million barrels per day.⁸
- Other OPEC members will restrain production to accommodate increasing exports from Kuwait throughout the forecast period. In particular, OPEC member countries will hold crude oil production within 400,000 barrels per day of their current production ceiling of 2.3 million barrels per day in the second quarter of 1992 (Table 3).⁹

The low-price case assumes that other OPEC members fail to reduce their production to accommodate the increase in Kuwaiti production and any resumption in Iraqi exports. Other supply factors adding to the downward pressure on prices include higher Kuwaiti production and higher exports from the former Soviet Union than in the mid-price case. Demand could be lower due to slower economic growth in the OECD countries and milder weather than assumed in the mid-price case.

The high-price case assumes that oil production from Kuwait and oil exports from the former Soviet Union are lower than in the mid-price case. Production from other OPEC countries is expected to be held down in order to push oil prices higher. In addition, abnormally cold winter weather and stronger economic growth than in the mid-price case are assumed.

U.S. Petroleum Product Prices

The following discussion provides projections for petroleum product prices, given the three assumed crude oil price paths presented in Table 4. The variation among cases in the petroleum product prices is based primarily on the pass-through of the differences in crude oil costs. The variation is based to a lesser extent on differences in supply and demand conditions for particular product markets.

Gasoline prices are likely to be subject to some additional increases during the winter of 1992-1993 due to higher supply costs associated with manufacturing, storing, and transporting gasoline designed to meet Federal requirements for oxygenate content by the fourth quarter (Figure 5 and Table 4). The estimated price increase caused by implementing these rules is about 3 to 5 cents per gallon in the affected regions, which translates into an increase in national prices of 1 to 2 cents per gallon from November through February (see "Demand and Price Outlook for Oxygenated Gasoline"). Diesel prices are also expected to increase, by as much as an additional 5 cents per gallon during the last quarter of 1993, due to lower sulfur content requirements.

In the mid-price case, motor gasoline prices are expected to decrease by about 1 cent per gallon in 1992, despite some State and local tax increases, the upward price effect of the Clean Air Act late in the year, and other production and distribution cost increases (Table 4). In 1993, crude oil price increases, the continuing compliance costs from the Clean Air Act, and additional expected increases in State and local taxes should add about 6 cents per gallon to the annual average price.

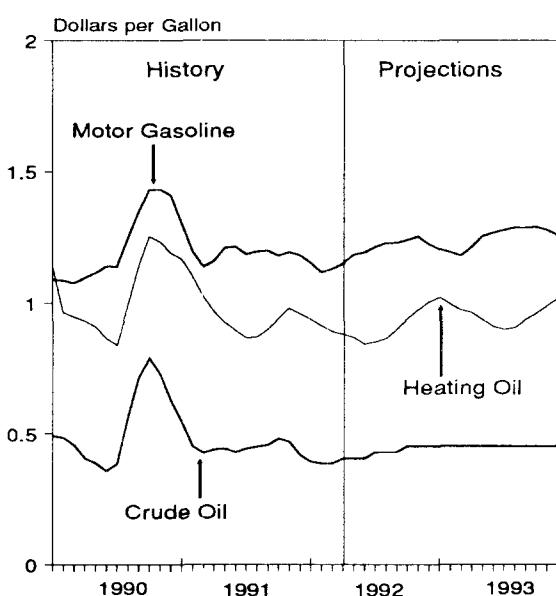


Figure 5. U.S. Crude Oil and Product Prices

Note: Crude oil price is the cost of imported crude oil to U.S. refiners.
 Sources: History: Energy Information Administration, *Monthly Energy Review* (April 1992). Projections: Table 4.

Residential heating oil prices are projected to average less in 1992 than in 1991 due to lower world oil prices and to the exceptionally warm winter (particularly in the Northeast) that occurred in the first quarter of the year (Tables 2 and 4). The 1993 price increase assumes higher world oil prices and normal weather. Prices for retail residual fuel oil are expected to average below 1991 levels in 1992, not only due to lower crude oil costs and warm winter weather, but also due to downward price pressure from a depressed natural gas market and a generally sluggish economy in the first half of the year. In 1993, a more robust economy and rising natural gas and crude oil prices along with normal weather should cause retail residual fuel oil prices to rise by more than \$2.50 per barrel.

The low-price case assumes slightly lower rates of inflation and a better economy than does the high case. Under this scenario, petroleum product prices generally follow the crude oil price path, which starts off at \$15 dollars per barrel in the second quarter of 1992 and increases to \$17 per barrel by 1993 (Table 4). Residual fuel oil prices follow the crude oil price path.

The high-price case assumes a slightly higher rate of inflation and a slightly weaker economy than does the mid-price case. Under this scenario, prices for all petroleum products are projected to increase through 1993.

U.S. Petroleum Product Supplied

Motor Gasoline

Motor gasoline product supplied fell slightly in 1991 to 7.2 million barrels per day, the third consecutive annual decline (Table 6). Highway travel continued to increase, but at a rate of only 1 percent, the smallest annual increase in 11 years.¹⁰ As a result, continuing efficiency increases, brought about primarily by retirements of older, less-efficient vehicles, more than offset the impact of travel growth, resulting in a decline in gasoline product supplied (Figure 6).

Motor gasoline product supplied is projected to increase by 0.6 percent in 1992, followed by stable demand in 1993 (Table 6). Travel activity is projected to rise by 2.7 percent in 1992. Much of that year-to-year increase results from the depressed levels of highway activity during the previous year as a result of a stagnant economy. In 1993, travel is projected to climb by a more moderate 2.4 percent. Fuel efficiency increases

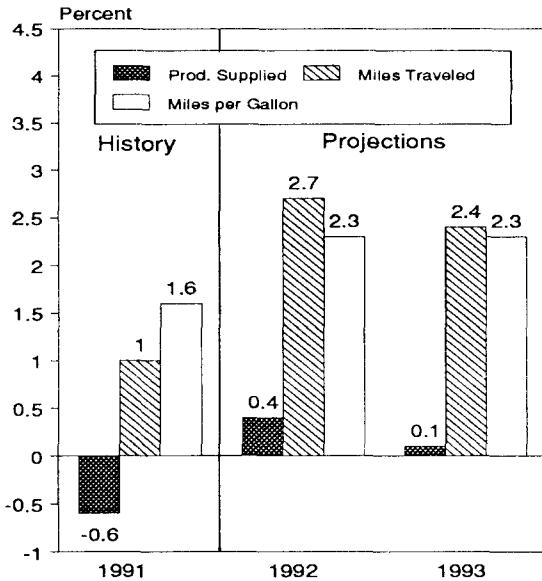


Figure 6. Annual Change In U.S. Motor Gasoline Market Indicators

Sources: **History:** Energy Information Administration, *Petroleum Supply Monthly* (February 1992); Federal Highway Administration, *Traffic Volume Trends*. **Projections:** Table 6 and internal calculations from the Short-Term Integrated Forecasting System.

are expected to average 2.1 percent in 1992 and 2.4 percent in 1993, constraining growth in product supplied in both years. These projections represent a trend in efficiency growth which is somewhat greater than that observed in 1991. This increase in efficiency is caused by growth in new car sales based on expectations of an economic recovery. Newer, more efficient cars are expected to replace older, less efficient cars. These efficiency gains are likely to result in declines in the retail cost per mile of gasoline, despite continuing increases in State motor gasoline taxes and added costs associated with compliance with the Clean Air Act Amendments.

Jet Fuel

Jet fuel product supplied declined by 3.7 percent in 1991 as a result of the recession and consequent declines in discretionary and business travel (Table 6). Although air carriers responded to reduced demand by

trimming available capacity by more than 1 percent, actual utilization declined by 2 percent. This resulted in load factors almost as low as those of the early 1980's.¹¹

Jet fuel product supplied is expected to recover with the economy over the next 2 years. In 1992, however, growth in jet fuel product supplied is expected to be only 0.7 percent despite projected growth of more than 6 percent in air travel activity, under the mid-price scenario (Table 6). Air carriers are expected to increase their load factors to pre-recession levels, as they try to optimize utilization of existing capacity. In addition, fuel efficiency increases associated with the delivery of new aircraft and the retirement of older equipment are expected to continue.

In 1993, jet fuel product supplied is projected to increase by a robust 6 percent. Air activity is expected to rise by more than 7 percent, led by a surge in international passenger travel and sizable increases in air freight activity.¹² In addition, a significant portion of additional air traffic is expected to be met by expanded flight schedules, boosting jet fuel product supplied noticeably.

Distillate Fuel Oil

Distillate is expected to be the major source of growth in total petroleum product supplied in 1992 and 1993 in the mid-price case (Table 6). The transportation and industrial sectors are expected to account for much of the strength in distillate shipments. This is due to the expected recovery in the economy. In addition to this, the assumption of normal winter temperatures results in higher expected demand for heating fuel in late 1992 and early 1993.

Residual Fuel Oil

Product supplied for residual fuel oil is expected to decrease slightly in 1992 (Table 6). A warm first quarter and low prices and ample supply of natural gas in 1992 contributed to weak demand for this fuel. The net effect on total product supplied is no growth for 1993. The use of residual fuel oil at electric utilities should pick up further due to the increasing demand for electricity caused by normal weather and a recovery in the economy. Nonutility use of residual fuel oil is expected to decline due to the continuing substitution of other fuels in the industrial and commercial sectors.

Other Petroleum Products

In 1991, product supplied of other oils declined by 1.6 percent¹³. That decline reflects the effects of a weak economy, mild weather during the first quarter, and local budgetary constraints.

Product supplied of other oils is expected to increase by 2.0 percent in 1992 in the mid-price scenario (Table 6). Milder-than-expected weather in the first quarter of this year (reducing demand for propane) and a sluggish economic recovery have constrained growth. The 1.3-percent increase in product supplied projected for 1993 reflects the assumption of normal weather patterns and accelerated economic growth.

Petroleum 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 enhance the usefulness of the mid-case forecast, Tables 8 and 9 provide a range of possible outcomes for petroleum demand and supply when alternative macroeconomic, price, and weather assumptions are used.

The petroleum price sensitivity assumes that non-petroleum prices remain constant. The weather sensitivities assume deviations above and below normal that correspond to one-half of the largest quarterly deviations from normal in heating and cooling degree days over the last 15 years. (See Appendix for more details).

Average petroleum sensitivity factors for this forecast are summarized below:¹⁴

- A 1-percent increase in real GDP raises petroleum product supplied by about 124,000 barrels per day.
- A \$1-per-barrel increase in crude oil prices, assuming no price response from nonpetroleum energy sources, reduces product supplied by about 63,000 barrels per day.
- A \$1-per-barrel increase in crude oil prices boosts domestic oil supply (crude oil and natural gas liquids production) by 94,000 barrels per day.
- A 1-percent increase in heating degree-days increases product supplied by about 31,000 barrels per day; a 1-percent increase in cooling degree-days increases petroleum product supplied by about 8,000 barrels per day.

For 1992, projections of the rate of domestic crude oil production range from 7.0 million barrels per day in the low-price case to 7.3 million barrels per day in the high-price case (Tables 5 and 7). This range increases in 1993, with production rates of 6.6 million barrels per day in the low-price case and 7.1 million barrels per day in the high-price case (Table 9). These estimates contain an element of uncertainty that goes beyond expected price impacts in the two cases. In the fourth quarter of 1993, for example, the difference between the low- and high-price case is 510,000 barrels per day.¹⁵ About 40 percent of this range of production can be attributed to uncertainties concerning both the current production level and the timing of expected events. About 60 percent of this range is attributed to the impact of prices on drilling rates and well maintenance.

Demand and Price Outlook for Oxygenated Gasoline

Title II of the Clean Air Act (CAA) Amendments, enacted on November 15, 1990, sets forth several provisions related to mobile sources of air pollution:

Provision	Effective Date
Oxygenated gasoline	November 1, 1992
Low-sulfur, on-highway diesel fuel	October 1, 1993
Reformulated gasoline, phase 1	January 1, 1995
Leaded gasoline ban	January 1, 1996
Clean-fueled fleet vehicles	January 1, 1998
Reformulated gasoline, phase 2	January 1, 2000

On the basis of the CAA, the Environmental Protection Agency (EPA) designated 39 areas of the country as mobile source carbon monoxide (CO) nonattainment areas.¹⁶ Beginning no later than November 1, 1992, all motor gasoline sold in the CO nonattainment areas (about 31 percent of total gasoline sales) during designated winter months (the "CO season") must contain no less than 2.7 percent oxygen by weight in the form of blended oxygenates. The CO season lasts a minimum of 4 months, but it may be longer in areas where the duration of CO nonattainment is longer.¹⁷

Oxygenates are liquid organic compounds which contain oxygen, and are approved by the EPA as substantially similar to motor gasoline. Because of the contained oxygen, blended oxygenates significantly lower the level of carbon monoxide produced during gasoline combustion. Several alcohols and ethers can be used as oxygenates, but only two are expected to be used in significant quantities in the coming winter. These are methyl tertiary butyl ether (MTBE) and fuel ethanol.¹⁸

The oxygenated gasoline requirements are of particular concern to the petroleum industry because of the large volumes of oxygenate required, the seasonal nature of the demand, and the short lead time available for installing new oxygenate production and storage facilities.

Demand projections for oxygenated gasoline are based on the 1990 populations of the designated CO

nonattainment areas, projected per capita gasoline demands, corrections for "spillover" of oxygenated gasoline to attainment areas, and continued demand for MTBE and ethanol in attainment areas not affected by spillovers. Total demand for oxygenates during the 1992-93 winter CO season is expected to range from 425,000 to 475,000 barrels per day (of MTBE equivalent volume).¹⁹

Projections of oxygenate supply are based on the recent EIA-822 Oxygenates Operation Identification Survey supplemented by industry announcements of production capacity under construction. Oxygenate production during the 1992-93 winter CO season is projected to range from 280,000 to 310,000 barrels per day (MTBE equivalent volume).

To meet the oxygenate shortfall during the 1992-93 winter CO season, MTBE working inventory of between 17 and 29 million barrels will be required, assuming minimal imports. These target working storage inventories may be reduced by 1.5 million barrels for every 10,000 barrels per day of MTBE available from foreign producers or offshore inventories. The EIA-819 Monthly Oxygenates Survey reported a MTBE inventory of 12.9 million barrels as of January 31, 1991. By March 31, 1992, MTBE inventory had increased to 15.4 million barrels.

Because winter production of oxygenates is expected to fall significantly short of demand during the CO season, oxygenate blending components are projected to command a price premium over the traditional gasoline blend octane values. This price premium may correspond to the cost of storing oxygenates during the spring and summer to satisfy winter demand, the cost of exchanging aromatics for MTBE in European markets, or the cost of rail or truck transportation to move fuel ethanol from the production sites in the Midwest to the large CO nonattainment areas on the East and West Coasts. An oxygenated gasoline price premium of 3 to 5 cents per gallon over conventional clear gasoline is projected. This translates to an average U.S. clear motor gasoline price increase of 1 to 2 cents per gallon. (A more detailed analysis of this subject will be released in the 1992 *Short-Term Energy Outlook: Annual Supplement*, DOE/EIA-0202.)

Summer Outlook for Motor Gasoline

Despite projections of increases in highway travel during the upcoming peak driving season as well as growing concerns that some refineries may close their facilities in response to more stringent Clean Air Act requirements later this year, available supplies of motor gasoline are projected to be more than sufficient to meet the anticipated demand. Moreover, shipments of motor gasoline are projected to be somewhat lower than those of the previous summer despite the projected increase in vehicle miles traveled. Stocks are projected to be ample, and drawdowns are expected to be substantially below normal seasonal levels.

For the 1992 peak driving season, defined as the period May through August, motor gasoline product supplied is projected to average 7.46 million barrels per day in the mid-price case.²⁰ This represents a decline of about 0.6 percent in product supplied from the same period last year despite projected economic growth. From the abnormally low levels of the previous summer, highway travel activity is projected to rise by almost 3 percent.²¹

The lack of growth in summer product supplied stems largely from continuing increases in fleet fuel efficiency that are projected to constrain growth in product supplied for the year as a whole. Another portion of the decline, however, may also be due to last summer's unusual strength which may have been brought about by factors such as the timing of deliveries and secondary stock fluctuations.

For the summer, refinery output of motor gasoline is projected to average slightly less than 7.2 million barrels per day, compared to slightly more than 7.2 million barrels per day last year.²² That decrease (about 90,000 barrels per day) reflects not only the reduced levels of shipments projected for this summer but also the ample supply of primary stocks. These projections, however, assume that disruptions of refinery operations will not be a factor during the summer months.

Continuing on a downward trend during the last 3 years, net imports of gasoline are expected to average 250,000 barrels per day compared to last summer's

average of 290,000 barrels per day, and down considerably from the record 430,000 barrels per day in 1988.²³ As a result, net imports are expected to account for only 3.5 percent of motor gasoline requirements, the lowest percentage in 10 years.

Finished motor gasoline stocks are projected to be about 180 million barrels at the beginning of the driving season, about 10 million barrels more than last year. As a result, stock levels by the end of the summer are also projected to be higher than last year. Total gasoline inventories (including blending components) are projected to be 215 million barrels at the end of the driving season, 6 million barrels above last year and well above the threshold of 205 million barrels defined by the National Petroleum Council as the minimum required to avoid spot shortages arising from unanticipated demand fluctuations.

It is possible that the projections for summer motor gasoline demand may be conservative. Highway travel activity may be more robust and fuel efficiency increases less than those projected in this *Outlook*. For example, a more robust economic recovery would boost demand and, hence, concerns about availability, especially in view of the recently announced shutdowns of refinery capacity noted above. A year-to-year increase in summer gasoline demand of 1 percent (instead of the projected decline) would require 70,000 barrels per day more availability than last summer's levels. However, refineries could increase production to handle such an increase.²⁴ In addition, imports could also increase. (Refineries have operated at even higher rates during the summer months).

Net imports would have to average only 300,000 barrels per day to maintain inventories at beginning-of-season levels throughout the driving season. Inventories themselves are able to withstand a drawdown averaging 130,000 barrels per day without falling below the National Petroleum Council's minimum operating inventory threshold. As a result, availability of supplies are regarded as more than sufficient to meet unanticipated fluctuations around a robust trend in motor gasoline demand growth.

Outlook for Other Major Energy Sources

Natural Gas

In 1992, total consumption of natural gas is expected to rise by 1.0 percent to 19.6 trillion cubic feet in the mid-price case (Table 10). Warm weather in the first quarter of 1992 is responsible for this weak overall growth rate. Consumption is projected to increase in the second through fourth quarters, particularly in the industrial sector. Gas consumption in the electric utility sector is expected to increase only slightly in 1992, despite continued low natural gas prices. Gas generation has been displaced by nuclear power in some areas on the West Coast.²⁵

In 1993, gas consumption is expected to rise across all sectors as the economy accelerates and gas prices maintain their competitive edge (Figure 7). Industrial and commercial sector gas consumption is expected to increase by 5.4 percent and 5.6 percent, respectively. Residential gas consumption will increase by 6.8 percent, under the assumption of normal weather and a gradually increasing customer base. Electric utility gas consumption is expected to be up due to low gas prices and higher demand for electricity. Total gas consumption in 1993 is projected to grow by 5.4 percent, to 20.7 trillion cubic feet.

As a group, U.S. natural gas producers registered their fifth successive increase in annual natural gas production in 1991 (Table 10)²⁶. The sustained increase in production largely reflected a surge in U.S. natural gas drilling that began in mid-1987. From 1987 through 1990, natural gas drilling rose by 27 percent, led by expectations of increased demand for this environmentally favored fuel.²⁷ Also, the scheduled expiration in 1992 of subsidies for new wells in coal-bed methane production contributed to the increase in drilling. When excess deliverability reappeared (the "gas bubble"), natural gas drilling fell off by 14 percent in 1990 to 1991.

Due to declining wellhead prices, U.S. natural gas production will be nearly flat in 1992 compared with 1991, as supply from new domestic wells is offset by cutbacks in production elsewhere (Table 10). The substantial expected increase in natural gas demand in 1993 will lead U.S. producers to step up their production by 0.4 trillion cubic feet from the 1992 level.

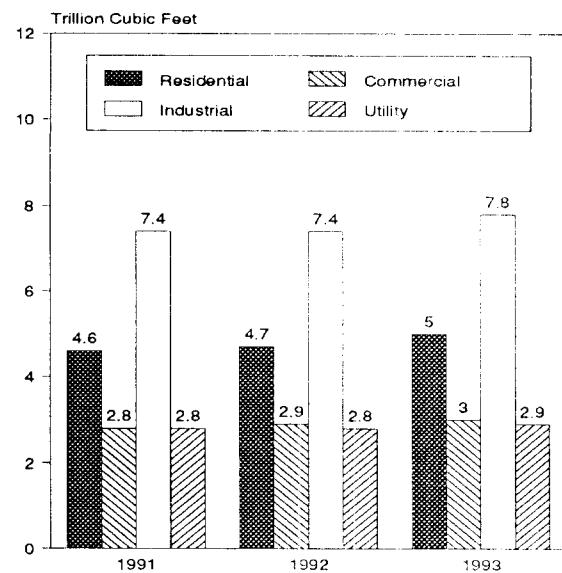


Figure 7. Natural Gas Consumption by Sector

Sources: History: Energy Information Administration, *Natural Gas Monthly* (April 1992). Projections: Table 10.

Net imports are expected to increase by less than 1 percent in 1992; again due to weak consumption during the first quarter caused by mild weather. In 1993, imports should increase by 19 percent (Table 10). The opening of several new or expanded natural gas pipelines will increase availability of Canadian gas in the Northeast, West, and Midwest regions. The completion of the Iroquois system in January 1992 brought capacity of approximately 0.6 billion cubic feet per day into the Northeast. The Great Lakes project, scheduled for completion later this year, will bring 0.4 billion cubic feet per day of capacity into the Midwest. The Pacific Gas Transmission System and the Altamont Pipelines, proposed projects scheduled for service in 1993, would bring 1.6 billion cubic feet per day of capacity from Canada into California markets.

Wellhead prices for the first quarter of the year were unusually low due to a weak economy and warmer-than-normal weather in January and February. These 2 months normally represent the peak consumption months for natural gas. However, spot prices for these 2 months averaged only about \$1.22 per thousand cubic feet, a level usually associated with weak demand in the spring and summer.²⁸ The colder-than-normal temperatures in March of this year caused spot prices to rise to \$1.16 from \$1.10 per thousand cubic feet in February.²⁹

Because of the low first quarter prices and unusually high storage levels, the wellhead gas price for 1992 is expected to decline by about 9 cents per thousand cubic feet (Table 4). However, some recovery is expected in the winter. In 1993, wellhead prices are expected to increase by 16 cents per thousand cubic feet. The reasons for this increase are an assumption of normal winter weather (after 2 years of near record warm winters), rising world oil prices and a strengthening of the economy. Furthermore, the subsidies for coal bed methane will expire at the end of 1992 for new wells. Also, the low prices of 1991 and 1992 have led to declines in drilling activity which should start to restrict growth in available natural gas supplies by 1993. Finally, the major natural gas producing States have been, or are considering, taking regulatory action to limit production. If these actions hold up in court, there could be upward pressure on prices.

Electric utility natural gas prices are expected to follow a pattern similar to the wellhead price. Residential gas prices, however, are expected to continue rising through 1992 and 1993, as costs of distributing gas from the wellhead to the end-use customer are also expected to continue rising. These costs comprise the majority of the residential price, while wellhead prices are a small portion.

Coal

Coal production is expected to increase in 1992 (Table 11). Increased domestic consumption, export growth, and stock additions at utilities contribute to growth in production in 1992. Continued growth in all sectors induces nearly 2-percent growth in 1993.

Coal is expected to meet the majority of additional generation needs at electric utilities in 1992 and 1993 (Table 12). Coal-fired electric generating capacity is expected to increase slightly. Increased economic activity in 1992 is expected to boost the domestic production of steel and result in higher consumption of

coal by coke plants.³⁰ Continued growth in raw steel production will cause coal consumption at coke plants to increase in 1993. Consumption of coal in the retail and general industry sectors is expected to be flat in 1992 and to grow slightly in 1993.

Stocks held by consumers are expected to increase in the fourth quarter of 1992 as a precaution, due to the expiration and renegotiation of the contract next winter between the United Mine Workers of America (UMWA) and the Bituminous Coal Operators' Association (BCOA). While a strike is not assumed, there could be some changes in the normal production and stock withdrawal patterns next winter.

Coal prices to electric utilities are projected to remain relatively flat in nominal terms, the result of continuing increases in productivity and relatively small increases in mining and transportation costs (Table 4). The UMWA/BCOA contract expiration may affect coal prices. Heavy stock building in the fourth quarter of 1992, could cause some upward pressure on prices in the latter part of the year. Excess stocks, however, may cause some weakness in coal prices in the first half of 1993.

Electricity

Electricity sales are expected to continue increasing over the next 2 years, although growth should be lower in 1992 than in 1993 (Table 12). Mild temperatures during the first quarter of this year stifled growth in the residential and commercial sectors. An assumed return to normal weather patterns and economic growth should stimulate sales in all sectors over the forecast period (Figure 8).

Sales to the commercial sector are driven primarily by changes in employment, while sales to the industrial sector are driven by manufacturing production. Both of these macroeconomic variables are expected to grow at accelerating rates through mid-1993 and stimulate sales in these two sectors. The residential sector is affected by trends in electricity use per household and by trends in the number of new homes built with electricity as the primary fuel, as well as the weather. Moderate growth in these underlying trends is expected over the next 2 years.

Utility purchases from nonutilities and imports from Canada and Mexico are expected to continue increasing, though these sources will remain small. Increases in nonutility purchases are caused by new nonutility capacity coming into service. The forecast for imports

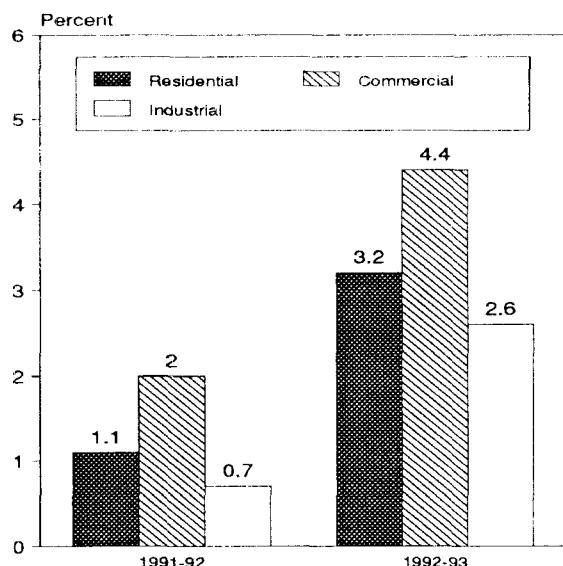


Figure 8. Annual Change in U.S. Electricity Sales by Sector

Sources: Table 12.

in 1992 is based on Quebec's recovery from the continuing effects of below normal water conditions and the commencement of power contracts between Northern States Power and Manitoba Hydroelectric. The forecast for 1993 is based on existing and planned contracts between U.S. electric utilities and Canadian and Mexican utilities.

Increases in electricity generation are expected to come primarily from coal and hydroelectric power in 1992 (Table 12). Coal generation increases because of minimal increases in nuclear and higher coal capacity. Growth in hydroelectric generation is based on assumed normal water conditions in 1992. Generation from oil is expected to decline slightly, while natural gas generation should rise due to the low price of gas and the high degree of availability of gas during peak electricity demand periods.

Generation sources are expected to follow a similar pattern in 1993. Coal and hydroelectric generation are expected again to contribute the largest increases in total generation. Nuclear generation is expected to increase significantly as a result of units coming back on line after being down for maintenance and refueling (a capacity factor of 71 percent in 1993) and the commencement of Texas Utilities Generating Company's Comanche Peak 2 nuclear unit. Oil and gas generation should both increase, with gas contributing the most as the gap between oil and gas prices at utilities widens. The 1993 level for hydroelectric generation represents normal. This level is lower than in the previous *Outlook*, however, because of new environmental flow restrictions on the Columbia River in order to protect the endangered species of salmon.

Residential electricity prices are expected to remain nearly flat in 1992 compared to 1991, increasing by about 1 percent (Table 4). This growth is about one-third the rate of inflation. Interest rates are expected to remain moderate and labor and fuel costs are expected to remain low. In 1993, rising fuel costs coupled with higher interest rates and labor costs are expected to result in an increase of about 2 percent in residential electricity prices, which is still only about two-thirds the rate of inflation.

Appendix

Computation of Petroleum Product Supplied Sensitivities

Table 8 summarizes how forecasts of United States total petroleum product supplied change in response to changes in the projections of economic activity, world crude oil price, and weather. The values shown in Table 8 are the aggregate results of computations involving all of the equations in the Short-Term Integrated Forecasting System (STIFS) model. The main text discusses these results in the section "Petroleum Product Supplied and Production Sensitivities". This appendix gives a more detailed explanation of the computation of these sensitivity numbers.

The STIFS model is described fully in the EIA publication *Short-Term Integrated Forecasting System: 1990 Model Documentation Report* (DOE/EIA-M009, June 1990). The key concepts of the STIFS model may be summarized as follows. The purpose of the model is to generate forecasts of U.S. energy supply, demand, and prices. Key inputs to the model include projections of the imported price of crude oil, the rate of U.S. economic growth, and weather (i.e. cooling and heating degree-days). Forecasts are generated for production, imports, exports, product supplied (or consumption or sales), and prices, for refined petroleum products, natural gas, coal, and electricity. Balances of supply and disposition are computed for each fuel.

The first sensitivity examined is the relationship between petroleum product supplied and economic activity. Table 8 shows low and high values of projected gross domestic product (GDP) for each of the 2 projection years, and the difference in petroleum product supplied between the low and high levels of GDP. For this report, in 1992 only the last three quarters are used because the first quarter is considered to be history. (For other details on specific periods used for some of the calculations, see footnotes to Table 8). For each of the 2 years, the percentage difference in GDP is computed as the difference between the low and high levels, divided by the mid-point of the range between low and high. Thus, the percentage difference in GDP for 1992 is as follows: $(4991 - 4874) / ((4991 + 4874) / 2)$, or 2.4 percent. For each year, we divide the petroleum product supplied difference (in million barrels per day) by the percentage difference in GDP. For 1992, the petroleum product supplied difference is

280,000 barrels per day; thus, a 1-percent change in GDP corresponds to a change in product supplied of $(280,000 / 2.37)$, or 118,000 barrels per day. For 1993, a 4.2-percent change in GDP corresponds to a change in product supplied of 540,000 barrels per day; thus, a 1-percent change in GDP corresponds to a product supplied change of 129,000 barrels per day. These results for 1992 and 1993 are averaged to calculate the average product supplied change corresponding to a 1-percent change in GDP.

Table 8 also shows the differences in petroleum product supplied due to changes in energy prices due to the change in the world crude oil price, as computed by running the STIFS model. In this case, there are two values for the change in petroleum product supplied in each year, one value for the case in which coal and natural gas prices are allowed to change in response to the change in petroleum prices, and a second value for the case in which coal and natural gas prices are held constant. The industrial and electric utilities sectors have some freedom to switch between use of petroleum, coal, and natural gas. If the price of petroleum decreases while the price of coal and gas remain constant, some industrial and utility users will switch from coal or gas to petroleum, and petroleum product supplied will increase. If coal and gas prices are reduced to meet the competition from petroleum, then there will be a smaller increase in petroleum product supplied. In either case, the change in petroleum product supplied (in million barrels per day) is divided by the change in the crude oil price (in dollars per barrel), and the result is averaged over the 2 projection years, to get an estimate of the change in petroleum product supplied per dollar of change in the crude oil price.

Finally, consider the change in petroleum product supplied due to changes in weather. Table 8 shows differences in petroleum product supplied due to changes in heating and cooling degree days (using the mid-case values for economic activity and imported crude oil prices). The percentage changes in heating or cooling degree days are computed and divided into the per-barrel changes in petroleum product supplied, and the result is averaged over the 2 projection years, to get

an estimate of the change in petroleum product supplied per 1-percent change in heating/cooling degree days. The changes in product supplied due to changes in heating degree days apply only to the heating season, roughly the first and fourth quarters of the year, while the changes in product supplied due to

changes in cooling degree days apply only to the cooling season, roughly the second and third quarters of the year. If changes on an annual basis are calculated, rather than just for the heating or cooling quarters, then the magnitude of the changes will be only half as big.

References and Notes

1. For a detailed definition of product supplied, see the glossary to the *Petroleum Supply Monthly*, DOE/EIA-0108.
2. It is estimated that domestic petroleum product supplied would have been approximately 400,000 barrels per day higher than the estimated actual value indicated on Tables 5, 6, and 7. This calculation is based on internal calculations from the Short-Term Integrated Forecasting System model.
3. This calculation is based on 15 years of heating degree-day data (first-quarter months) using the assumption that the data are normally distributed.
4. Based on the estimated relationship between weather and petroleum product supplied: a 1-percent difference in heating degree-days translates into a difference of about 30,000 barrels per day in petroleum product supplied. A 15-percent warmer-than-normal first quarter (that is, 15 percent fewer heating degree days) implies approximately 450,000 barrels per day less petroleum demand.
5. Based on internal calculations from the Short-Term Integrated Forecasting System model. The 270,000 barrels per day figure corresponds to one-half the product supplied range for 1993 shown in Table 8 under "Economic Activity." The high growth case would result in a similar difference from the base case in 1993 in the upward direction. The 540,000 barrels per day in Table 8 for 1993 Economic Activity sensitivity is the sum of the differences from the mid price case for the low and high economic growth cases. Detailed results for these high and low growth cases are not published in this report but are kept in computer files of the Energy Markets and Contingency Information Division.
6. Based on internal calculations from the Short-Term Integrated Forecasting System model.
7. Energy Information Administration. *Monthly Energy Review*. DEO/EIA-0035(92/04). (Washington, DC, April 1992). Table 5.1.
8. Based on assumptions and internal calculations of the Energy Markets and Contingency Information Division.
9. Based on assumptions and internal calculations of the Energy Markets and Contingency Information Division.
10. Based on internal calculations from the Short-Term Integrated Forecasting System model.
11. Based on internal calculations from the Short-Term Integrated Forecasting System database.
12. Based on internal calculations from the Short-Term Integrated Forecasting System model.
13. See *Petroleum Supply Monthly*, DOE/EIA-0109(92/04).
14. 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.
15. Of this total, the lower 48 States had 340,000 barrels of oil per day. The uncertainty portion for the lower 48 States contains 87,000 barrels of oil per day that resulted from varying the low and high price case estimates by an amount equal to 1 percent of the 1991 third quarter oil rate and reducing that amount starting with the fourth quarter of 1991 through the end of 1993. The remaining 30,000 barrels per day is additional oil production expected from the Point Arguello field in the Pacific Federal Outer Continental Shelf. The larger portion of the difference is attributable to the price impact where more drilling is expected at the higher prices, as well as more frequent well maintenance and reduction of well abandonments.

16. CO nonattainment areas refer to areas with carbon monoxide design values of 9.5 parts per million or more, generally based on data for 1988 and 1989. The control area is the larger of the Consolidated Metropolitan Statistical Area or the Metropolitan Statistical Area in which the nonattainment area is located. Those control areas are primarily located on the East and West coasts.
17. Control periods for Las Vegas, NV and Phoenix, AZ last 5 months; Los Angeles, CA and Spokane, WA have 6-month CO seasons; the New York metropolitan area will have a year-round program.
18. Jones, Russell O. and Thomas J. Lareau. "Meeting the Oxygenate Requirements of the 1990 Clean Air Act Amendments." American Petroleum Institute Research Study No. 058. (June 1991). The use of MTBE and fuel ethanol has grown in the last decade in response to octane demand resulting initially from the phaseout of lead from gasoline and later from rising demand for premium gasoline. Nameplate production capacity of MTBE has grown from about 50,000 barrels per day in 1986 to over 135,000 barrels today. The ethanol industry added about 13,000 barrels per day of capacity annually between 1982 and 1986, with a current capacity of about 94,000 barrels per day.
19. The projected demand for oxygenates is derived by multiplying total motor gasoline supply from the middle oil price case by the proportion of the population residing in nonattainment areas and adjusting by an assumed factor for spillover and continued attainment area demand. A range of uncertainty encompasses the range of gasoline supply in the high and low oil price cases plus an internal calculation of uncertainties associated with the spillover demand for oxygenates in attainment areas.
20. Calculations for the summer driving season, which covers portions of the second and third quarters, are based on internal monthly calculations from the Short-Term Integrated Forecasting System model.
21. Based on internal monthly calculations from the Short-Term Integrated Forecasting System model.
22. Based on internal calculations from the Short-Term Integrated Forecasting System model.
23. Based on internal calculations from the Short-Term Integrated Forecasting System model.
24. The refinery utilization rate in the middle oil price case is projected to increase from a 1991 average of 86 percent to 87 percent in 1992 and to almost 90 percent in 1993. This increase reflects both higher total demand for products and a decline in refining capacity of 150,000 barrels per day from the 1991 average.
25. Regional electricity generation details derived from internal calculations from the Electricity Model of the Short-Term Integrated Forecasting System.
26. See also Natural Gas Monthly, DOE/EIA-0130(92/04) for historical data prior to 1991.
27. Energy Information Administration. *Monthly Energy Review*. DOE/EIA-0035(92/04). (Washington, DC, April 1992.)
28. *Natural Gas Week*. (Washington, DC, April 6, 1992).
29. *Natural Gas Week*. (Washington, DC, April 6, 1992).
30. Steel production forecasts are produced by a sub-model in the Coking Coal Demand Model of the Short-Term Integrated Forecasting System.

Table 8. U.S. Petroleum Product Supplied Sensitivities

Determinant	1992	1993
	Three Quarters ^a	Four Quarters ^a
Economic Activity		
Gross Domestic Product (billion 1987 dollars)	4,874 - 4,991	4,989 - 5,203
Resulting Change in Petroleum Product Supplied (million barrels per day) ^b28	.54
Energy Prices		
Imported Crude Oil (nominal dollars per barrel) ^c	\$16.04 - \$19.02	\$17 - \$21
Resulting Change in Petroleum Product Supplied (million barrels per day) ^b		
Due to Changes in All Energy Prices16	.18
Due to Changes in Petroleum Prices Only18	.26
Weather		
Heating Degree Days ^d	1,539 - 1,875	3,758 - 4,450
Resulting Change in Petroleum Product Supplied (million barrels per day)	0.47	0.58
Cooling Degree Days ^d	991 - 1,184	991 - 1,184
Resulting Change in Petroleum Product Supplied (million barrels per day) ^b09	.20

^aIn the case of weather, calculations apply to certain quarters only, as follows: for heating degree days, in 1992 the fourth quarter only is used, while the first and fourth quarter results only are used for the 1993 calculation; for cooling degree days, the average of second and third quarters only are used.

^bRanges of petroleum product supplied associated with varying each determinant (or determinants), holding other things equal.

^cCost of imported crude oil to U.S. refiners.

^dHeating and cooling degree days are U.S. 1980 population-weighted.

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

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

	High Price Case	Low Price Case	Difference		
			Total	Uncertainty	Price Impact
United States	7.06	6.55	.51	.20	.31
Lower 48 States	5.39	5.05	.34	.12	.22
Alaska	1.67	1.50	.17	.09	.09

Note: Components provided are for the fourth quarter 1993 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.

**Table 10. Supply and Disposition of Natural Gas: Mid World Oil Price Case
(Trillion Cubic Feet)**

Supply and Disposition	1991				1992				1993				Year		
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1991	1992	1993
Supply															
Total Dry Gas Production ^a	4.55	4.35	4.32	4.64	4.57	4.32	4.37	4.65	4.76	4.39	4.42	4.71	17.87	17.91	18.28
Net Imports	0.41	0.39	0.36	0.42	0.42	0.39	0.37	0.41	0.51	0.46	0.43	0.47	1.57	1.58	1.88
Supplemental Gaseous Fuels	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.11	0.10	0.10
Total New Supply	4.99	4.77	4.71	5.09	5.01	4.73	4.76	5.09	5.30	4.87	4.88	5.21	19.55	19.59	20.26
Underground Working Gas Storage															
Opening	3.07	1.92	2.55	3.19	2.82	1.80	2.39	3.22	2.83	1.73	2.32	3.16	3.07	2.82	2.83
Closing	1.92	2.55	3.19	2.82	1.80	2.39	3.22	2.83	1.73	2.32	3.16	2.76	2.82	2.83	2.76
Net Withdrawals ^b	1.05	-0.70	-0.65	0.39	1.09	-0.59	-0.83	0.40	1.10	-0.59	-0.83	0.40	0.08	0.06	0.07
Total Supply ^a	6.04	4.07	4.05	5.47	6.10	4.14	3.92	5.48	6.40	4.28	4.04	5.61	19.63	19.65	20.33
Balancing Item ^c	0.13	0.10	-0.18	-0.25	-0.08	0.25	0.02	-0.22	0.21	0.30	0.03	-0.20	-0.20	-0.20	0.34
Total Primary Supply ^a	6.16	4.18	3.87	5.22	6.01	4.40	3.94	5.26	6.61	4.58	4.08	5.40	19.43	19.62	20.67
Consumption															
Lease and Plant Fuel	0.32	0.30	0.30	0.32	0.29	0.30	0.30	0.33	0.34	0.32	0.32	0.34	1.25	1.22	1.31
Pipeline Use	0.22	0.15	0.14	0.18	0.17	0.14	0.14	0.16	0.16	0.15	0.15	0.16	0.68	0.61	0.62
Residential	2.09	0.75	0.38	1.35	2.05	0.87	0.38	1.38	2.33	0.89	0.39	1.41	4.58	4.69	5.01
Commercial	1.13	0.51	0.36	0.78	1.10	0.57	0.37	0.80	1.23	0.58	0.38	0.82	2.79	2.85	3.01
Industrial	1.90	1.74	1.77	1.95	1.87	1.79	1.81	1.98	2.01	1.90	1.90	2.04	7.36	7.44	7.84
Electric Utilities	0.51	0.72	0.92	0.63	0.53	0.73	0.93	0.61	0.54	0.74	0.95	0.64	2.78	2.80	2.87
Total Consumption	6.16	4.18	3.87	5.22	6.01	4.40	3.94	5.26	6.61	4.58	4.08	5.40	19.43	19.62	20.67

^aExcludes nonhydrocarbon gases removed.

^bNet withdrawals may vary from the difference between opening and closing stocks of gas in working gas storage due to book transfers between base and working gas categories, and other storage operator revisions of working gas inventories.

^cThe balancing item represents the difference between the sum of the components of natural gas supply and the sum of components of natural gas disposition.

Notes: Minor discrepancies with other EIA published historical data are due to rounding. Historical data are printed in bold, forecasts are in italic. The forecasts were generated by the following simulations of the demand and supply subsystems of the Short-Term Integrated Forecasting System: D040892BBBB12:09 and S042792BBBB18:56 for the middle oil price case.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(92/04); *Natural Gas Monthly*, DOE/EIA-0130(92/04); and *Electric Power Monthly*, DOE/EIA-0226(92/04).

Table 11. Supply and Disposition of Coal: Mid World Oil Price Case
 (Million Short Tons)

Supply and Disposition	1991				1992				1993				Year		
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1991	1992	1993
Supply															
Production	254	237	251	252	254	243	255	261	259	251	258	264	994	1012	1032
Primary Stock Levels ^d															
Opening	33	42	41	34	33	39	36	33	30	35	36	33	33	33	30
Closing	42	41	34	33	39	36	33	30	35	36	33	30	33	30	30
Net Withdrawals	-9	1	7	1	-6	3	3	3	-5	-1	3	3	0	3	0
Imports	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3
Exports	22	26	31	29	24	29	31	27	24	30	29	29	109	112	113
Total Net Domestic Supply	224	213	228	225	224	217	227	239	229	221	232	240	889	907	923
Secondary Stock Levels*															
Opening	168	167	172	164	169	170	178	168	178	175	180	169	168	169	178
Closing	167	172	164	169	170	178	168	178	175	180	169	173	169	178	173
Net Withdrawals	1	-4	8	-5	-1	-8	10	-10	3	-5	11	-4	-1	-8	5
Total Supply	225	208	236	219	223	209	237	229	232	216	244	235	888	899	928
Consumption															
Coke Plants	9	8	9	8	9	9	9	9	9	9	9	10	34	35	38
Electric Utilities	189	183	208	192	193	181	209	199	201	187	215	204	772	782	807
Retail and General Industry ^f	22	19	19	22	21	19	19	22	22	19	19	22	82	82	83
Total Consumption	219	209	236	223	223	209	237	229	232	216	244	235	888	899	928
Discrepancy ^g	5	-1	-1	-4	0	0	0	0	0	0	0	0	0	0	0

*Primary stocks are held at the mines, preparation plants, and distribution points.

*Secondary stocks are held by users. Most of the secondary stocks are held by electric utilities.

^fSynfuels plant consumption in 1990 was 1.7 million tons per quarter, and is assumed to remain at that level in 1991 and 1992.

^gHistorical period discrepancy reflects an unaccounted-for shipper and receiver reporting difference.

Notes: Rows and columns may not add due to independent rounding. Zeros indicate amounts of less than 500,000 tons. Historical data are printed in bold, forecasts are in italic. The forecasts were generated by the following simulations of the demand and supply subsystems of the Short-Term Integrated Forecasting System: D040892BBB12:09 and S042792BBB18:56 for the middle oil price case.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(92/04); and *Quarterly Coal Report*, DOE/EIA-0221(91/4Q).

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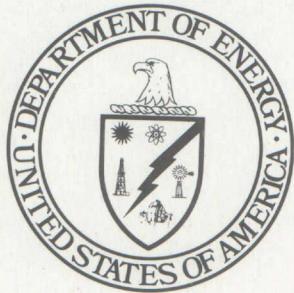


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