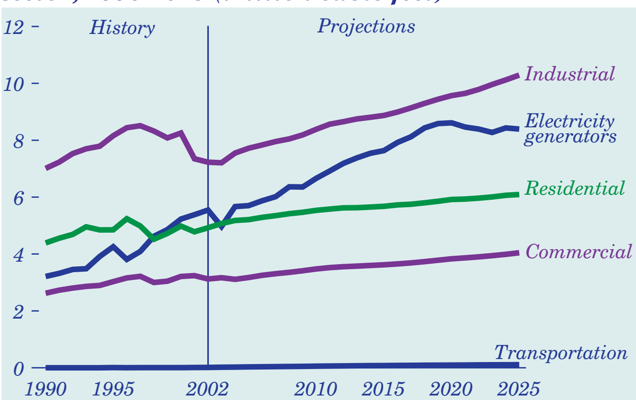
Projected Increases in Natural Gas Use Are Led by Electricity Generators

Figure 85. Natural gas consumption by end-use sector, 1990-2025 (trillion cubic feet)



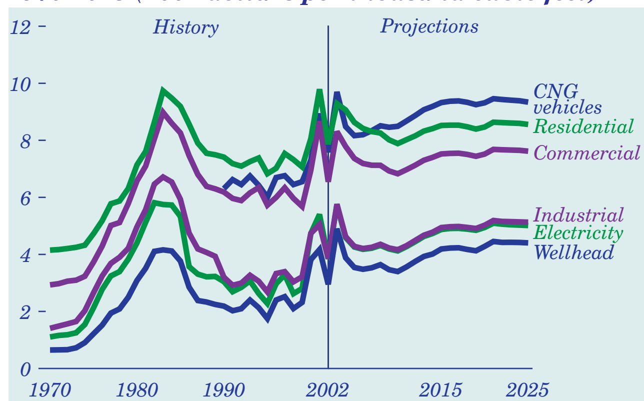
Total natural gas consumption is projected to increase from 2002 to 2025 in all the *AEO2004* cases. The projections for domestic natural gas consumption in 2025 range from 29.1 trillion cubic feet per year in the low economic growth case to 34.2 trillion cubic feet in the rapid technology case, as compared with 22.6 trillion cubic feet in 2002. In the reference case, natural gas consumption in the electric power sector is projected to increase from 5.6 trillion cubic feet in 2002 to 6.7 trillion cubic feet in 2010 and 8.4 trillion cubic feet in 2025 (Figure 85). Demand by electricity generators is expected to account for 29 percent of total end-use natural gas consumption in 2025, as compared with 27 percent in 2002.

Most new electricity generation capacity is expected to be fueled by natural gas, because natural-gas-fired generators are projected to have advantages over coal-fired generators that include lower capital costs, higher fuel efficiency, shorter construction lead times, and lower emissions. Toward the end of the forecast, however, when natural gas prices rise substantially, coal-fired power plants are expected to be competitive for new capacity additions.

Demand growth is also expected in the residential, commercial, industrial, and transportation sectors. In the reference case, industrial consumption is projected to increase from 7.3 trillion cubic feet in 2002 to 8.4 trillion cubic feet in 2010 and 10.3 trillion cubic feet in 2025. In the residential and commercial sectors, natural gas consumption is projected to increase by 0.9 percent and 1.1 percent per year, respectively, from 2002 to 2025.

Delivered Prices Increase More Slowly Than Wellhead Prices

Figure 86. Natural gas prices by end-use sector, 1970-2025 (2002 dollars per thousand cubic feet)



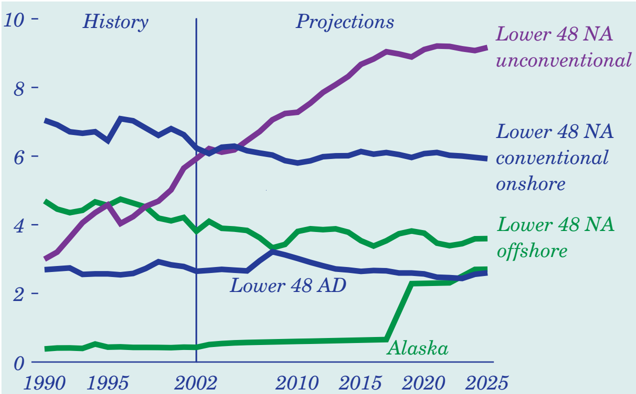
Prices for natural gas delivered to the end-use sectors are expected to fall in the early years of the forecast as wellhead prices decline (Figure 86). After 2006 wellhead prices are projected to start increasing, and delivered natural gas prices begin to increase in 2012. The increase in wellhead gas prices is expected to be offset in part by a projected decline in average transmission and distribution margins.

The average end-use price is projected to increase by 54 cents per thousand cubic feet from 2006 to 2025 (in constant 2002 dollars), compared with a projected increase of 97 cents per thousand cubic feet in the average price of domestic and imported natural gas supplies. The slower increase in delivered prices reflects continued depreciation of existing infrastructure, increased pipeline utilization, and more imports of LNG directly into end-use markets.

The natural gas transmission and distribution margin reflects both the volume of gas delivered and the infrastructure arrangements of the sector. The industrial and electricity generation sectors have the lowest end-use prices, because they receive most of their natural gas directly from interstate pipelines, avoiding local distribution charges. Summer-peaking electric generators reduce transmission costs by using interruptible transportation rates during the summer, when there is spare pipeline capacity. As power generators take a larger share of the natural gas market, however, they are expected to rely more on higher cost firm transportation service. The compressed natural gas vehicle margin is expected to increase, because the cost of the refueling infrastructure must be added to serve non-fleet vehicles.

Unconventional Production Becomes the Largest Source of U.S. Supply

Figure 87. Natural gas production by source, 1990-2025 (trillion cubic feet)



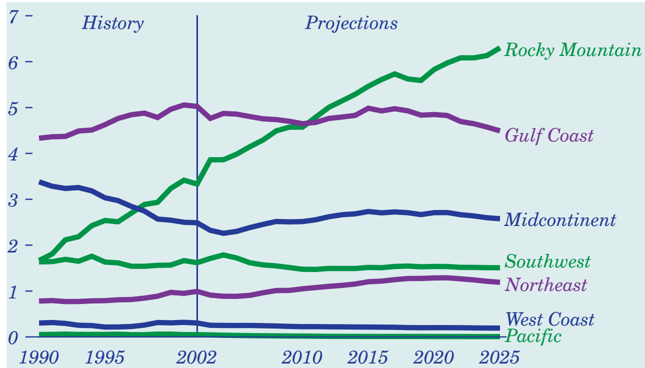
As a result of technological improvements and rising natural gas prices, natural gas production from unconventional sources (tight sands, shale, and coalbed methane) is projected to increase more rapidly than conventional production. In the reference case, lower 48 unconventional gas production is projected to grow from 5.9 trillion cubic feet in 2002 to 9.2 trillion cubic feet in 2025 (Figure 87), increasing from 32 percent of total lower 48 production in 2002 to 43 percent in 2025. Production of lower 48 nonassociated (NA) conventional natural gas is projected to decline from 10.0 trillion cubic feet in 2002 to 9.5 trillion cubic feet in 2025, as resource depletion causes exploration and production costs to increase. Offshore NA natural gas production is projected to fluctuate around 3.7 trillion cubic feet throughout the forecast, because sufficient reserves of natural gas must be discovered in an offshore region to justify investment in the necessary production and transportation infrastructure.

Production of associated-dissolved (AD) natural gas from lower 48 crude oil reserves is projected to increase from 2.7 trillion cubic feet in 2002 to 3.2 trillion cubic feet in 2008 [*115*]. After 2008, both onshore and offshore AD gas production are projected to decline, and total lower 48 AD gas production falls to 2.6 trillion cubic feet in 2025.

The North Slope Alaska natural gas pipeline is expected to begin transporting Alaskan gas to the lower 48 States in 2018. In 2025, total Alaskan gas production is projected to be 2.7 trillion cubic feet in the reference case.

Growing Production Is Expected from the Rocky Mountain Region

Figure 88. Lower 48 onshore natural gas production by supply region, 1990-2025 (trillion cubic feet)



In the reference case, total foreign and domestic natural gas supplies are projected to grow by 3.5 trillion cubic feet from 2002 to 2010 and by 8.7 trillion cubic feet from 2002 to 2025. Domestic natural gas production is expected account for 57 percent of the total growth in supply, and net imports are projected to account for the remaining 43 percent.

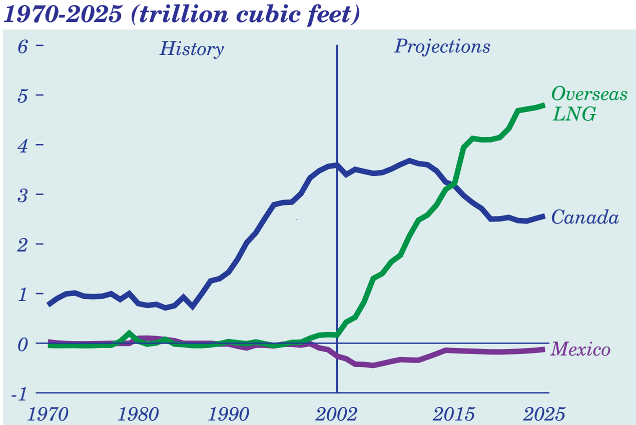
Over the forecast period, the largest increase in lower 48 onshore natural gas production is projected to come from the Rocky Mountain region, predominantly from the large volume of unconventional resources located in the region [*116*]. Rocky Mountain natural gas production is projected to increase from 3.3 trillion cubic feet in 2002 to 4.6 trillion cubic feet in 2010 and 6.3 trillion cubic feet in 2025 (Figure 88).

The other lower 48 onshore production regions are projected either to show moderate increases in production, followed by declines after 2020, or to remain relatively constant through 2020 and decline thereafter. The regional declines after 2020 largely reflect the depletion of the conventional natural gas resource base.

Because production from the Rocky Mountain region is projected to increase throughout the forecast while the other lower 48 onshore regions do not, Rocky Mountain production makes up an increasing share of total lower 48 onshore natural gas production. In 2002, Rocky Mountain production was 24 percent of total lower 48 onshore production. Its share is projected to increase to 32 percent in 2010 and 39 percent in 2025.

Net Imports of Natural Gas Grow in the Projections

Figure 89. Net U.S. imports of natural gas, 1970-2025 (trillion cubic feet)



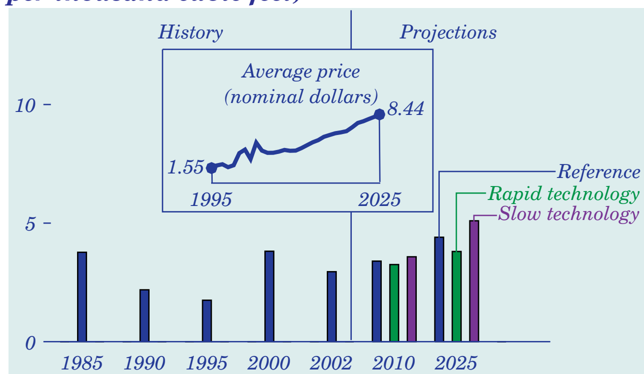
Net imports of natural gas make up the difference between U.S. production and consumption. Imports are expected to be priced competitively with domestic sources. Supplies of natural gas from overseas sources, imported through U.S. LNG terminals, account for most of the projected increase in net imports in the reference case (Figure 89). When planned expansions at the four existing terminals are completed, new LNG terminals are projected to start coming into operation in 2007, and net LNG imports increase from 0.2 trillion cubic feet in 2002 to 2.2 and 4.8 trillion cubic feet in 2010 and 2025, respectively.

Net imports of natural gas from Canada are projected to peak at 3.7 trillion cubic feet in 2010, then decline gradually to 2.6 trillion cubic feet in 2025. The depletion of conventional resources in the Western Sedimentary Basin is expected to reduce Canada's future production and export potential, and prospects for significant production increases in eastern offshore Canada have diminished over the past few years. There is also considerable uncertainty about the economic viability and timing of coalbed methane production in western Canada. The reference case does project that a MacKenzie Delta natural gas pipeline will begin moving supplies to U.S. buyers in 2009.

Historically, although Mexico has considerable natural gas resources, the United States has been a net exporter of gas to Mexico. In the reference case, net exports of U.S. natural gas to Mexico are projected to grow until 2006, when imports of natural gas from western Mexico are projected to begin entering the United States from an LNG import terminal in Baja California, Mexico [*117*].

Technology Advances Could Moderate Future Natural Gas Prices

Figure 90. Lower 48 natural gas wellhead prices in three cases, 1985-2025 (2002 dollars per thousand cubic feet)



In the reference case, average lower 48 wellhead natural gas prices are projected to decline from 2003 levels to $3.40 per thousand cubic feet (2002 dollars) in 2010 and then increase to $4.40 per thousand cubic feet in 2025 (Figure 90). Technically recoverable natural gas resources (Table 22) are expected to be adequate to support projected production increases. As lower 48 natural gas resources are depleted, wellhead prices increase, causing an increasing proportion of U.S. natural gas supply to come from Alaska, as well as imports from Canada and other countries.

In the slow oil and gas technology case, advances in exploration and production technologies are assumed to be 50 percent slower than in the reference case. As a result, natural gas development costs are higher, wellhead prices are higher ($3.58 and $5.10 per thousand cubic feet in 2010 and 2025), natural gas consumption is reduced, and construction of liquefied natural gas (LNG) import terminals is advanced relative to the reference case projections.

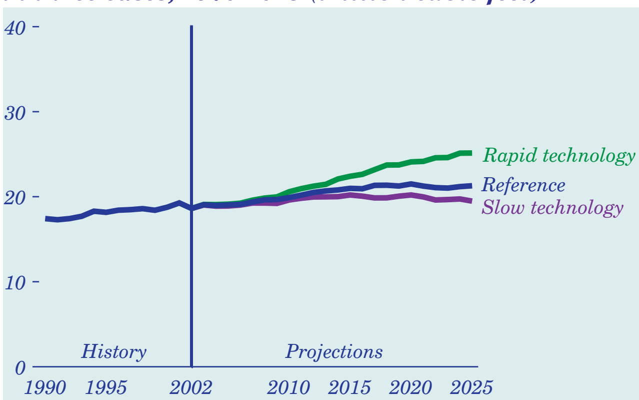
The rapid technology case assumes 50 percent faster technology progress than in the reference case, resulting in lower development costs, lower wellhead prices ($3.25 and $3.80 per thousand cubic feet in 2010 and 2025), and increased consumption of natural gas. LNG imports are reduced in the rapid technology case, and construction of LNG terminals is slowed relative to the reference case projections.

Table 22. Technically recoverable U.S. natural gas resources as of January 1, 2002 (trillion cubic feet)

Proved	Unproved	Total
183.5	1,096.0	1,279.5

Natural Gas Supply Projections Reflect Technological Progress

Figure 91. Lower 48 natural gas production in three cases, 1970-2025 (trillion cubic feet)



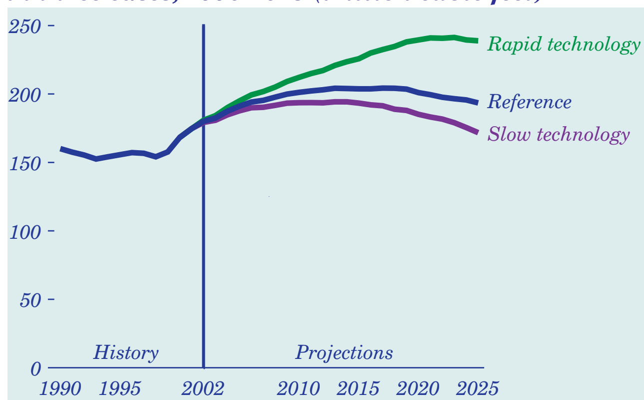
Because the impacts of technological progress are cumulative, the rapid and slow technology cases diverge increasingly from the reference case path in the later years of the forecast (Figure 91). In the reference case, lower 48 natural gas production is projected to total 21.3 trillion cubic feet in 2025. The corresponding projections are 25.1 trillion cubic feet in the rapid technology case and 19.5 trillion cubic feet in the slow technology case.

The cost-reducing effects of rapid technological progress primarily affect the economic recoverability of the large resource base of unconventional natural gas, because the conventional gas resource base is farther along the depletion curve than the unconventional resource base, especially in the later years of the forecast. In 2025, the rapid and slow technology cases project 12.9 and 8.4 trillion cubic feet of unconventional natural gas production, respectively.

The rate of technological progress also affects the contributions of other natural gas supply sources. Because rapid progress is projected to increase the rate of production of lower 48 natural gas resources, both an Alaska gas pipeline and new LNG terminals are less viable economically in the rapid technology case than in the reference case, and their construction is delayed. In the slow technology case, with lower 48 wellhead prices projected to increase more rapidly, earlier completion is expected for the Alaska pipeline and for new LNG terminals, and more LNG facilities are built. Projected LNG imports in 2025 total 3.8 trillion cubic feet in the rapid technology case and 5.5 trillion cubic feet in the slow technology case.

Rapid Technology Assumptions Raise Natural Gas Reserve Projections

Figure 92. Lower 48 natural gas reserves in three cases, 1990-2025 (trillion cubic feet)



The *AEO2004* projections for lower 48 natural gas reserves reflect expected levels of natural gas well drilling resulting from projected cash flows and profitability. In the reference case, lower 48 reserves grow to 204 trillion cubic feet in 2013, remain relatively constant until 2018, and then decline slowly to 194 trillion cubic feet in 2025 (Figure 92).

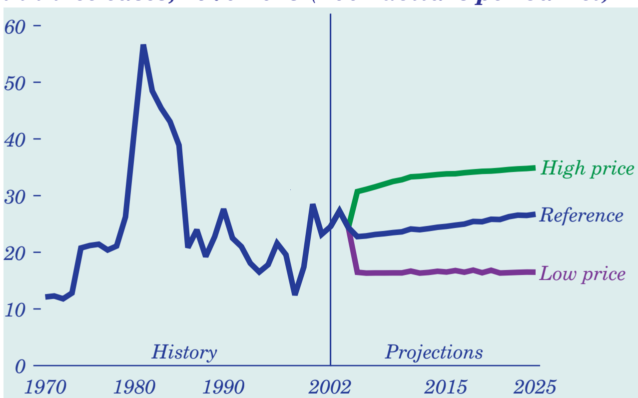
In the rapid technology case, the finding and success rates for gas well drilling are improved and exploration and production costs are reduced, resulting in more drilling activity and reserve additions. In this case, lower 48 reserves are projected to peak at 241 trillion cubic feet in 2023, then decline to 239 trillion cubic feet in 2025.

In the slow technology case, finding and success rates are lower, exploration and production costs are higher and drilling activity and reserve additions are lower than projected in the reference case. Lower 48 reserves are projected to peak at 194 trillion cubic feet in 2013, then decline to 172 trillion cubic feet in 2025.

In all three cases, the natural gas resource base is sufficient in the early years of the forecast to support the increases in drilling activity and reserve additions that are stimulated by higher projected prices, and additions generally exceed production. In later years, rising costs of gas well development reduce drilling activity, and resource depletion reduces reserve additions per well. As a result, total reserves are projected to decline.

Oil Prices Are Expected To Remain Near Recent Historical Levels

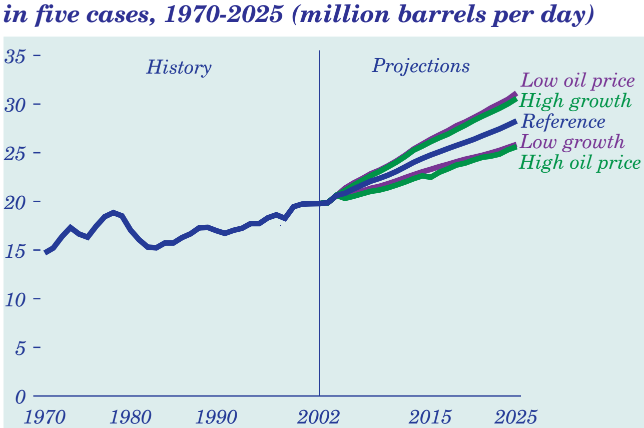
Figure 93. Lower 48 crude oil wellhead prices in three cases, 1970-2025 (2002 dollars per barrel)



Crude oil prices are determined largely in an international marketplace by the balance between production in OPEC and non-OPEC nations and demand. In the reference case, the average lower 48 crude oil price is projected to be $23.61 per barrel in 2010 and $26.72 per barrel in 2025 (Figure 93). In the high world oil price case, the lower 48 crude oil price increases to $32.80 per barrel in 2010 and $34.90 per barrel in 2025. In the low world oil price case, the lower 48 price generally declines to $16.36 per barrel in 2010, then rises to $16.49 per barrel in 2025.

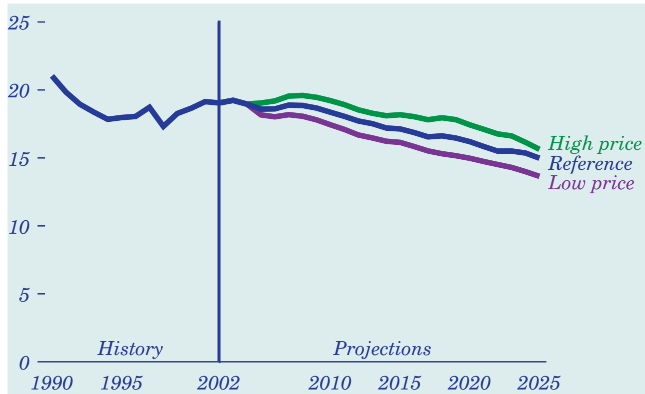
The projections for U.S. petroleum consumption vary with changes in assumptions about economic growth; however, larger variations result from changes in assumptions about world oil prices. Total petroleum consumption in 2025, projected at 28.3 million barrels per day in the reference case, ranges from 25.6 to 31.1 million barrels per day in the high and low world oil price cases (Figure 94).

Figure 94. U.S. petroleum consumption in five cases, 1970-2025 (million barrels per day)



Oil Reserve Projections Are Sensitive to Oil Price Assumptions

Figure 95. Lower 48 crude oil reserves in three cases, 1990-2025 (billion barrels)



Lower 48 crude oil reserves are sensitive to crude oil price projections (Figure 95). In the reference and high and low world oil price cases, lower 48 oil reserves decline as resources are depleted. In the low and high oil price cases, projected lower 48 reserves are 13.6 and 15.6 billion barrels in 2025, respectively, compared with 15.0 billion barrels in the reference case.

The variation in crude oil prices in the world oil price cases primarily affects the development and production of offshore oil resources (Table 23), because smaller deepwater fields that are not profitable when price are low are expected to become profitable when oil prices rise.

Crude oil reserve additions reflect the number of oil wells completed during the forecast period, the size of the crude oil resource base (Table 24), and the pace of technological progress. In the reference case, technological progress is expected to continue at the historical rate.

Table 23. Onshore and offshore lower 48 crude oil production in three cases, 2025 (million barrels per day)

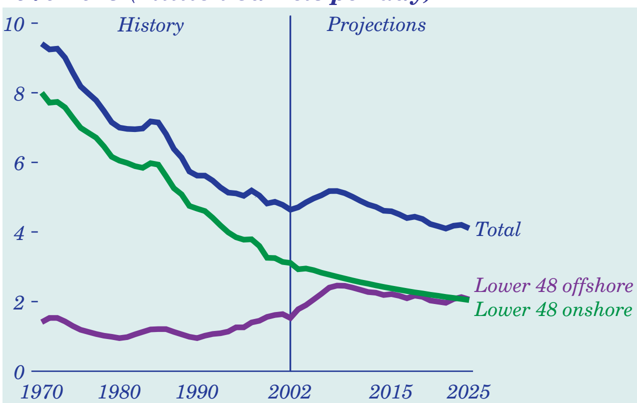
	Onshore	Offshore	Total
Low oil price	1.87	1.68	3.55
Reference	2.04	2.06	4.11
High oil price	2.13	2.17	4.31

Table 24. Technically recoverable U.S. oil resources as of January 1, 2002 (billion barrels)

Proved	Unproved	Total
24	130	154

Lower 48 Crude Oil Production Is Expected To Decline After 2008

Figure 96. Lower 48 crude oil production by source, 1970-2025 (million barrels per day)



In the reference case, total lower 48 crude oil production is projected to increase from 4.6 million barrels per day in 2002 to 5.2 million barrels per day in 2008, then decline to 4.1 million barrels per day in 2025 (Figure 96). In the low oil price case, lower 48 production is projected to peak in 2007 at 5.0 million barrels per day and decline to 3.6 million barrels per day in 2025. In the high oil price case, lower 48 oil production is projected to peak in 2008 at 5.3 million barrels per day and decline to 4.3 million barrels per day in 2025. The projected peaks in oil production are attributable to offshore production. In the reference case, total offshore oil production (including the Gulf of Mexico and offshore California) rises to 2.5 million barrels per day in 2008, then declines to 2.1 million barrels per day in 2025. Oil production in the Gulf of Mexico is projected to peak in 2009 at 2.4 million barrels per day and decline in the later years of the forecast (Table 25).

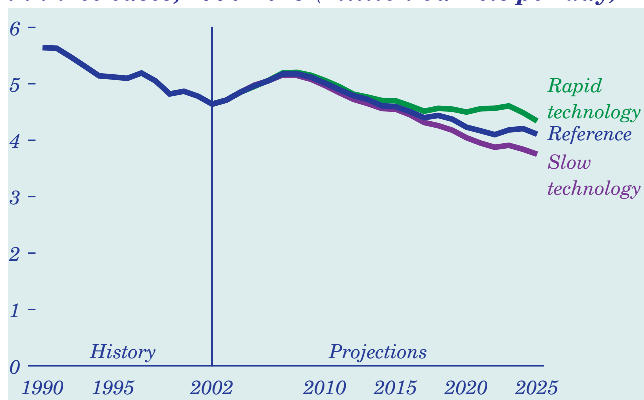
Offshore crude oil production is more sensitive than onshore production to oil prices. In the low and high oil price cases, lower 48 offshore production is projected to be 1.7 and 2.2 million barrels per day, respectively, in 2025. Onshore lower 48 oil production is projected to decline in all cases, with 2025 values ranging from 1.9 million barrels per day in the low oil price case to 2.1 million barrels per day in the high oil price case.

Table 25. Crude oil production from Gulf of Mexico offshore, 2002-2025 (million barrels per day)

	2002	2010	2015	2020	2025
Shallow	0.6	0.7	0.6	0.7	0.5
Deep	0.8	1.6	1.6	1.3	1.5
Total	**1.4**	**2.4**	**2.2**	**2.0**	**2.0**

More Rapid Technology Advances Could Raise Oil Production Slightly

Figure 97. Lower 48 crude oil production in three cases, 1990-2025 (million barrels per day)



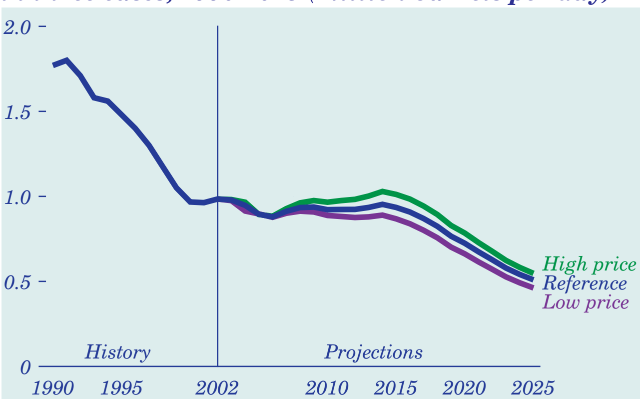
Lower 48 crude oil production is projected to reach 4.3 and 3.8 million barrels per day in 2025 in the rapid and slow technology cases, respectively, compared with 4.1 million barrels per day in the reference case (Figure 97). The technology cases assume the same world oil prices as in the reference case, but the rate of technological progress is assumed to be 50 percent higher (in the rapid technology case) or lower (in the slow technology case) than the historical rate. With domestic oil demand determined largely by oil prices and economic growth rates, consumption is not expected to change significantly in the technology cases. Thus, changes in production resulting from the different rates of technological progress result in different levels of petroleum imports. In 2025, net petroleum imports are projected to range from 19.0 million barrels per day in the rapid technology case to 20.4 million barrels per day in the slow technology case.

In the lower 48 States, offshore crude oil production is more sensitive than onshore production to changes in technology. Consequently, as technologies change, investments are shifted between onshore and offshore exploration and drilling, and production volumes reflect the reallocation of capital.

Cumulative offshore production from 2002 to 2025 is projected to be 1.17 billion barrels (6.3 percent) higher in the rapid technology case and 1.00 billion barrels (5.4 percent) lower in the slow technology case than in the reference case. Cumulative onshore production is about 0.3 percent lower in the rapid oil and gas technology case and 0.3 percent higher in the slow technology case than in the reference case.

Crude Oil Production in Alaska Depends on Oil Price Assumptions

Figure 98. Alaskan crude oil production in three cases, 1990-2025 (million barrels per day)



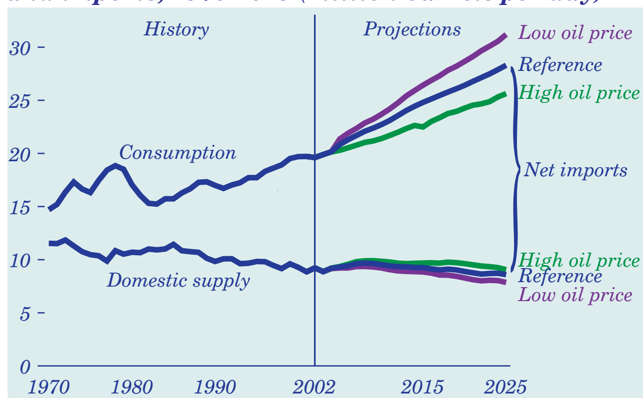
Alaskan crude oil production is expected mainly on the Alaskan North Slope, which includes the National Petroleum Reserve-Alaska (NPR-A) and the State lands surrounding Prudhoe Bay. NPR-A lease sales were held on May 5, 1999, and June 3, 2002. Because oil and gas producers are prohibited from building permanent roads in NPR-A, oil exploration and production is expected to be about 30 percent more expensive than is typical for the North Slope of Alaska. Because drilling is currently prohibited in the Arctic National Wildlife Refuge (ANWR), *AEO2004* does not project any production from ANWR.

In the reference case, crude oil production from Alaska is expected to continue at about 900 thousand barrels per day through 2016 (Figure 98), with a projected drop in North Slope oil production offset by new oil production from NPR-A. After 2016, total Alaskan crude oil production is projected to decline, to 510 thousand barrels per day in 2025. Declining production levels are projected for the North Slope, NPR-A, and southern Alaskan oil fields from 2016 to 2025.

As in the lower 48 States, oil production in Alaska is projected to be sensitive to changes in oil prices. Higher prices make more of the reservoir oil in-place profitable, particularly in the North Slope heavy oil fields. In the high oil price case, Alaska's oil production is above 1 million barrels per day from 2013 to 2015, then declines to 550 thousand barrels per day in 2025. In the low price case, with a lower expected reservoir recovery factor, Alaska's oil production is projected to fall below 900 thousand barrels per day after 2009, to 460 thousand barrels per day in 2025.

Imports Fill the Gap Between Domestic Supply and Demand

Figure 99. Petroleum supply, consumption, and imports, 1970-2025 (million barrels per day)



In 2002, net imports of petroleum accounted for 53 percent of domestic petroleum consumption. Increasing dependence on petroleum imports is projected, reaching 70 percent in 2025 in the reference case (Figure 99). The corresponding import shares of total consumption in 2025 are expected to be 65 percent in the high oil price case and 75 percent in the low oil price case.

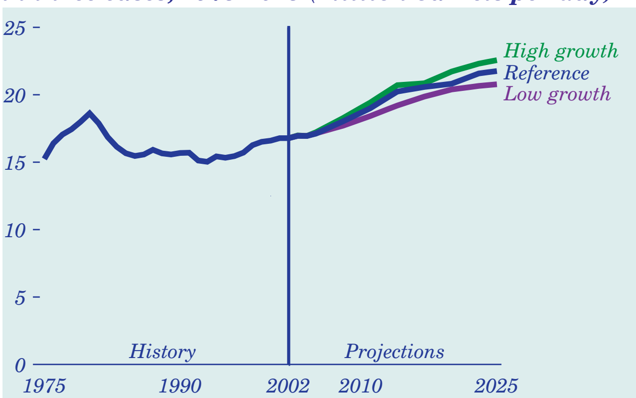
Although crude oil is expected to continue as the major component of petroleum imports, refined products are projected to represent a growing share. More imports would be needed as the projected growth in demand for refined products exceeds the expansion of domestic refining capacity. Refined products are projected to make up 13 percent of net petroleum imports in 2025 in the high oil price case and 25 percent in the high growth case, compared with 20 percent in the reference case, increasing from a 13-percent share in 2002 (Table 26).

Table 26. Petroleum consumption and net imports in five cases, 2002 and 2025 (million barrels per day)

Year and projection	Product supplied	Net imports	Net crude imports	Net product imports
2002	19.8	10.5	9.1	1.4
2025				
Reference	28.3	19.7	15.7	3.9
Low oil price	31.1	23.3	18.2	5.1
High oil price	25.6	16.6	14.3	2.2
Low growth	25.9	17.6	15.0	2.6
High growth	30.6	21.8	16.4	5.4

New U.S. Oil Refining Capacity Is Likely To Be at Existing Refineries

Figure 100. Domestic refining capacity in three cases, 1975-2025 (million barrels per day)



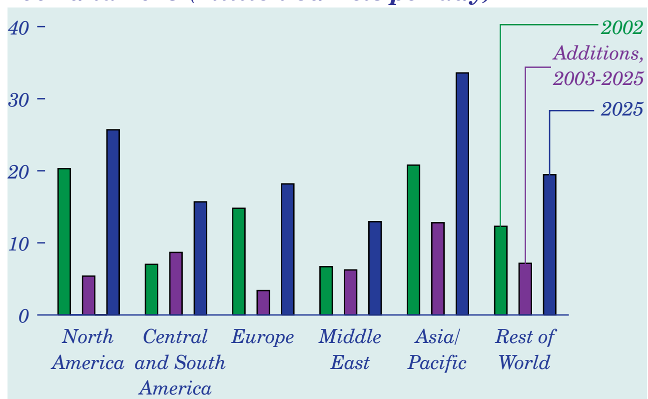
Falling demand for petroleum and deregulation of the domestic refining industry in the 1980s led to 13 years of decline in U.S. refinery capacity. That trend was reversed in 1996, and 1.4 million barrels per day of distillation capacity was added between 1996 and 2002. Financial and legal considerations make it unlikely that new refineries will be built in the United States, but additions at existing refineries are expected to increase total U.S. refining capacity in all the *AEO2004* cases (Figure 100).

Distillation capacity is projected to grow from the 2002 year-end level of 16.8 million barrels per day to 21.8 million barrels per day in 2025 in the reference case, 20.6 million barrels per day in the high oil price case, and 23.8 million barrels per day in the low oil price case, compared with the 1981 peak of 18.6 million barrels per day. Almost all the capacity additions are projected to occur on the Gulf Coast. Existing refineries are expected to continue to be utilized intensively (91 to 95 percent of operable capacity) throughout the forecast. The 2002 utilization rate was 91 percent, well above the lows of 69 percent during the 1980s and 88 percent during the early 1990s but consistent with capacity utilization rates since the mid-1990s.

Additional "downstream" processing units are expected to allow domestic refineries to produce less residual fuel, which has a shrinking market, and more of the higher value "light products," such as gasoline, distillate, jet fuel, and liquefied petroleum gas.

Asia/Pacific Region Is Expected To Surpass U.S. Refining Capacity

Figure 101. Worldwide refining capacity by region, 2002 and 2025 (million barrels per day)



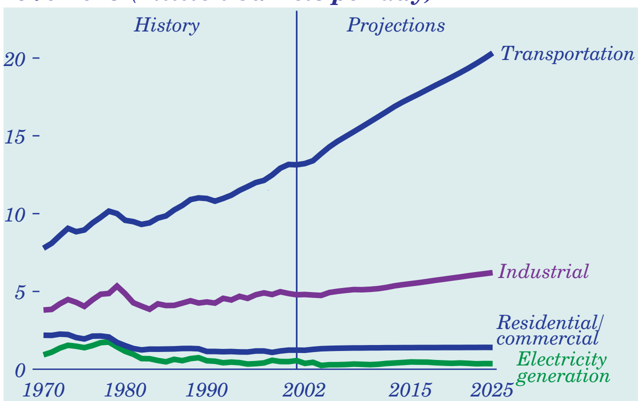
Worldwide crude oil distillation capacity was 81.9 million barrels per day at the end of 2002. To meet the growth in international oil demand in the reference case, worldwide refining capacity is expected to increase by about 53 percent—to more than 125 million barrels per day—by 2025. Substantial growth in distillation capacity is expected in the Middle East, Central and South America, and the Asia/Pacific region (Figure 101).

The Asia/Pacific region has been the fastest growing refining center over the past decade. In the mid-1990s, it surpassed Western Europe as the world's second largest refining center (after North America) in terms of distillation capacity; and in 2002, the Asia/Pacific region surpassed even North America. While not adding significantly to their distillation capacity, refiners in the United States and Europe have tended to improve product quality and enhance the usefulness of heavier oils through investment in downstream capacity.

Future investments in the refinery operations of developing countries must include configurations that are more advanced than those currently in operation. Their refineries will be called upon to meet increased worldwide demand for lighter products, to upgrade residual fuel, to supply transportation fuels with reduced lead, and to supply both distillate and residual fuels with lower sulfur levels. An additional burden on new refineries will be the need to supply lighter products from crude oils whose quality is expected to deteriorate over the forecast period.

Petroleum Use Increases Mainly in the Transportation Sector

Figure 102. Petroleum consumption by sector, 1970-2025 (million barrels per day)

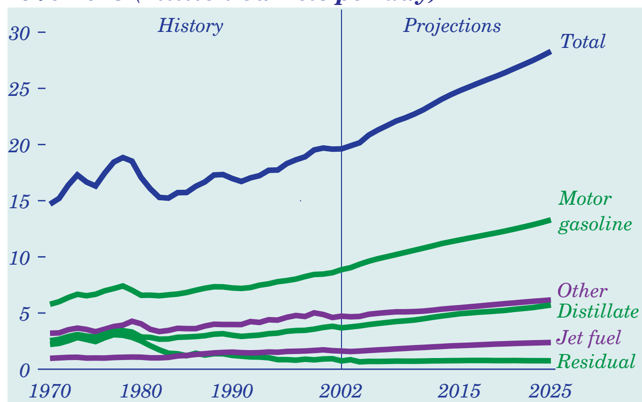


U.S. petroleum consumption is projected to increase by 8.7 million barrels per day from 2002 to 2025. Most of the increase is in the transportation sector, which accounted for two-thirds of U.S. petroleum use in 2002 (Figure 102). Petroleum use for transportation increases by 7.1 million barrels per day in the reference case, as the number and usage of vehicles grow. In the industrial sector, which currently accounts for 24 percent of U.S. petroleum use, consumption in 2025 is projected to be higher than in 2002 by 1.4 million barrels per day in the reference case.

In the reference case, distillate oil use for home heating is expected to decline as oil loses market share to liquefied petroleum gas (LPG), natural gas and electricity. Petroleum use for electricity generation peaks in 2015 and then declines to 14,000 barrels per day below 2002 levels. Increased oil use for heating and electricity generation is projected, however, in the low oil price case. In the low oil price case, natural gas use for home heating is projected to grow in the Northeast, the last stronghold of home heating oil. Compared with 2002, U.S. residential and commercial heating oil use is projected to be 29,000 barrels per day lower in 2025 in the high oil price case and 147,000 barrels per day higher in the low oil price case. For electricity generation, oil- and gas-fired steam plants are being retired in favor of natural gas combined-cycle units. Oil use for electricity generation (excluding combined heat and power) is projected to be 176,000 barrels per day lower in 2025 than in 2002 in the high price case and 1.5 million barrels per day higher in the low price case.

Light Products Account for Most of the Increase in Demand for Petroleum

Figure 103. Consumption of petroleum products, 1970-2025 (million barrels per day)

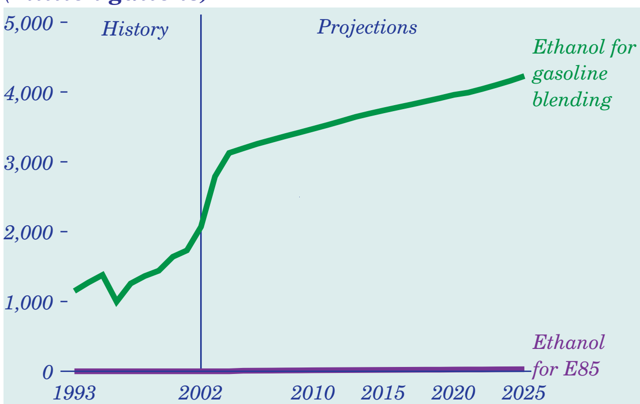


About 93 percent of the projected growth in petroleum consumption consists of increased consumption of "light products," including gasoline, diesel, heating oil, jet fuel, kerosene, liquefied petroleum gases, and petrochemical feedstocks, which are more difficult and costly to produce than heavy products (Figure 103). Although refinery investments and enhancements are expected to increase the ability of domestic refineries to produce light products, imports of light products are expected to more than double by 2025.

In the forecast, gasoline continues to account for about 47 percent of all the petroleum used in the United States. From 2002 to 2025, U.S. gasoline consumption is projected to rise from 8.9 million barrels per day to 13.3 million barrels per day. Consumption of distillate fuel is projected to be 2.0 million barrels per day higher in 2025 than it was in 2002. An even greater percentage increase is projected for diesel fuel, as a larger portion of total distillate supply is used for diesel production and less is used in other sectors. With air travel also expected to increase, jet fuel consumption is projected to be 759,000 barrels per day higher in 2025 than in 2002. Consumption of LPG is projected to increase by about 689,000 barrels per day from 2002 to 2025, largely for use as a feedstock in the industrial sector. Consumption of "other" petroleum products—including LPG, petrochemical feedstocks, still gas used to fuel refineries, asphalt and road oil, and other miscellaneous products—is projected to grow by 1.4 million barrels per day. Residual fuel use is projected to increase slightly, from about 700,000 barrels per day in 2002 to 751,000 barrels per day in 2025, mostly for fuel in the electricity generation sector.

State Bans on MTBE Are Expected To Result in Increased Use of Ethanol

Figure 104. U.S. ethanol consumption, 1993-2025 (million gallons)



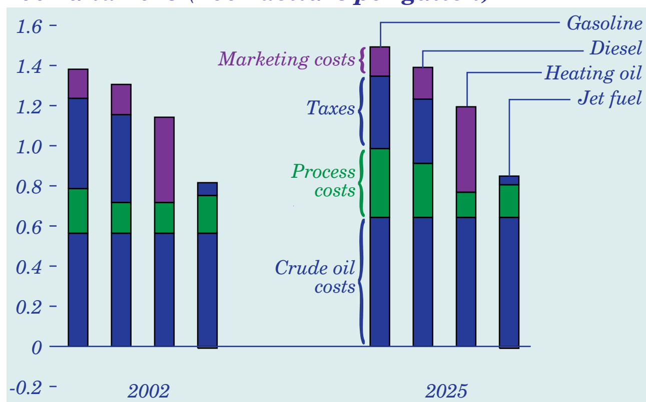
U.S. ethanol production, with corn as the primary feedstock, totaled 139,000 barrels per day in 2002. Production is projected to increase to 278,000 barrels per day in 2025 (Figure 104), with about 27 percent of the growth from conversion of cellulosic biomass (such as wood and agricultural residues). Ethanol is used primarily in the Midwest as a gasoline volume extender and octane enhancer and also serves as an oxygenate in areas that are required to use oxygenated fuels (minimum 2.7 percent oxygen content by volume) during the winter months to reduce carbon monoxide emissions. The high renewables case projects similar production, but all the projected growth is from cellulose, due to more rapid improvement in the technology. In the reference case, corn-based ethanol production drops from 100 percent of total ethanol output in 2009 to 86 percent in 2025.

Ethanol is expected to replace MTBE as the oxygenate for reformulated gasoline (RFG) in 17 States that have placed limits on MTBE use mainly because of concerns about groundwater contamination. It is assumed that the Federal requirement for 2 percent oxygen in RFG will continue in all States. Ethanol consumption in E85 vehicles is also projected to increase, from the national total of 7.8 million gallons in 2002 to 42 million gallons in 2025.

The Federal Highway Bill of 1998 extended the excise tax exemption for ethanol through 2007 with reductions from 54 cents per gallon to 53 cents in 2001, 52 cents in 2003, and 51 cents in 2005. It is assumed that the exemption will continue to be extended at 51 cents per gallon (nominal dollars).

Refining Costs for Most Petroleum Products Rise in the Forecast

Figure 105. Components of refined product costs, 2002 and 2025 (2002 dollars per gallon)



Refined product prices are determined by crude oil costs, refining process costs (including refiner profits), marketing costs, and taxes (Figure 105). In the *AEO2004* projection, crude oil continues as the largest part of product prices. Marketing costs remain stable, but the contributions of processing costs and taxes are projected to change considerably.

Refining costs for gasoline and diesel fuel, including processing costs and profits, are expected to increase by 12 cents a gallon from 2002 to 2025 (2002 dollars), primarily due to growth in demand for gasoline and diesel fuels and new Federal requirements for low-sulfur gasoline (2004 to 2007) and ultra-low-sulfur diesel fuel (2006 to 2010). Refining costs for heating oil and jet fuel fall by 2.6 to 2.8 cents a gallon from 2002 to 2025. Tighter gasoline and diesel specifications cause some refiners to shift production from gasoline and diesel to jet fuel and heating oil, which have less stringent specifications.

Whereas processing costs tend to increase refined product prices in the forecast, the assumption that Federal motor fuel taxes remain at nominal 2002 levels tends to reduce prices. Although Federal motor fuel taxes have been raised occasionally in the past, the assumption of constant nominal Federal taxes is consistent with history. The net impact of the assumption is an expected decrease in Federal taxes (in 2002 dollars) from 2002 to 2025—9 cents per gallon for gasoline, 12 cents for diesel fuel, and 2 cents for jet fuel. State motor fuels taxes are assumed to keep up with inflation, as they have in the past.