The 2025 Outlook for Oil and Gas
By James M. Kendell

Over the next 20 years U.S. consumption of oil and gas is expected to increase by at least one-third, while prices decline somewhat in real terms from today’s high levels. Dependence on foreign imports of oil and gas is expected to increase as domestic production declines.

These projections are from the Energy Information Administration’s Annual Energy Outlook 2005 (AEO2005), which provides projections of domestic energy consumption, supply, prices and carbon emissions. The Energy Information Administration (EIA) is an independent analytical and statistical agency within the U.S. Department of Energy. It does not represent any particular point of view on energy policy, and its views are not necessarily those of the Department or the Administration.

Assumptions are critical to any forecast. The projections are not statements of what will happen but of what might happen, given certain assumptions. The reference case projections are business-as-usual forecasts, given known technology and technological trends, demographic trends, and current laws and regulations. EIA does not propose, advocate, or speculate on changes in laws and regulations. So, one of the forecast’s key assumptions is that all current laws and regulations remain as enacted. For AEO2005, that means, for example, that the provisions of proposed comprehensive energy legislation are not included in the forecast.

Petroleum Outlook
Since the beginning of 2004, high world oil prices have raised gasoline prices and unsettled consumers, but have not significantly reduced their driving. Despite higher prices, domestic crude oil production is expected to continue its historic decline, while consumption increases by 7.9 million barrels per day from 2003 to 2025. As a result, net imports are expected to grow by 7.9 million barrels per day between 2003 and 2025.

If world oil prices are higher than projected, the gap between supply and demand is expected to narrow, with higher oil prices spurring production and depressing demand.

Prices
World oil prices are one of the key assumptions in the Annual Energy Outlook. In addition to the reference case world oil price path, EIA normally publishes a high and a low world oil price path. Because of recent crude oil price volatility, a futures case and a very high case were added to AEO2005 (Figure A). World prices are defined as the “average refiners acquisition cost” of imported oil into the United States. This price is about $5-6 per barrel less than the often-quoted West Texas Intermediate price.

In the Reference case, prices in 2010 are projected to be about $10 per barrel lower than current prices in 2003 dollars. Between 2003 and 2010, crude oil prices are expected to decline as production from Russia and the Caspian area expands, new fields come on in West Africa, new oil sands production is initiated in Canada, new deepwater oil fields are brought into production in the Gulf of Mexico, and the Organization of Petroleum Exporting Countries (OPEC) expands production capacity. After 2010, oil prices are projected to rise to more than $30 per barrel in 2025. In the October futures case, prices in the near term rise through 2005, and then resume a growth trend similar to the reference case. This case is based on an extrapolation of oil prices loosely corresponding to the October 2004 NYMEX futures strip. In the October futures case, world crude oil prices are assumed to average $44 per barrel in 2005 before falling to about $31 per barrel in 2010 and then generally paralleling the rise in the reference case. In the High A case, prices are projected to remain at about $34 per barrel through 2015 and then increase to more than $39 per barrel in 2025. In the High B case, projected prices continue to increase through 2005 to $44 dollars per barrel, fall to $37 in 2010, and rise to $48 dollars per barrel by 2025. In the Low case, prices are projected to decline from their high in 2004 to $21 per barrel in 2009 and to remain at that level out to 2025.

Refined product prices are determined by crude oil costs, refining costs (including profits), marketing costs, and taxes. Whereas crude oil costs tend to increase refined product prices in the forecast, the assumption that Federal motor fuel taxes remain at nominal 2003 levels tends to reduce prices. Thus, gasoline price projections are relatively flat through-
out the projection period with gasoline at $1.59 per gallon in 2025 in the reference case.

**Oil Consumption**

In the reference case U.S. petroleum consumption is projected to increase by 7.9 million barrels per day from 2003 to 2025 (Figure B). However, a steep and prolonged rise in crude oil prices, as in the High B case, could reduce the growth in consumption to 6.2 million barrels per day, mainly because of lower growth in gasoline consumption.

About 92 percent of the projected reference case growth in petroleum consumption consists of “light products” (including gasoline, diesel, heating oil, jet fuel, kerosene, LPG and petrochemical feedstocks), which are more difficult and costly to produce than heavy products. Gasoline continues to make up nearly one-half of all petroleum used in the United States, increasing from 8.9 million barrels per day in 2003 to 12.9 million in 2025, mostly for transportation. Consumption of distillate fuel is also projected to increase, by 1.9 million barrels per day, from 2003 to 2025. Gasoline is used only in spark-ignition engines; distillate is used in furnaces, boilers, diesel engines and some turbines. Jet fuel consumption is projected to increase by 789,000 barrels per day from 2003 to 2025.

Residual fuel use, constrained by air quality regulations, increases by only 110,000 barrels per day from 2003 to 2025, including an increase of 79,000 barrels per day in residual fuel use for baseload electricity generation. More intensive refinery processing to maximize light product yield and minimize heavy product yield is expected to limit the availability of residual fuel.

The transportation sector accounted for two-thirds of U.S. petroleum use in 2003. In the forecast, population growth and economic growth cause miles traveled to increase across all modes of transit. Although improvements in vehicle technology yield reductions in fuel use per mile traveled, the increases in mileage outweigh increases in efficiency, leading to increases in consumption of gasoline, diesel and jet fuel.

The industrial sector currently accounts for 24 percent of U.S. petroleum demand. In the reference case, industrial consumption is projected to be 1.2 million barrels per day higher in 2025 than it was in 2003, and industrial consumption of liquefied petroleum gas (LPG), largely as a chemical feedstock, increases by about 490,000 barrels per day.

In the residential sector, distillate use is displaced by LPG, natural gas, and electricity for home heating toward the end of the forecast. As a result, residential oil use drops by 88,000 barrels per day from 2003 to 2025. Commercial use of heating oil grows from 246,000 barrels per day in 2003 to 362,000 barrels per day in 2025. The delivered price of dis-
tillate to commercial customers is projected to be lower than the price of natural gas throughout the forecast.

Only 3 percent of U.S. electricity is currently generated from refined petroleum, but the electricity sector nearly matches residential petroleum use by the end of the forecast. Consumption of residual and distillate fuel in the electric power sector increase modestly.

Oil Production

In the AEO2005 reference case, U.S. crude oil production is projected to increase from 5.7 million barrels per day in 2003 to 6.2 million barrels per day in 2009 as a result of increased production offshore, predominantly from the deep waters of the Gulf of Mexico. Beginning in 2010, U.S. crude oil production begins to decline, falling to 4.7 million barrels per day in 2025. A steep and prolonged rise in crude oil prices, as in the High B case, could increase total domestic supply by 2.2 million barrels a day in 2025, including 1.2 million barrels per day from synthetic petroleum fuel produced from coal and natural gas (Figure B).

In the reference case, crude oil production from Alaska is expected to decline to about 810,000 barrels per day in 2010. After 2010, increased production from the National Petroleum Reserve-Alaska (NPR-A) raises Alaska’s total production to about 890,000 barrels per day in 2014. Depletion of the oil resource base in the North Slope, NPR-A, and southern Alaska oil fields is expected to lead to a decline in the State’s total production to about 610,000 barrels per day in 2025.

Alaska crude oil production originates mainly from the North Slope, which includes the NPR-A and the state lands surrounding Prudhoe Bay. Because drilling is currently prohibited in the Arctic National Wildlife Refuge (ANWR), AEO2005 does not project any production from ANWR.

Import Dependence

In 2003, net imports of petroleum climbed to a record 56 percent of domestic petroleum consumption. Dependence on petroleum imports is projected to reach 68 percent in 2025 in the reference case. (In the High B case, import dependence reaches only 58 percent in 2025.) The expected value of petroleum imports in the reference case in 2025 is projected to be $216 billion in 2003 dollars. Total annual U.S. expenditures for petroleum imports, which reached a historical peak of $148 billion in 1980, were $122 billion in 2003.

Net U.S. petroleum imports are projected to in-
crease from 11.2 million barrels per day in 2003 to 19.1 million in 2025. Crude oil accounts for most of the increase in imports, because distillation capacity at U.S. refineries is expected to be more than 5.5 million barrels per day higher in 2025 than it was in 2003. Net imports of refined petroleum, including refined products, unfinished oils, and blending components, are expected to almost double by 2025, to 3.0 million barrels per day.

Crude oil imports from the North Sea are projected to decline gradually as North Sea production ebbs. Significant imports of petroleum from Canada and Mexico are expected to continue, with much of the Canadian contribution coming from the development of its enormous oil sands resource base. West Coast refineries are expected to import small volumes of crude oil from the Far East to replace the declining production of Alaska crude oil. The Persian Gulf share of total gross petroleum imports, 20.4 percent in 2003, is expected to increase to almost 30 percent in 2025; and the OPEC share of total gross imports, which was 42 percent in 2003, is expected to be above 60 percent in 2025. Vigorous growth in demand for lighter petroleum products in developing countries means that U.S. refiners are likely to import smaller volumes of light, low-sulfur crude oils.

Most of the increase in refined product imports is projected to come from refiners in the Caribbean Basin, North Africa and the Middle East, where refining capacity is expected to expand significantly.

Natural Gas Outlook

Unlike oil, natural gas is still largely supplied from domestic sources. But over the forecast, imports are expected to more than double. Domestic natural gas production is expected to increase more slowly than consumption over the forecast, rising from 19.0 trillion cubic feet (Tcf) in 2003 to 21.8 Tcf in 2025. Growing production is supported by rising wellhead gas prices, relatively abundant gas resources, and improvements in technologies, particularly for unconventional gas. Economic conditions allow an Alaskan pipeline to begin moving gas to the lower 48 states in 2016.

Consumption is forecast to climb from 22.4 Tcf in 2003 to 30.7 Tcf by 2025. The increase is primarily due to the rapid growth in demand for electricity generation and industrial applications, which account for almost 75 percent of the growth. The difference be-

![Figure C: Net U.S. Imports of Natural Gas, 1970–2025 (trillion cubic feet) Source: Annual Energy Outlook 2005](image-url)
The national average wellhead price is projected to reach $4.16 per thousand cubic feet (mcf) in 2003 dollars in 2015 and $4.79 per mcf in 2025.

Consumption
The strongest growth in natural gas consumption is in the electric power sector, where consumption is projected to almost double, from 5.1 trillion cubic feet in 2003 to 9.4 trillion cubic feet in 2025. Demand by electricity generators is expected to account for 31 percent of total natural gas consumption in 2025, compared with about 23 percent in 2003. Electric power gas consumption growth results from both the construction of new gas-fired generation plants and from a higher capacity utilization of gas-fired generation plants. 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, including 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, and gas begins to lose market share to coal.

Industrial consumption (including lease and plant fuel) remains the largest consuming sector and is projected to increase from 8.3 trillion cubic feet in 2003 to 10.3 trillion cubic feet in 2025. Those industrial sectors projected to experience the greatest gas consumption growth from 2003 through 2025 include metal-based durables, petroleum refining, bulk chemicals, and food.

In the residential and commercial sectors, natural gas consumption is projected to increase by about 0.7 percent and 1.2 percent per year, respectively, from 2003 to 2025.

Production
Domestic gas production is expected to increase from 19.0 Tcf in 2003 to 21.8 Tcf in 2025. Increased U.S. natural gas production comes primarily from unconventional sources and from Alaska.

Unconventional gas production increases by 2.0 Tcf over the forecast period, mainly because of technological improvements, rising prices, and relatively
abundant unconventional sources (tight sands, shale and coalbed methane). Annual production from unconventional sources is expected to account for 44 percent of lower-48 production in 2025, compared to 35 percent in 2003.

Over the forecast, Alaska gas production accounts for most of the growth in domestic conventional gas production, growing by 1.8 Tcf over the forecast period. Alaska gas is projected to begin flowing to the lower-48 states in 2016. With subsequent expansion of this pipeline, Alaskan gas production reaches 2.2 Tcf in 2025, compared with 0.4 Tcf in 2003.

Lower-48 onshore and offshore non-associated conventional gas production is expected to decline by about 900 Bcf, as resource depletion causes exploration and development costs to increase.

Production of associated-dissolved (AD) natural gas from lower-48 crude oil reserves is projected to grow from 2.5 Tcf in 2003 to 3.1 Tcf in 2010. After 2010, both onshore and offshore AD gas production is expected to decline, with total AD gas production falling to 2.4 Tcf in 2025.

Imports
Imports are expected to be priced competitively with domestic sources of natural gas, and net imports of natural gas are expected to make up the difference between U.S. production and consumption. Liquefied natural gas (LNG) is expected to account for most of the projected increase in net imports (Figure C). One new LNG terminal started operation this year offshore Louisiana. By the end of the forecast, sufficient new LNG terminal capacity comes into operation to allow net LNG imports to increase from 440 bcf in 2003 to 6.4 trillion cubic feet in 2025. By 2025, net LNG imports are expected to equal 21 percent of total U.S. gas consumption, compared to 2 percent in 2003. Net LNG imports are expected to rise from 13 percent of net imports in 2003 to 74 percent in 2025.

Net imports of natural gas from Canada are projected to be 3.0 trillion cubic feet in 2005, and then decline gradually to 2.5 trillion cubic feet in 2009. A MacKenzie Delta natural gas pipeline is projected to begin transporting gas in 2010, and imports subsequently rise to 3.0 tcf in 2015. After 2015, net gas imports from Canada are projected to again decline, falling to 2.5 trillion cubic feet in 2025. Conventional production in the Western Sedimentary Basin is projected to decline throughout the projection, but unconventional gas production in Western Canada, conventional production in the MacKenzie Delta and Eastern Canada, and LNG imports are expected to more than offset the production decline in the Western Sedimentary Basin. Towards the end of the forecast, imports from Canada decline as Canadian gas consumption increases faster than Canadian gas production.

Although Mexico has considerable natural gas resources, the United States historically has been a net exporter of gas to Mexico. Net exports of U.S. natural gas to Mexico are projected to grow until 2006, and subsequently decline after 2006 as LNG terminals in Baja California come online to serve both the Mexican and U.S. markets.

Prices
Average wellhead prices for natural gas are projected to increase from $4.88 per thousand cubic feet (2003 dollars) in 2003 to $5.30 per thousand cubic feet in 2005 (Figure D). After 2005, natural gas wellhead prices are projected to decline to $3.64 per thousand cubic feet in 2010 as the initial availability of new import sources and production from increased drilling expands available supply. After 2010, wellhead prices are projected to increase gradually, reaching $4.79 in 2025. The increase is in response to higher exploration and development costs associated with smaller and deeper gas deposits in the remaining domestic gas resource base.

Prices are projected to increase in an uneven fashion as new, large-volume supply projects temporarily depress prices when initially brought online. In nominal dollars, the 2025 price is the equivalent of $8.23 per thousand cubic feet.

The reference case forecast assumes known technology and technological trends. Wellhead natural gas price projections are more sensitive to variations in technological change than to the levels of natural gas production and consumption. And, prices vary significantly under alternate technology assumptions. Under the reference case, technologies are assumed to increase at historical rates. In the rapid and slow technology cases, the technology parameters in the model are increased and decreased by 50 percent.

The slow technology case projects a wellhead price of $5.18 per thousand cubic feet in constant 2003 dollars in 2025, which is 8 percent higher than the reference case price. In the rapid technology case, lower 48 natural gas wellhead prices are projected to reach $4.35 per thousand cubic feet in 2025, which is 9 percent lower than in the reference case.
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Summary
Oil and gas prices are expected to decline in real terms through 2010, as current high prices spur the development of more foreign and domestic supplies and technological development continues. After 2010, prices are expected to rise steadily—though not as high as 2004 prices, as demand increases and resources continue to deplete.

Domestic consumption of oil and gas is expected to increase by at least one-third through 2025. In the face of declining oil and gas production by 2020, dependence on imports of oil and gas is expected to increase significantly. LNG is projected to meet most of the U.S. needs for additional natural gas imports.

About the Author
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