

Scenarios for Energy and Resource Development on the North Slope and Adjacent Seas

Research and Monitoring
Prioritization for the NSSI

Price of oil and gas | Demand and Global Market

Summary

Petroleum is very important to the Alaska economy, accounting for 31 percent of all jobs in Alaska. Oil-related state revenue amounted to 92 percent of unrestricted general funds in 2013. Oil is produced on the North Slope—averaging 529,000 barrels per day in Fiscal Year 2014. That oil is carried south to Valdez through the trans-Alaska pipeline, where just about all of it is loaded onto tankers bound for the U.S. West Coast and a small amount is processed at Alaska refineries. For several decades Alaska was the second leading U.S. producer of oil, but with declining production it has fallen to fourth place (behind Texas, North Dakota and California). Much smaller quantities of oil, as well as natural gas, are produced in Cook Inlet, mostly for in-state markets. The North Slope and adjacent offshore areas are estimated to have very large reserves of oil and gas, but much of the conventional oil has already been produced, and most of the remaining oil is unconventional—e.g. heavy oil, tight sands and offshore continental shelf—and will be more difficult and expensive to produce. To deliver North Slope gas to markets would require construction of an 800-mile pipeline as currently proposed by North Slope producers to deliver the gas to a liquefaction plant at tidewater on the Kenai Peninsula for shipment to Asia as LNG. The entire project is estimated to cost between \$45 billion and \$65 billion. Even though fossil fuels are expected to remain the dominant source of energy for decades to come, the global transition away from fossil fuels continues, and reduced demand for fossil fuel could lead to stranded resources.

Oil and gas are globally traded commodities, and Alaska’s petroleum sector is affected by global market forces. Oil prices have been relatively stable in recent years, with record increases in US domestic oil production balancing global supply disruptions. The costs of North Slope oil development, production, and transportation are high compared to other areas, requiring high oil prices to be justified. However, the continuation of high oil prices in the future is highly uncertain.

Overview

Global

Emerging economies continue to contribute to global energy demand growth while energy production remains affected by advances in technology and geopolitical events. In 2013 oil production in Libya suffered the world’s largest decline due to civil unrest, and supply disruptions in Africa, Europe, and the Middle East continue. Growth in US domestic oil production largely offset these supply disruptions, and kept average global oil prices stable above \$100 per barrel (1, 8, 9). Capital costs for oil exploration and production have risen in the past two decades worldwide with partial offsets due to technological advances. Costs for oil and gas exploration, development, and production have been increasing at a faster rate than oil prices over the past decade (with oil prices recently beginning to sharply decline, while costs continue to increase globally). This trend of cost increases outpacing price increases is especially evident in frontier regions such as the Arctic.

Easily accessible conventional oil is becoming scarce and future production will increasingly require more advanced technology in more remote locations at increasing costs. Unconventional sources of hydrocarbon also require greater attention to environmental management than conventional production (1, 3, 9). Gas is the fastest growing fossil fuel due to the shale gas revolution, its environmental attractiveness compared to other fossil fuels, and its global abundance.

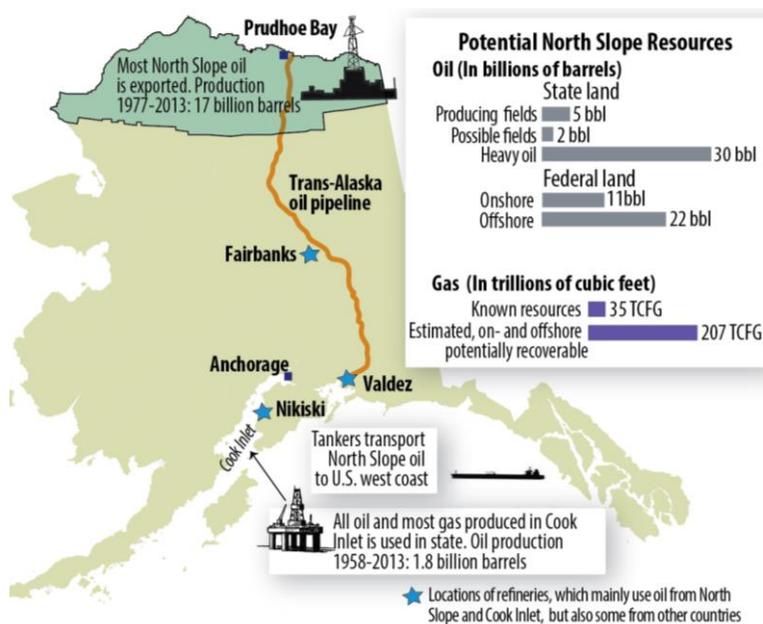


Figure 1. Alaska’s petroleum sector, 2014. Source: ISER

Even though Asia is expected to consume most of the growth in natural gas demand followed by Latin America, natural gas prices are expected to remain stable in the near future due to the capacity of multiple LNG export projects proposed worldwide (1, 2, 8, 9). The price of oil and gas also differ in a key way, with oil prices affected in the international market, and gas prices affected through a regional market with prices varying by region.

Domestic

Abundant and relatively inexpensive domestic supply of tight oil and gas, sourced largely in fairly close vicinity to main U.S. consumption centers, have left oil prices either stable or declining and gas prices low (9). Technological advances in the recovery of tight oil and gas have reduced development and production costs and are projected to lead to a surplus in domestic oil and gas. This is likely to lead to downward pressure on oil prices in the short-term. In the power sector, gas remains competitive with coal, leading to a US wide transition away from coal to natural gas fired power plants, particularly as older coal plants are replaced and emission standards are tightened (1, 8, 9). Natural gas is also making inroads as a transportation fuel for the shipping and trucking industries. The shift away from carbon-intensive fuels helps stabilize carbon dioxide emissions (9).

Alaska

Since the start of oil production on the North Slope in 1977, 17 billion barrels of oil have been produced primarily consisting of the largest and most easily accessible oil accumulations. However, the Arctic shelf is one of the world’s largest remaining prospective areas for oil and gas development and is believed to contain 30 percent of the world’s undiscovered natural gas. The USGS estimates technically recoverable oil resources to amount to 37 billion barrels on state land and 33 billion barrels on federal land, onshore and offshore. In addition, there are 35 trillion cubic feet of known gas resources on state land and a mean estimate of 220 trillion cubic feet of undiscovered, technically recoverable gas (10). Assuming high future oil and gas prices, stable fiscal policies, reserve growth in known fields, and all areas being open for exploration, economically recoverable oil and gas additions are estimated to range between 28 and 36 billion barrels of oil and between 125 and 137 trillion cubic feet of gas (Figure 1) (6). In this optimistic estimate, development of additional oil and gas resources would extend well beyond 2050. This would potentially require an increase of current transportation capacity for oil and construction of a natural gas pipeline (Figure 2). More pessimistic predictions without development of the Outer Continental Shelf, Arctic National Wildlife Refuge Area 1002, and without construction of a gas pipeline, result in estimates of recoverable oil dropping to 9 to 10 billion barrels (Figure 3) (6).

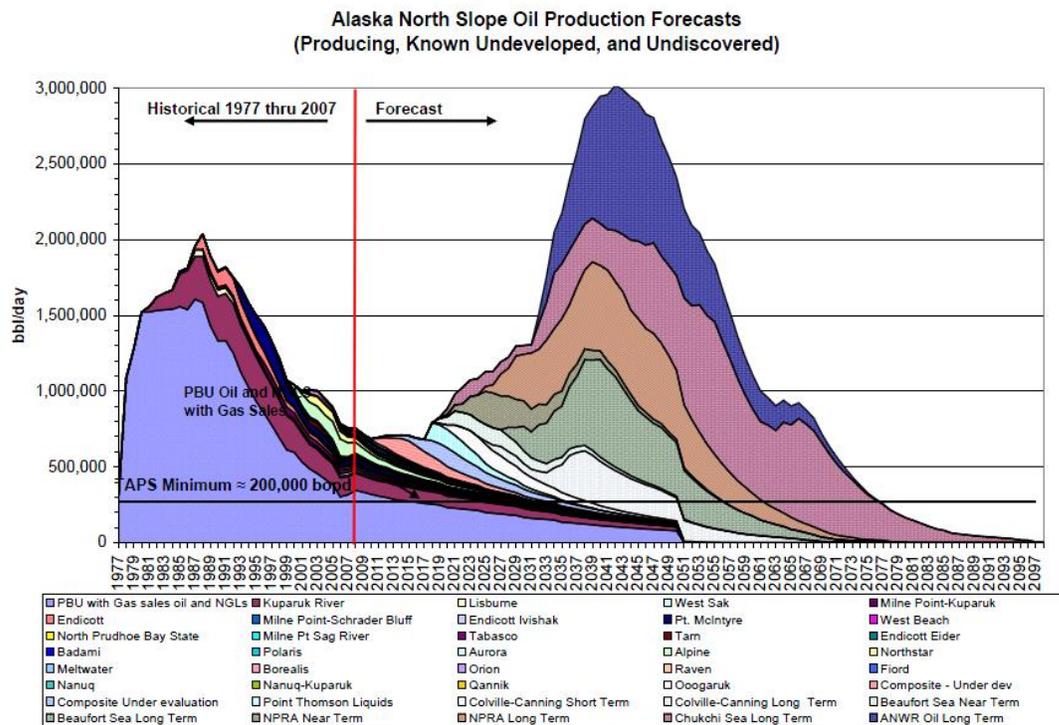


Figure 2. Alaska North Slope Oil Production Forecasts, Source: National Energy Technology Laboratory (2009).

Differences to other oil producing U.S. states

Alaska North Slope production differs from most oil-producing states in a number of important ways:

- *Alaska's large oil fields don't require large workforces.* Even though at the margin, labor requirements have increased, comparatively few direct jobs are associated with the size of Alaska oil fields compared to the labor needs of multiple small fields.
- *Oil fields in Alaska are comparatively larger.* In Alaska fewer or none of the small fields are being developed in contrast to other areas. Small fields are often not economically feasible due to remoteness and other Alaska-specific challenges resulting in higher costs.
- *Alaska's oil industry is less diverse.* While Texas has more than 200 large and small oil and gas explorers and producers, on Alaska's North Slope a small group of large oil companies dominate the industry. Investments in new fields in Alaska compete with a global portfolio of projects.
- *Alaska does not headquarter the oil industry.* The management for most oil companies is headquartered elsewhere.
- *Alaska has smaller transportation infrastructure and fewer downstream operations.* Fewer spin-off jobs such as with refineries exist in Alaska.
- *Alaska has had slower job growth in the oil industry.* Over the past decade, Alaska's direct employment in oil production increased by 37 percent compared to nationwide 62 percent.
- *Implications of Jones act restrictions on Alaska.* Exporting hydrocarbons from NPR-A and the Outer Continental Shelf are currently prohibited by law.

Other considerations include:

- Exploration and development of new oil fields in areas without pre-existing infrastructure (e.g. Point Thompson) are difficult due to seasonal restrictions. Outside of established fields (which may have existing pads and roads to work from) the exploratory drilling season in Alaska is greatly reduced compared to other locations. Accordingly, cash flow from Alaskan fields is delayed from first expenditure by many years. The lag may be less than a year in the lower 48 states (in the case of shale oil and gas developments). This places an enormous burden on the economics of Alaska production: one needs very large anchor fields to justify initial investment in infrastructure.
- Development of small fields can be economic, but generally only if existing processing and transportation infrastructure is available.
- While smaller fields can be economic, the incumbent producers are large multi-national oil companies. Accordingly, satellite production isn't a favorable strategic 'fit' for investment as Alaska projects compete with other international projects within multi-national portfolios.
- The state of Alaska is alone in having reserved for itself essentially all of the subsurface mineral rights. This means that there is typically only one landowner for an explorer/developer to deal with — a significant advantage in putting together prospects

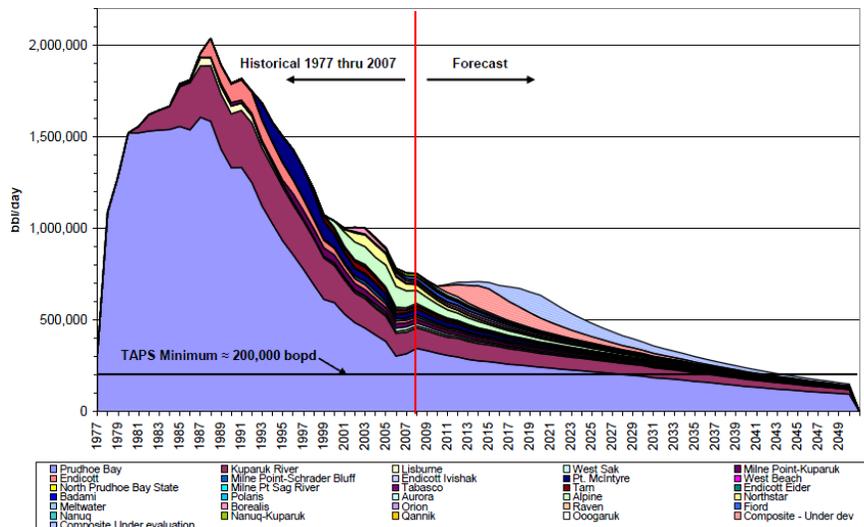


Figure 3. Currently producing fields, known fields with development plans and fields under evaluation on the North Slope. Projections without Outer Continental Shelf or ANWR development. Source: National Energy Technology Laboratory (2009).

Trends

In 2011, 81 percent of global energy demand was met by fossil fuels. Hydrocarbons are believed to continue to dominate the global energy mix in the coming decades. But growth in fossil fuel use is expected to decline and by 2035 meet only 60 percent of global energy demand. Most of the growth in energy demand is expected to be concentrated in emerging economies (2, 8, 9). Lower 48 onshore tight oil production is expected to remain the main driver of US crude oil production resulting in the U.S. becoming a net exporter of petroleum products, and dramatically reducing its dependence on foreign oil. Alaska production is believed to stagnate or decline until 2040 (8, 9).

The U.S. Energy Information Administration forecasts oil and gas prices in their reference cases. The West Texas Intermediate Spot Price, a benchmark for the value of Alaska North Slope crude, shows an increasing trend (Fig. 4) in the reference case, but with large uncertainties as seen in the differences between the high and low price projections (9). The Alaska Department of Revenue's most recent oil price forecast to 2023 presents an increase in the nominal West Coast price for Alaska North Slope crude from \$106.61 bbl in 2014 to \$131.85 in 2023 (11).

The Henry Hub natural gas price reference case is forecast to increase for most scenarios by 2040 (Fig. 5). Projected prices are affected by uncertainty in the extent of recoverable tight gas resources (9). Global LNG trade is expected to grow with new LNG terminals and LNG carriers being constructed or on order. Also, proposed LNG export projects exceed predicted global gas demand, though most of the proposed projects are not expected to advance to construction. This trend may lead to lower LNG prices and a further divergence of oil and gas prices for the next decade or two (9). Australia, North America and Africa are expected to join Qatar as the largest suppliers of LNG worldwide (2). China could become the world's largest importer for gas by 2020 via LNG and pipelines with the dominant source expected to originate from Former Soviet Union states (2, 9).

Natural gas is expected to make inroads into all transportation sectors (2, 8, 9). By 2035 gas is expected to account for 8 percent of transport fuel in the US, almost matching biofuels. However, fuel switches require more infrastructure development and thus occur at a slower rate in transportation compared to the power sector. In the power sector, gas is likely to continue to grow at the expense of coal despite the rapid expansion of renewables.



Figure 4. West Coast Intermediate Spot price projections for crude oil in 2012 dollars per barrel. Source: US Energy Information Administration.

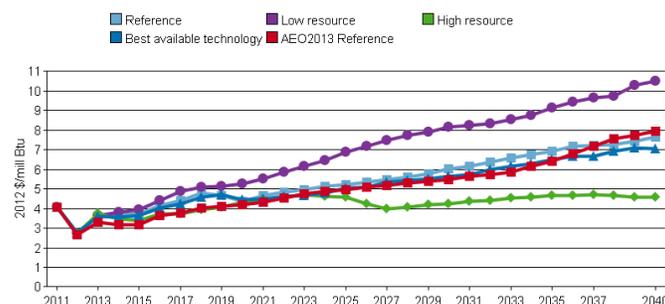


Figure 5. Henry Hub Spot price projections for natural gas in 2012 dollars per mill Btu

Uncertainties

How energy markets evolve in the future is subject to much uncertainty. Many of the events that shape energy markets are random and cannot be anticipated. For example, current oil prices show a downward trend contrary to the most recent forecast illustrating the downward risks in oil prices. In addition, future developments in technologies, demographics, and resources cannot be foreseen with certainty. Even though large economically and technically recoverable oil and gas resources may remain on Alaska's North Slope, development of new fields depend not only on future oil prices but complex factors including the following:

Large portfolios and publically unknown evaluation: Oil companies have their own private portfolio and evaluation procedures related to projects and their associated risk. The larger the oil companies who invest in Alaska, the larger their portfolios of competing projects.

Complex global energy markets:

Resource development in Alaska depends on global market forces consisting of many energy substitutes and dynamic changes in supply and demand out of the control of Alaskans.

Fiscal terms and regulations:

While fiscal policies provide incentives for investments into additional production, they are not the only factor driving decisions. Stable fiscal policy creates certainty for oil companies and fosters positive investment conditions. Poor or unstable fiscal policies dispel certainty for oil companies and fosters negative investment conditions. They may also lead to dis-investment.

Technological advancements:

High oil prices above \$100/barrel allowed for the development of new technology to recover tight oil and gas resources. These new advances eventually lead to a reduction in cost related to tight oil and gas recovery.

Geology:

The estimated technically recoverable resources as stated above are uncertain but based on hypothetical sizes of oil and gas accumulations.

Labor supply:

Availability of labor for large projects such as a gas pipeline can have implications for timeliness and cost

World economic change:

Global energy markets are affected by structural changes in the global economy and related with primary energy demand.

Geopolitical events:

Civil unrest in Africa, the Middle East, and Russia can cause supply disruptions and affect oil prices.

Driver interactions

Petroleum resource development has a large impact on job and wealth creation in Alaska's economy through direct and spin-off economic activity. In addition, over three quarters of state and local government jobs are dependent on the petroleum sector underlining widespread overreliance on oil revenues for local and state government operations throughout Alaska. Declining petroleum production can result in budget cuts. Businesses providing goods and services to the oil industry and local and state governments would lay off workers. With the loss of employees, the loss of income would further cause a reduction of spending, jobs, and income and could lead to a contracting economy. At the same token, large increases in resource development spending in Alaska can create and support direct and related spin-off jobs.

A big change in the Alaska economy since statehood has been the growth of industries providing goods and services that as recently as the 1960s, were unavailable locally. To a large degree, this diversification is traceable to spending by the petroleum sector and federal government.

Climate change related policies to reduce emissions and carbon sequestration technology could affect future demand for fossil fuels, while climate change effects (e.g. erosion, accessibility for tundra travel or shipping) may affect the cost of development activities in the Arctic.

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