An Introduction to the Alaska Oil and Gas Industry

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for

Economics 300: The Economy of Alaska

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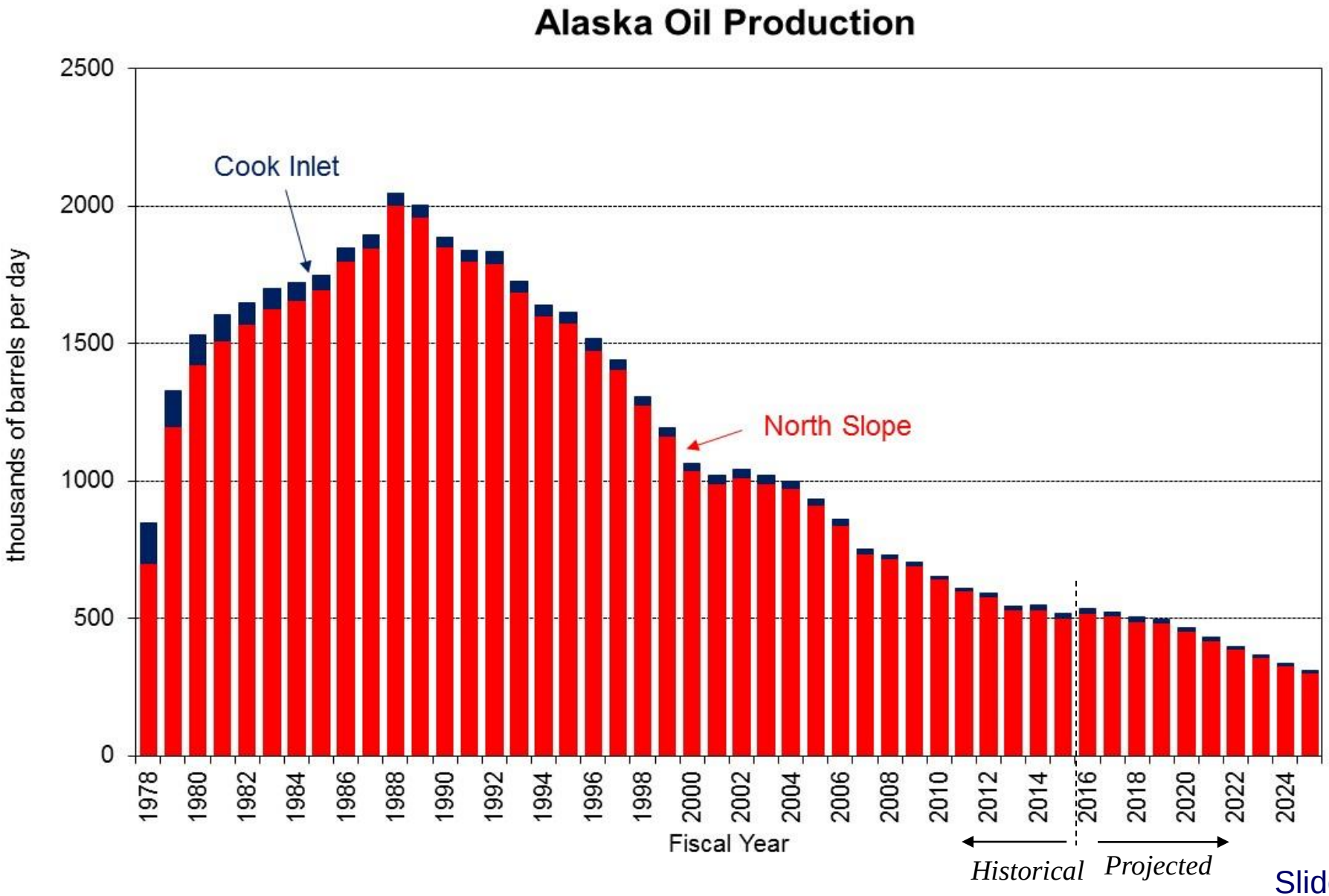
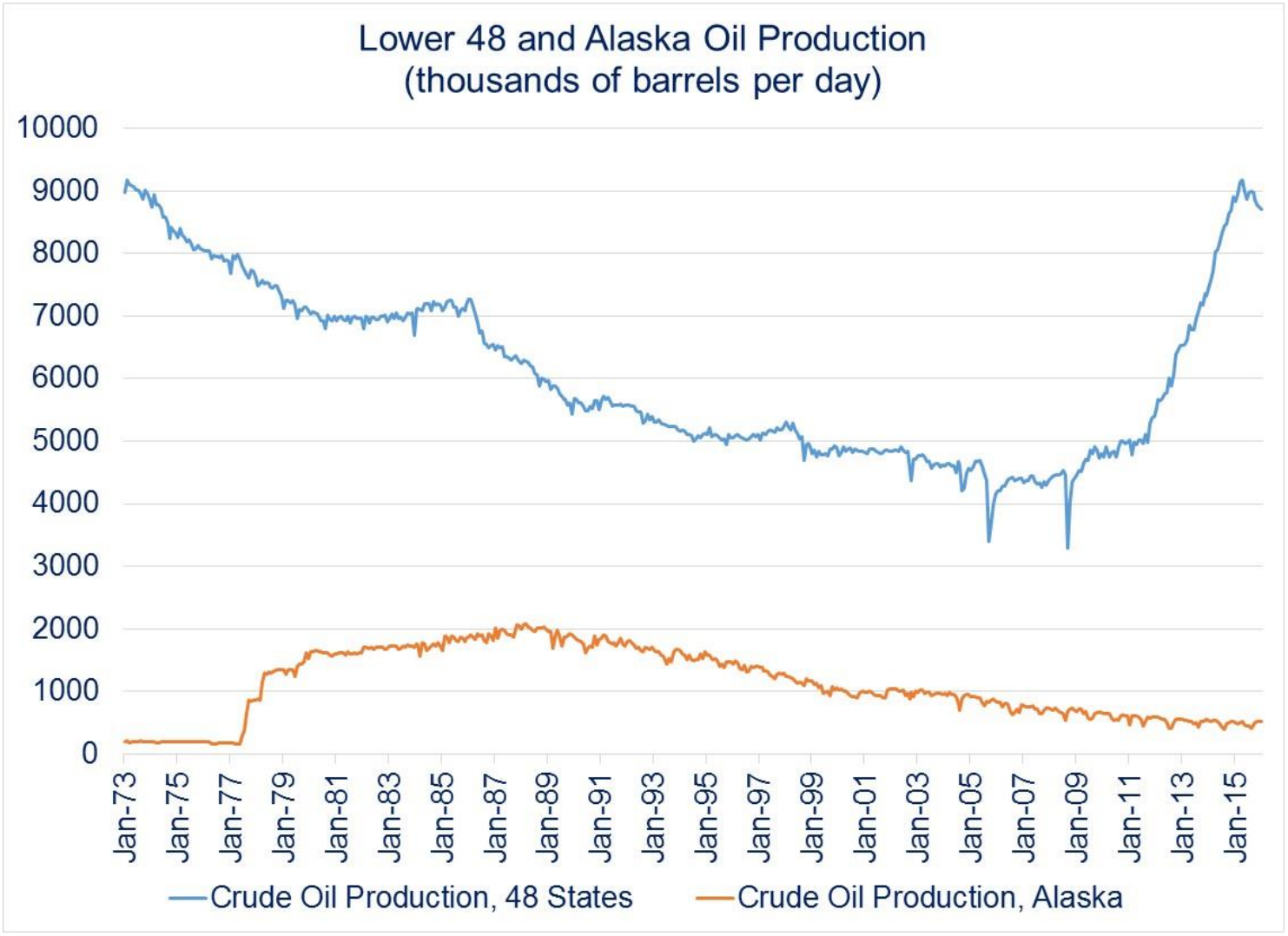
Significant oil production has occurred in two parts of Alaska: Cook Inlet and the North Slope. Cook Inlet production began in the early 1960s, peaked in 1970, and has been declining since then. North Slope production began in 1978 and has since then been much greater than Cook Inlet. North Slope production peaked in 1988 at more than 2 million barrels per day and has since fallen by almost 75% to just over 500 thousand barrels per day. It is projected to fall to as low as 300 thousand barrels per day by 2025.

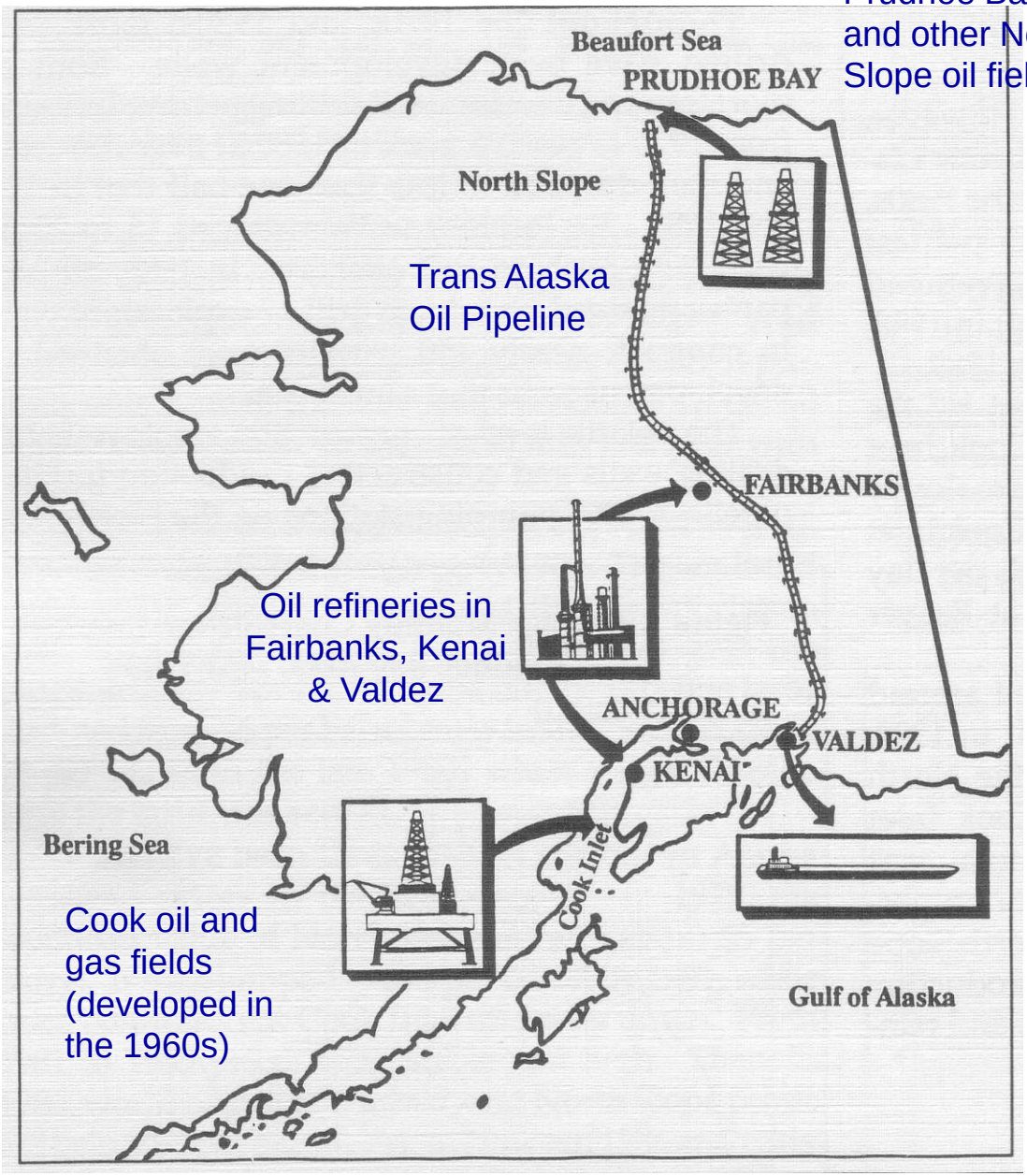


Alaska's share of U.S. oil production fell from 25% in 1988 to 5% in 2015, as Alaska's production declined and Lower 48 production soared after 2009. Note that over the past year Lower 48 oil production has begun to fall due to the drastic fall in oil prices over the past two years.

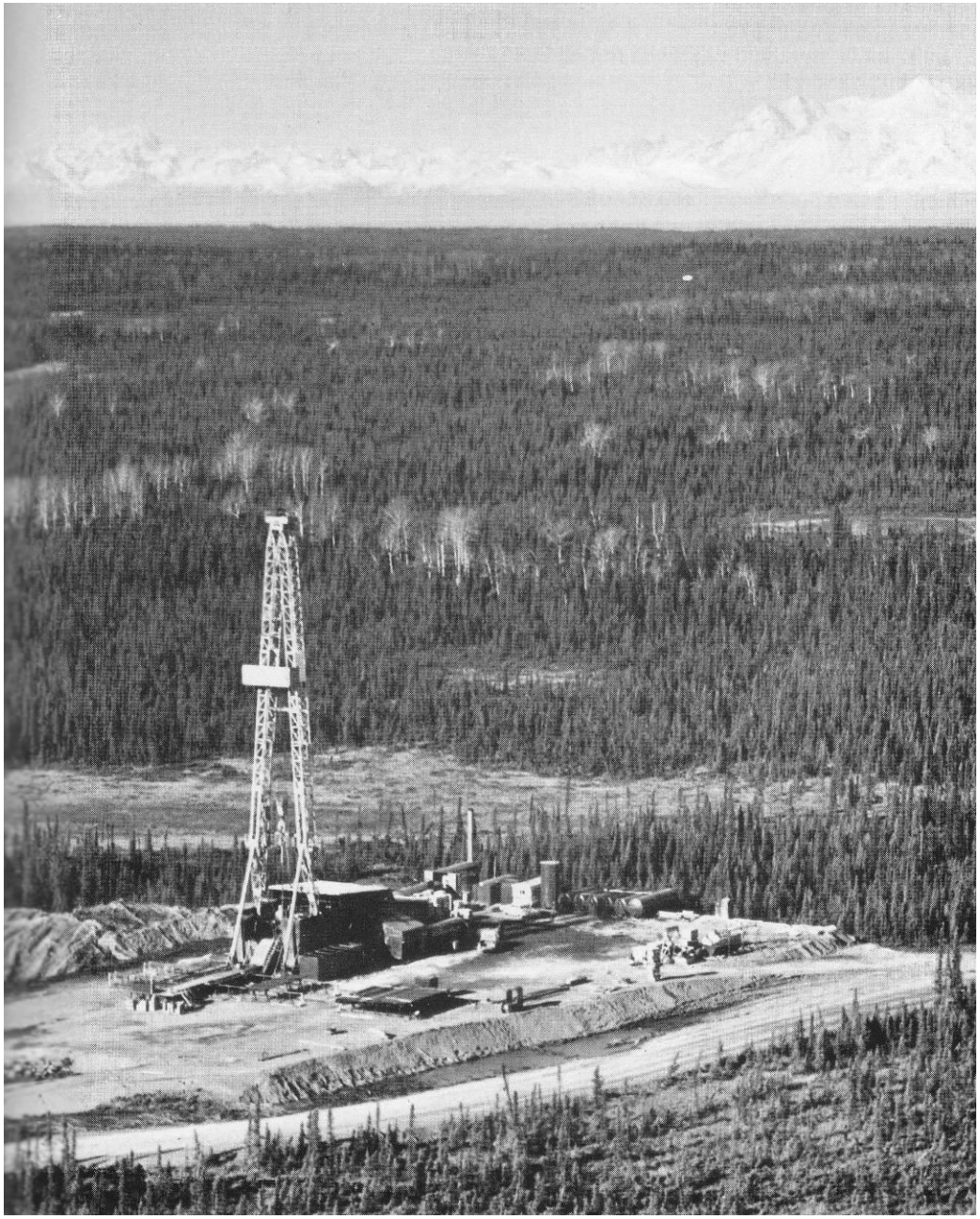


Source: Source: US Energy Information Administration, March 2016 Monthly Energy Review, http://www.eia.gov/totalenergy/data/monthly/index.cfm#petroleum

Alaska's oil and gas industry began with the development of Cook Inlet oil in the 1960's. However, now most oil production is on the North Slope, at Prudhoe Bay and other oil fields. The oil is shipped to Valdez in the Trans Alaska Pipeline. Relatively small amounts of oil have been refined at refineries near Fairbanks, Kenai and Valdez (although most of these refineries are no longer in operation). Gas fields located beneath and near Cook Inlet are an important energy source for southcentral Alaska.



Oil was discovered on Alaska's Kenai Peninsula in 1959, touching off a boom in oil exploration and development. Significant commercial production began in 1961.



Since the 1960s, the oil and gas industry has been an important part of the Kenai Peninsula economy. This picture shows an oil refinery, fertilizer plant (which closed in 2008) and liquified natural gas plant (which closed in 2012) at Nikiski, on the Kenai Peninsula north of the town of Kenai.

Source for photograph: http://www.cookinletoilandgas.org/images/Community%20Images/NIKISKI.jpg

For decades, Cook Inlet natural gas has been a source of relatively cheap electricity and heating energy for southcentral Alaska, including Anchorage. This picture shows the Beluga power plant, on the west side of Cook Inlet near Tyonek, which uses Cook Inlet natural gas to generate electricity. Declining Cook Inlet natural gas reserves have been a significant concern for southcentral Alaska in recent years—raising fears that we might soon have to find a different and potentially much more expensive source of energy for heating and electricity. However, recent new discoveries have reduced this concern for the moment.

Source for photograph: http://inlinethumb53.webshots.com/628/2865446380048388827S600x600Q85.jpg

Oil was discovered at Prudhoe Bay on Alaska's North Slope in 1968. This picture shows the original discovery well.

ISER economist Scott Goldsmith visiting Prudhoe Bay in the 1980s. Photograph by Gunnar Knapp

Since the discovery of oil at Prudhoe Bay in 1968 and the construction of the pipeline, the Prudhoe Bay area and other North Slope oil fields have become a huge industrial complex.

The Trans Alaska Pipeline System (TAPS) was constructed between 1974 and 1977 to bring North Slope oil to market. It begins at Prudhoe Bay and ends at Valdez, where the oil is shipped to market by oil tankers. TAPS is operated by Alyeska, a company owned by the major North Slope oil companies.

Source: Alyeska Pipeline website:
http://www.alyeska-pipe.com/news.html

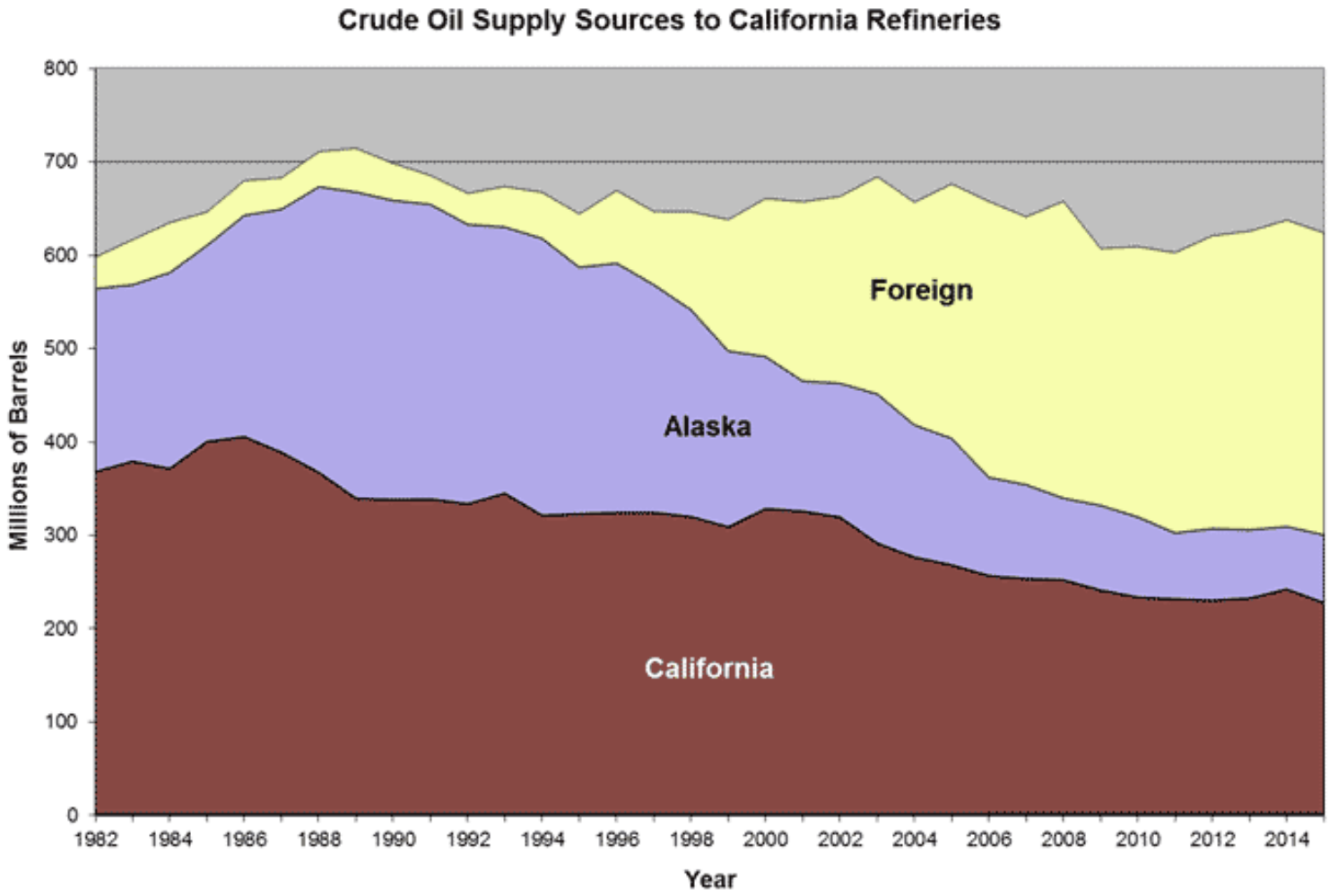
Source: http://www.prudhoebay.com/images/DaveW/Alyeska_Pipeline.jpg

At the pipeline oil terminal in Valdez, the oil is loaded onto tankers for shipment to markets, mostly on the U.S. west coast.

Source:
http://www.qsl.net/kc0hoj/bmh/Images/visit/pipelineterminal.jpg

Source:
http://www.oceanservice.noaa.gov/education/stories/oilymess/media/oily09b_450.jpg

Most North Slope oil is shipped on tankers to refineries on the U.S. west coast.



Source: California Energy Commission website,
http://energyalmanac.ca.gov/petroleum/statistics/crude_oil_receipts.html

As of 2015, there were five oil refineries in Alaska. These refineries produced mainly products for use in Alaska and used only a small share of total Alaska crude oil production. Two small refineries were located on the North Slope and produce fuels for use on the North Slope. The others were located at North Pole (near Fairbanks), Valdez, and Nikiski (on the Kenai Peninsula).

Overview of Alaska Refineries as of 2015

Location	Company	Operating capacity (barrels per day)	Notes
North Slope	BP Exploration	10,500	Produces fuels for heating and industrial uses on the North Slope
North Slope	ConocoPhillips	15,000	Produces fuels for heating and industrial uses on the North Slope
North Pole	Petro Star	19,700	Produces primarily jet fuel and heating oil
Valdez	Petro Star	55,000	Produces primarily jet fuel and heating oil
Tesoro	Nikiski	65,000	Processes Cook Inlet oil production. Products are shipped via a 75-mile 10-inch diameter pipeline to Anchorage. Provides jet fuel used at the Anchorage airport.

Source: U.S. Energy Information Administration, *"U.S. Refineries, Operable Capacity as of January 1, 2015" (excel file). US Department of Energy. Retrieved April 2 2016.*

Alaska's formerly largest refinery, the Flint Hills refinery in North Pole, ended production in 2014.

Alaska Dispatch News

Energy

Alaska's Flint Hills refinery winds down operations ahead of closure

Dermot Cole | May 19, 2014

NORTH POLE -- Oil refining in North Pole won't come to a sudden halt this weekend when the Flint Hills Refinery stops taking crude oil from the trans-Alaska pipeline, but it will mark the end of an era.

After 37 years, Alaska's largest refinery is scheduled to stop taking oil from the pipeline as of 8 a.m. Saturday, but it won't be like flipping a switch, say longtime refinery employees Shaun Coghill and Mike Shefchik.

RELATED:

Flint Hills halts gasoline production at North Pole refinery

Flint Hills refinery must overcome bureaucratic finger-pointing to find a buyer

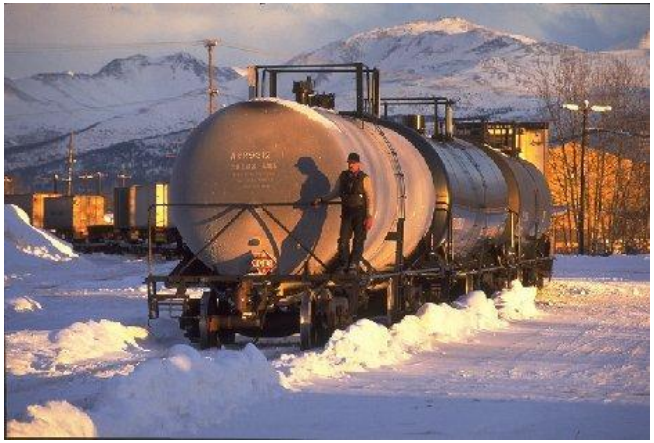
"It takes a couple of days to do it right. You have flows and temperature that you need to step down in a controlled manner," said the 32-year-old Shefchik, a 12-year employee who began as an intern and is now an operations manager.

Contract employees and staff members are decommissioning the Flint Hills refinery in North Pole in advance of its weekend shutdown.

Dermot Cole

The Flint Hills refinery produced mainly jet fuel which was shipped to Anchorage by railroad for use at the Anchorage International Airport. Flint Hills closed the refinery for several reasons including the high costs of operations and an expensive clean-up of contamination of the local groundwater caused by the refinery's previous owner.

These are tanker cars which were used to ship petroleum products on the Alaska Railroad. The Flint Hills jet fuel shipping had been one of the largest contracts of the Alaska railroad and the closure of the refinery was a major economic blow to the railroad.

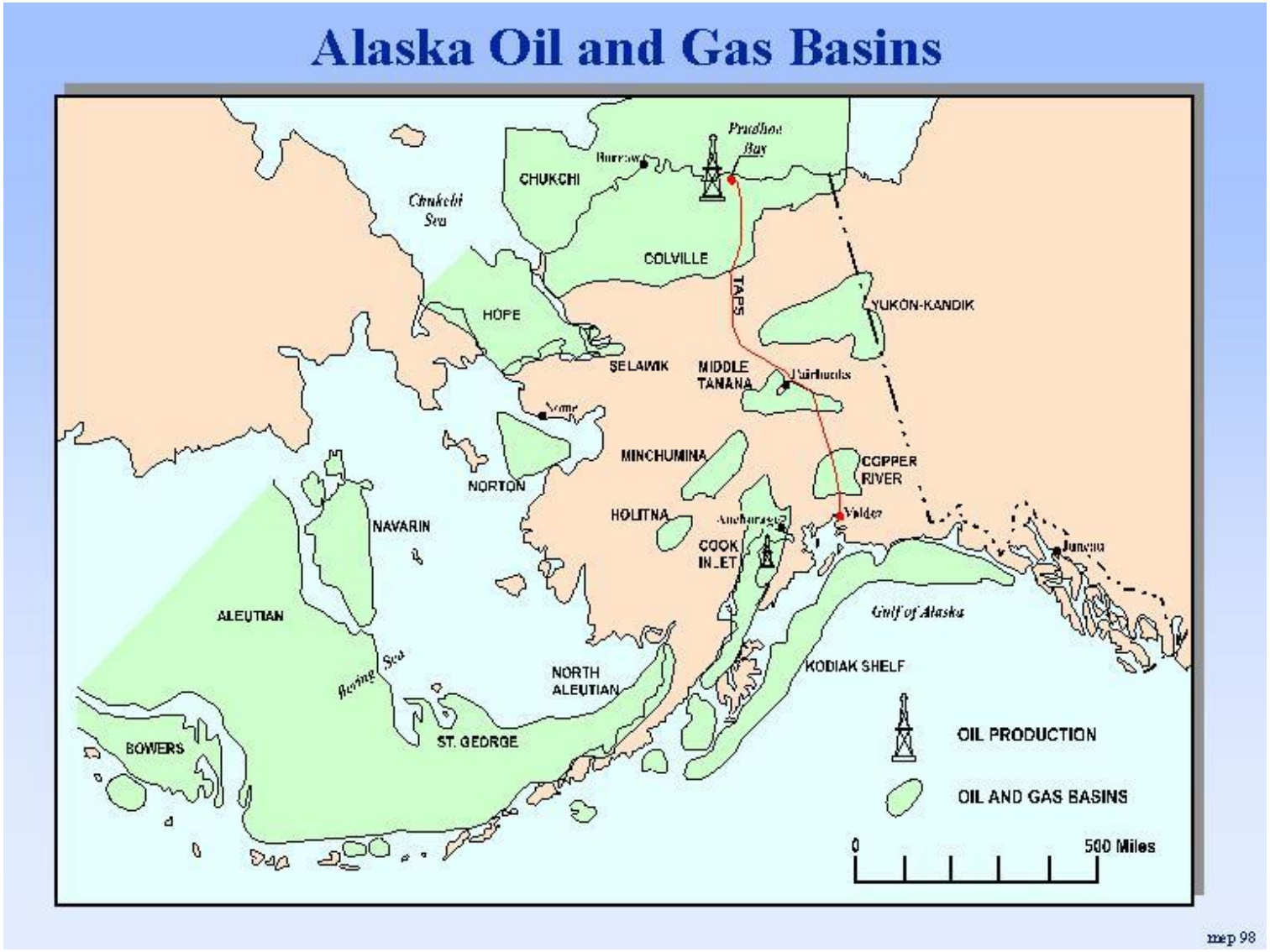


Source: http://www.alaskarails.org/fp/tankcars/arr-tanks.jpg; http://www.alaskarails.org/fp/tankcars/JC-tank-1.jpg

The Petro Star Refinery at Valdez

Source: http://www.netl.doe.gov/technologies/oil-gas/Petroleum/projects/Environmental/Petroleum_Refining/Images/Refinery%20&%20Abercrombie.jpg.

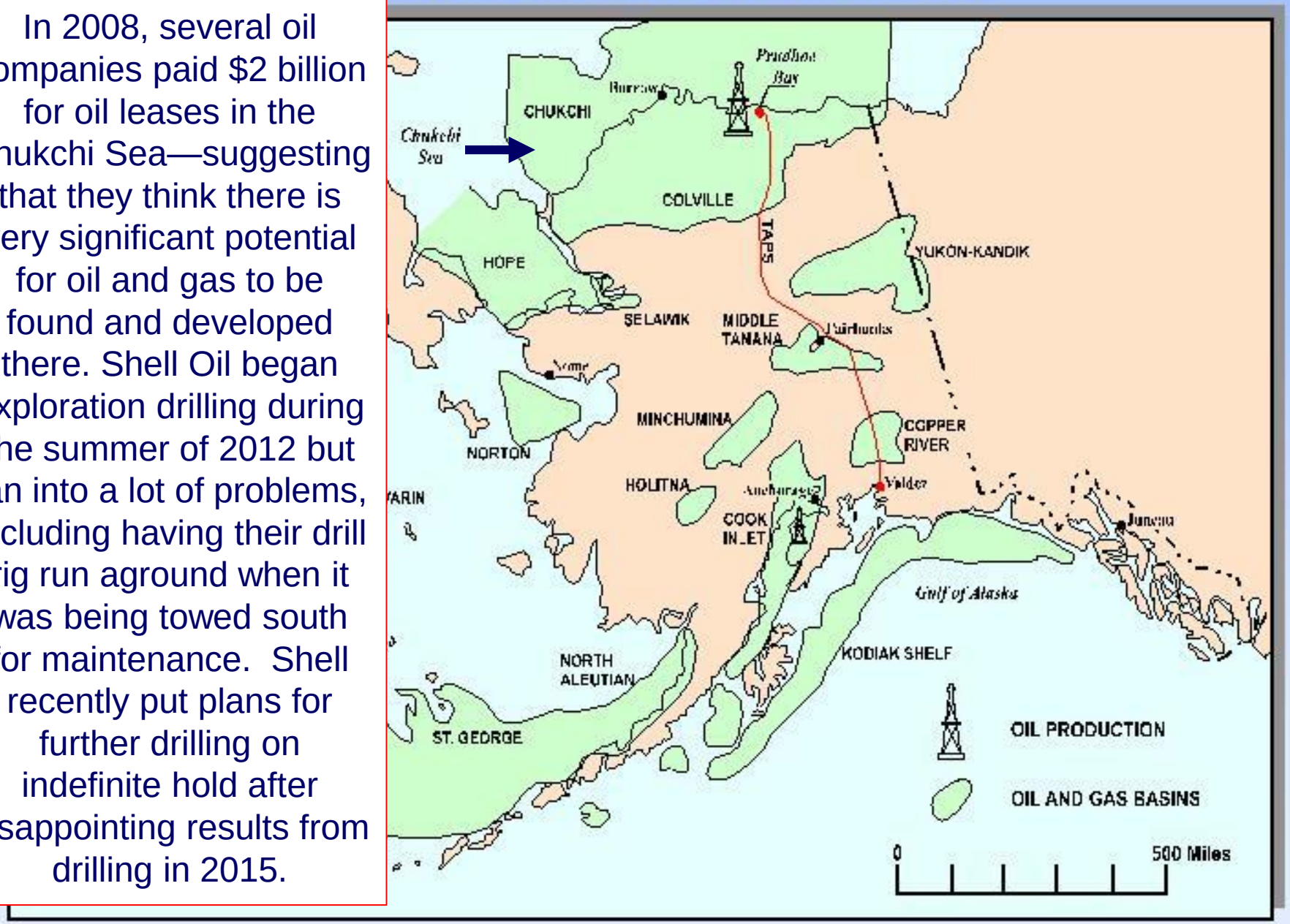
Beyond the North Slope and Cook Inlet, Alaska has numerous other areas with oil and gas potential.



A significant amount of exploration for oil has occurred in parts of Alaska other than Cook Inlet and the North Slope, including offshore exploration in the Gulf of Alaska, the Bering Sea, and most recently the Chukchi Sea. This exploration has resulted in some discoveries, but no significant development has occurred. I took this picture of an offshore oil exploration rig near Dutch Harbor in the early 1980s.

Alaska Oil and Gas Basins

In 2008, several oil companies paid $2 billion for oil leases in the Chukchi Sea—suggesting that they think there is very significant potential for oil and gas to be found and developed there. Shell Oil began exploration drilling during the summer of 2012 but ran into a lot of problems, including having their drill rig run aground when it was being towed south for maintenance. Shell recently put plans for further drilling on indefinite hold after disappointing results from drilling in 2015.



Units for measuring oil and gas

- Oil reserves and production are typically measured in millions of barrels

- Gas reserves and production are typically measured in billions of cubic feet

- Gas reserves are sometimes described in units of barrels of oil equivalent (BOE). One barrel of oil has about the same energy as 6,040 cubic feet of gas. So one million barrels of oil has about the same energy as 6.04 billion cubic feet of gas.

I made the following slides in 2009
to contrast four kinds of Alaska oil and gas production:

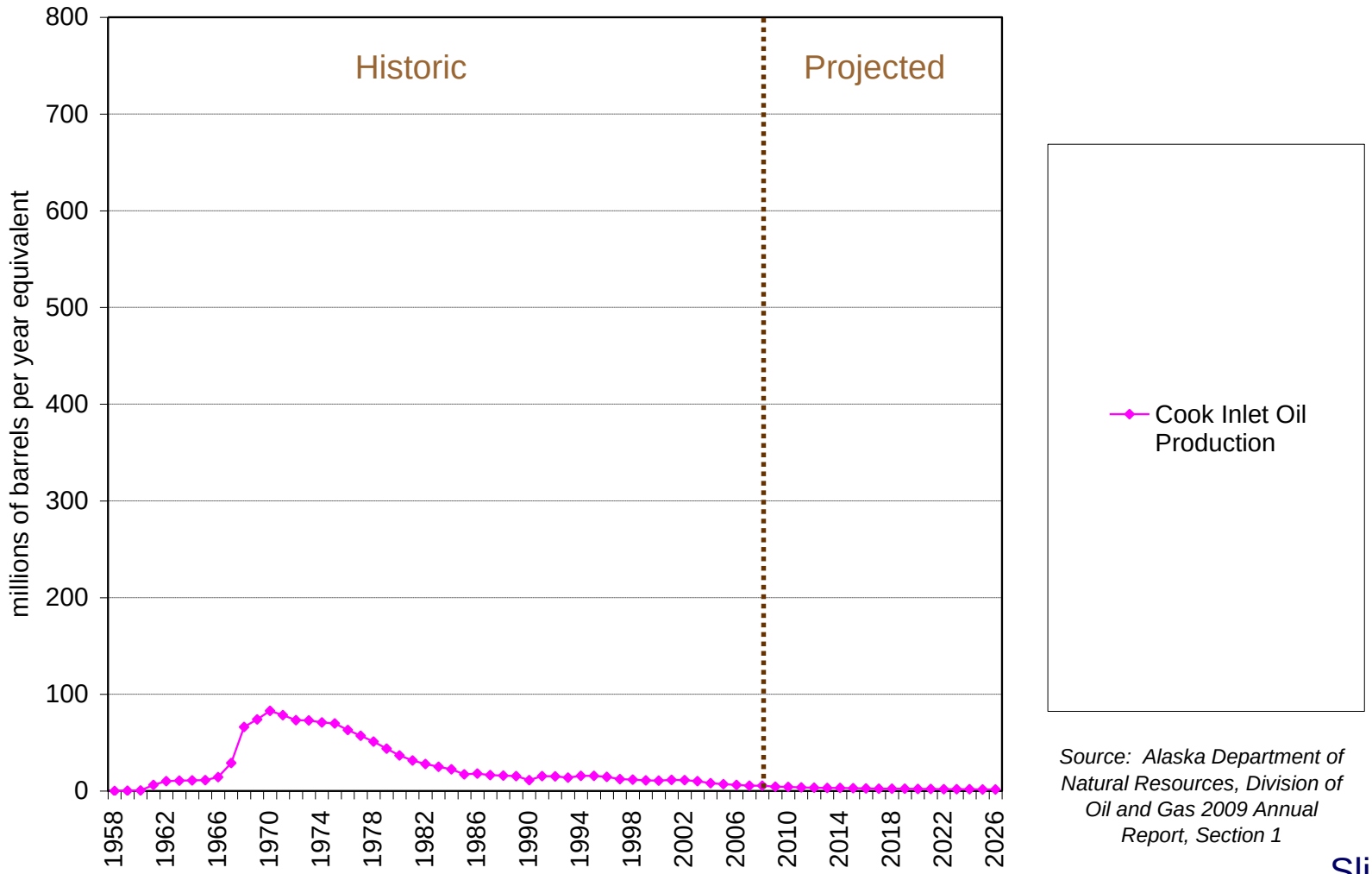
Cook Inlet oil production
Cook Inlet natural gas production
North Slope oil production
North Slope natural gas production

The recent and projected production numbers are out of date,
but the general magnitudes are still the same.

The next five graphs show trends over time
in five components of Alaska oil and gas production.

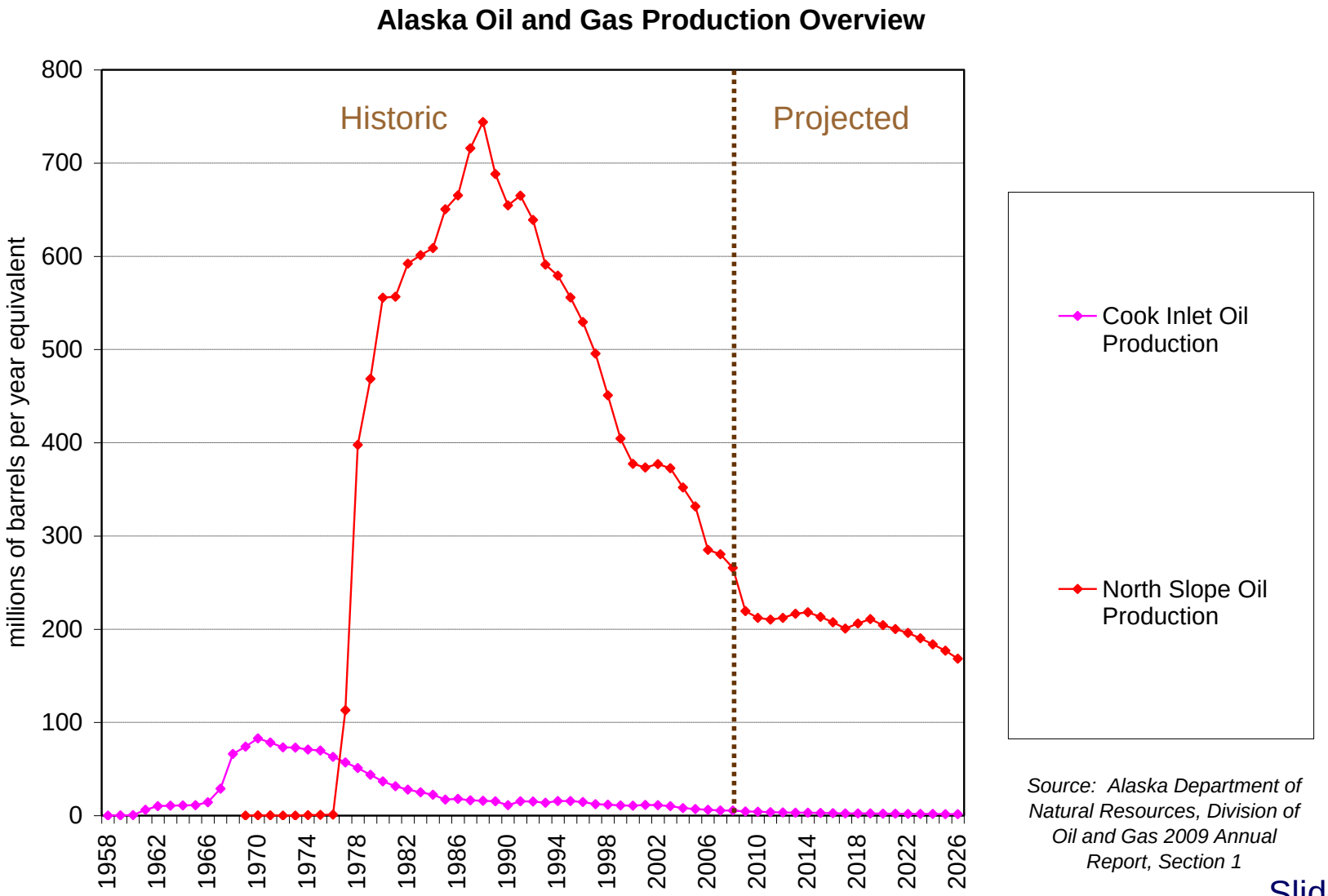
Cook Inlet oil production began in the late 1950s,
peaked in 1970 at 80 million barrels per year,
and is now only 5 million barrels per year.

Alaska Oil and Gas Production Overview



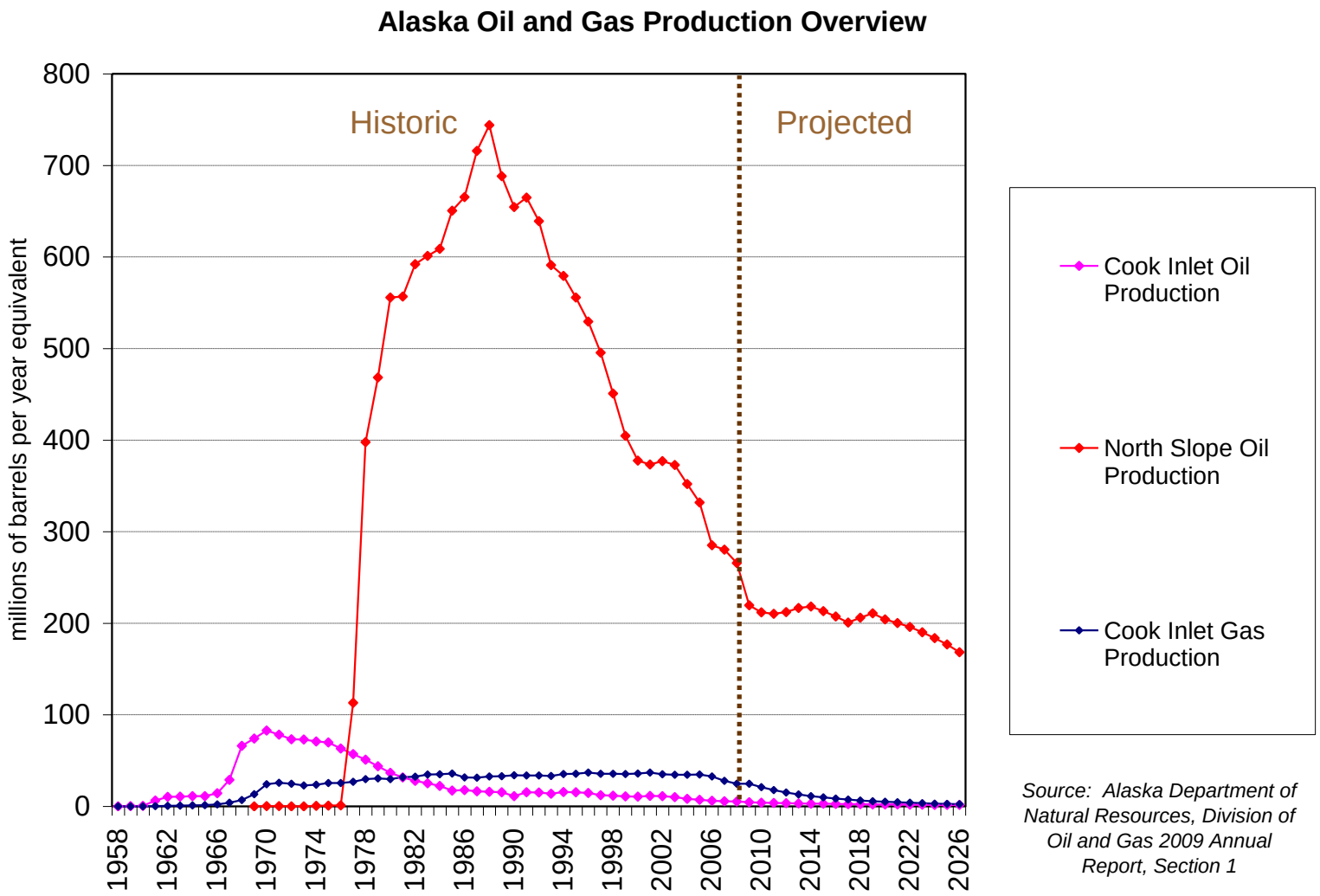
Source: Alaska Department of Natural Resources, Division of Oil and Gas 2009 Annual Report, Section 1

North Slope oil production began in 1977 and grew very rapidly to a peak of 750 million barrels per year (more than 2 million barrels per day) in 1988. It has since declined to less than 300 million barrels per year and is projected to continue to decline in the future—a big cause for concern!



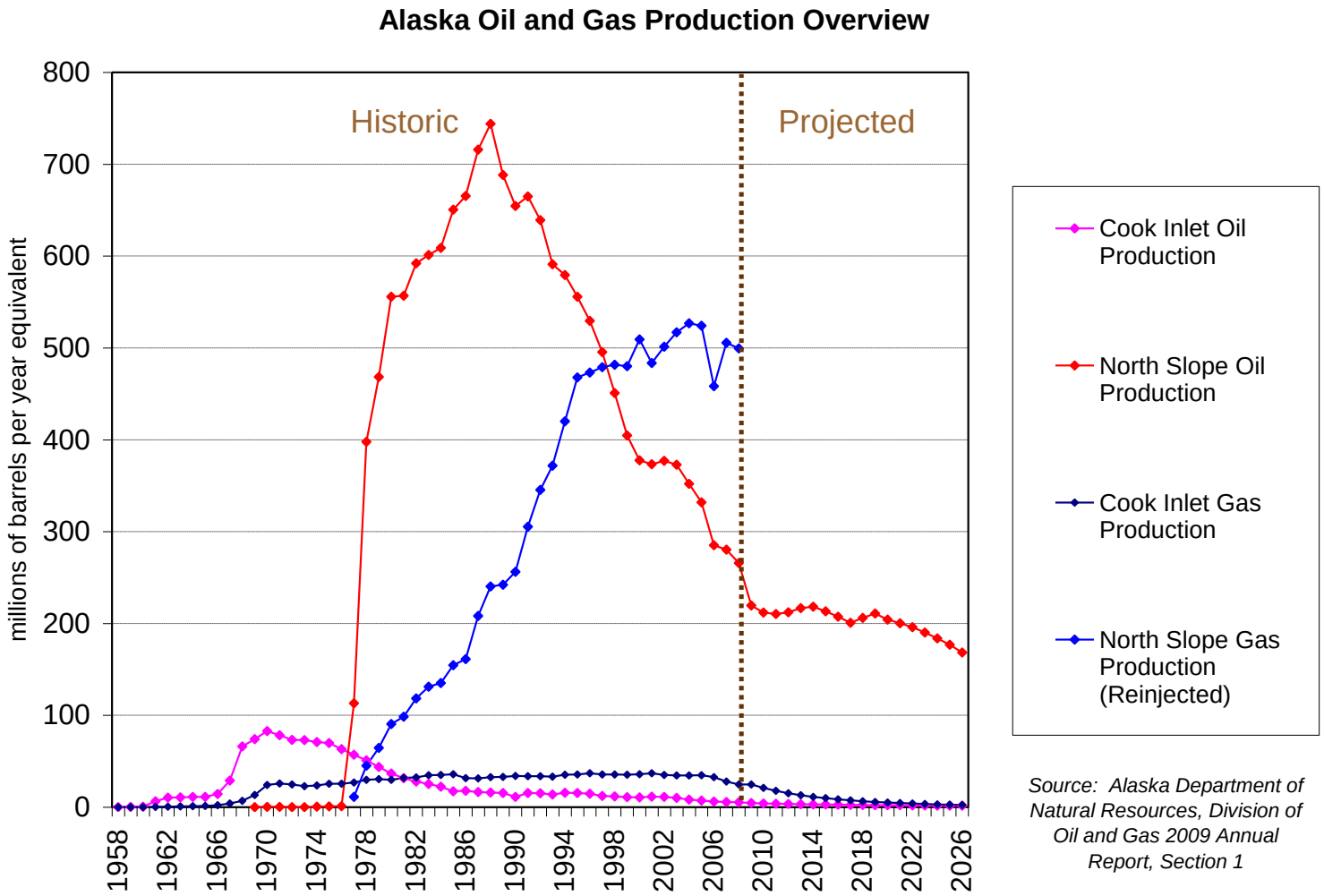
Source: Alaska Department of Natural Resources, Division of Oil and Gas 2009 Annual Report, Section 1

Expressed in barrels of oil equivalent, Cook Inlet gas production is relatively small compared to North Slope oil production. But it is very important as an energy source for southcentral Alaska. Cook Inlet gas production has been relatively stable for several decades, but it is projected to decline in the future—another cause for concern!



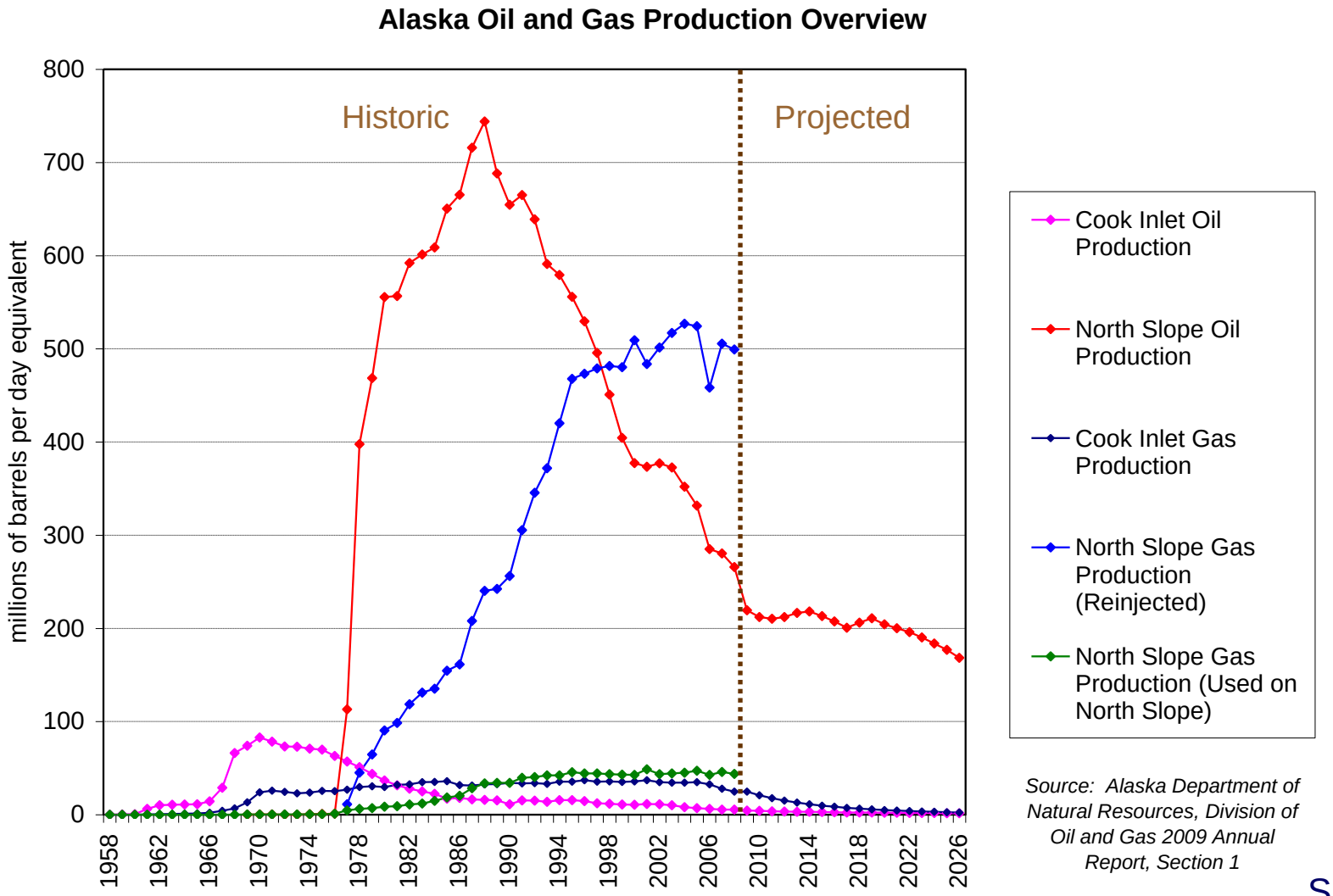
Source: Alaska Department of Natural Resources, Division of Oil and Gas 2009 Annual Report, Section 1

There is very large natural gas production on Alaska's North Slope. The gas comes out of the oil wells mixed in with the oil. But there is no way to ship it to a market and sell it. So most of it gets reinjected back into the ground, where it is stored for the future and helps keep up pressure in the oil fields.



Source: Alaska Department of Natural Resources, Division of Oil and Gas 2009 Annual Report, Section 1

Some of the North Slope natural gas is used on the North Slope to generate electricity to power the North Slope operations.



Source: Alaska Department of Natural Resources, Division of Oil and Gas 2009 Annual Report, Section 1

This table summarizes the most important things you will need to learn about Alaska's oil and gas industry.

Don't worry if this table looks confusing at first! The next few slides will explain the most important things in the table. The rest of the material presented for this topic will help you understand the details.

Resource	Location	Volume of original resource	Scale of production	Historic production trend	How is it used?	Future production
Oil	North Slope	Very large (world-scale)	Very large (world-scale)	Began in 1977 Peaked in 1988 Declining since 1988	Mostly shipped by pipeline and tanker to U.S. west coast A small share is refined in Alaska	Continued decline likely
	Cook Inlet	Much smaller	Much smaller	Began in 1958 Peaked in 1970 Declining since 1970		Continued decline likely
	Other Alaska	Unknown, potentially very large				Unknown; many years away
Natural Gas	North Slope	Very large (world-scale)	Very large but mostly reinjected into the ground		Small share used for energy for North Slope operations	Could be very large if a gas pipeline is built
	Cook Inlet	Much smaller	Much smaller	Began in 1961 Leveled out since 1990s	Major energy source for southcentral Alaska Some industrial products exported	Projected to decline sharply (causing concern in southcentral Alaska)
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Alaska produces both OIL and NATURAL GAS.

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There are two major producing areas: The NORTH SLOPE and COOK INLET.

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The NORTH SLOPE resources of oil and gas are very large (world scale).
The COOK INLET resources are much smaller (but still significant)

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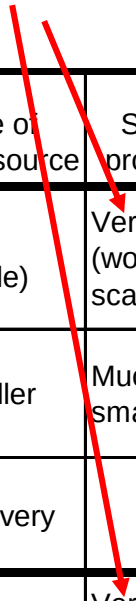
The NORTH SLOPE produces only oil.

There isn't any gas pipeline to bring the North Slope oil to market. So even though a lot of gas comes out with the oil, most of it is reinjected back into the ground. (A small share is used to provide energy for the North Slope operations).



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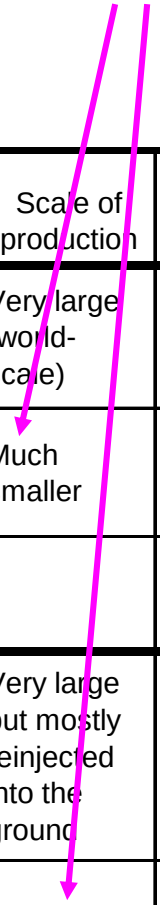
Unlike the North Slope, COOK INLET produces both oil *and* gas.



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The NORTH SLOPE oil production is mostly shipped out of Alaska.
A significant share of COOK INLET gas is used in Alaska—and provides a significant share of the energy consumed in southcentral Alaska.

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NORTH SLOPE oil production is declining..
This is a major concern because most of Alaska's oil revenues depend on North Slope oil production!

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COOK INLET gas production had been declining until recently. This was a major concern because southcentral Alaska gets much of its (relatively cheap) electricity and heating from Cook Inlet natural gas. However, recent discoveries have helped boost production.

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