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

Research and Monitoring Prioritization for the NSSI

Commodity prices and demand | Coal, minerals and metals

Summary

Large coal deposits remain worldwide, with the largest share in the United States—and one third of U.S. coal on Alaska's North Slope. Demand for coal is expected to increase until the 2030s, driven mainly by energy-intensive industrialization in China and India. But the growth in coal use, particularly for generating electricity, is slowing. China's economic structure is changing, from a producing to a service and consumption-oriented economy which will likely be less energy-intensive in the future. Despite depressed coal prices, coal is not expected to see an uptick in demand. The remoteness from markets and high development costs for Arctic coal are working against its development, given the global abundance of coal and the projected drop in demand over time. However, potential opportunity exists for coal-to-liquids development coupled with carbon sequestration and enhanced oil recovery in oil reservoirs on the North Slope. The Arctic Slope Regional Corporation (ASRC) is the largest Native-owned business in the region and one of the financially strongest Native organizations in Alaska. ASRC owns vast land holdings with untapped resources including coal. Other mineral resources known to occur in the North Slope Borough include significant polymetallic deposits and base metal deposits. Most of the areas where significant mineral deposits occur are, however, currently off-limits to mining development.

Demand and prices of coal and mineral commodities on the North Slope may drive industry to explore the potential for production of mineral resources. However current regulations, limited supporting infrastructure, high cost for extraction and the availability of mineral resources elsewhere may limit coal and mineral development activity in the near-term on the North Slope.

Overview

Coal remains the dominant source for power worldwide. Total worldwide coal deposits are extensive enough to last more than 120 years at current consumption rates. Coal deposits are found worldwide, so very little is being traded on a global scale; most coal consumption is associated with local rather than global supplies (1, 4). The United States has one-quarter of proved reserves worldwide—the most of any country—and one third of those U.S. reserves are estimated to lie within the Northern Alaska Coal Province (1, 6).

Since 2000, China's energy-intensive industrialization has been the main driver of global coal consumption and production. Coal is used to meet two-thirds of China's energy demand, and because it has abundant reserves, China is also the world's largest coal producer, mining three times more coal than the United States (1).

Compared with natural gas, which is the cleanest fossil fuel, coal is environmentally problematic. Coal contains mercury, and emits more than twice the carbon dioxide and five times the carbon monoxide and nitrogen oxides as natural gas. It also contains almost three thousand times the sulfur dioxide and particulate matter per energy unit (5). In addition, the generation of coal to liquids has the highest life-cycle production-to-refining emissions of any fossil fuel (3).

Worldwide, many major coal-burning countries see their dependence on coal as a problem (4). The Chinese want to fight air pollution and phase in cleaner fuels (1, 4). The transition from coal to natural gas is ongoing in the U.S. power sector, and the use of gas in the United States is likely to continue to grow.

Coal prices are expected to stay depressed, and demand is unlikely to increase over the long term (Fig. 4) (1). But coal remains indispensable for the world's most populous countries, particularly India (Fig. 3).

Other mineral resources known to occur in the North Slope Borough include significant polymetallic deposits and base metal deposits including copper, lead, and zinc. Most of these areas are currently off-limits to mining development (7).

Trends

Non-coal minerals: While the U.S. demand for raw materials have shown continued increasing trends (10) the commodity prices for three potential metal resources on the North Slope (zinc, lead and copper) have not shown predictable trends. Demand for mineral resources changes as technology and manufacturing trends allow substitution of raw materials that may be cheaper or better functionally better suited (10) (e.g. replacing copper with aluminum in electrical transmission lines).

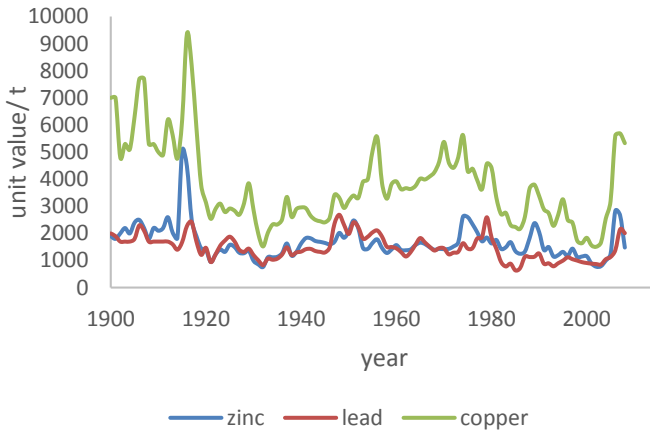

Figure 1. Trends in commodity prices for zinc, lead and copper. Prices are listed per metric ton in 1998 dollars. Source: USGS Historical Statistics for Mineral and Material Commodities

Coal: The U.S. Energy Information Administration forecasts coal prices, and the agency's reference case projects that average coal prices at the mine mouth will rise with inflation. Under that projection, coal prices would continue on a flat trend in real (inflation-adjusted) dollars (5).

Globally, coal is expected to remain the largest source of power through 2035, but to lose market share over time. Worldwide, the power sector accounts for a growing share of total energy demand, but the use of coal in that sector is predicted to decline (2, 3, 4). Among fossil fuels, gas remains the fastest growing energy source, with slower growth rates projected for both oil and coal. Global coal prices have been depressed, and they are expected to remain flat, for several reasons. U.S. gas prices are likely to remain subdued for some time (see oil & gas factsheet), and the U.S. electricity industry faces increasingly tight emission standards which is expected to lead to decommissioning of a number of U.S. coal power plants.

This trend is also observable in other developed countries of the Organization for Economic Co-operation and Development (OECD). China—currently the largest coal producer and consumer worldwide (Fig. 3)—is expected to see economic change that will affect global coal demand. China's economy is expected to switch from energy-intensive industrialization toward services and domestic consumption. Also, more stringent environmental regulation is already underway in China, and will likely become more prevalent as the country fights air pollution. India, by contrast, is expected to continue its coal-driven industrialization. North Slope coal is lower in sulfur than many other coal reserves which may affect potential demand for coal from this region.

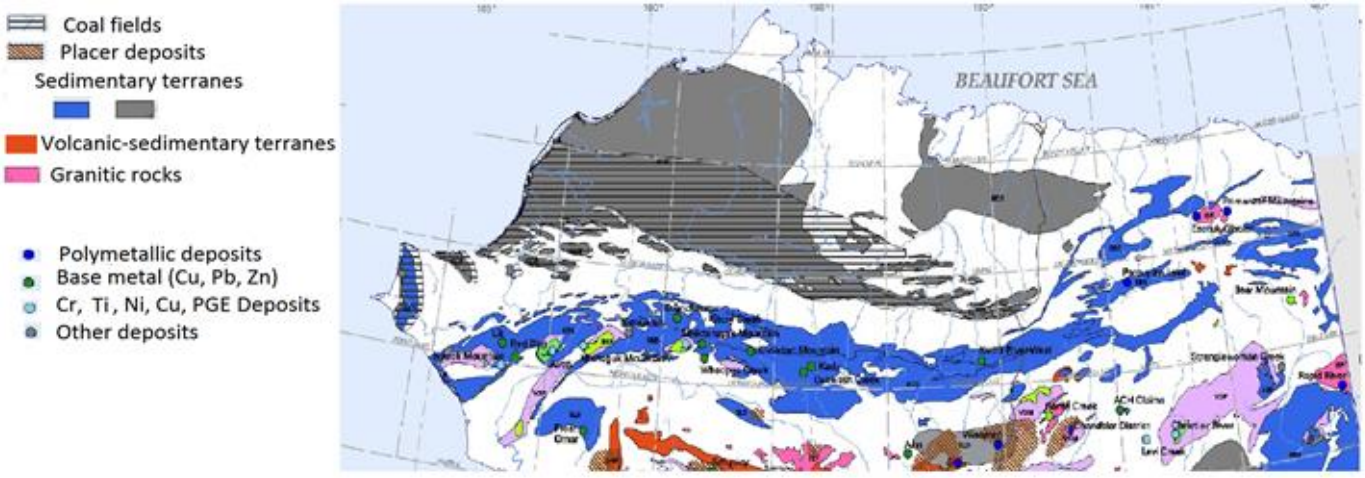

Figure 2. Prospective mineral areas and mineral resources of Alaska. Source: Adapted from Alaska Department of Natural Resources Division of Geological and Geophysical Surveys maps

Other factors may also affect potential coal development on Alaska's North Slope. These factors include the distance from markets and high development costs due to the remoteness and harsh climate of the region, the technical challenges of coal mining in a thick permafrost setting, as well as the cost of developing resources in environmentally sensitive areas. By the end of the 2030s, non-fossil fuels will contribute more than 39 percent of the growth in energy. Carbon-free sources are expected to increase their combined share of power generation in the coming decades, and are likely to overtake nuclear energy as a source of power generation at the end of the next decade (2, 5).

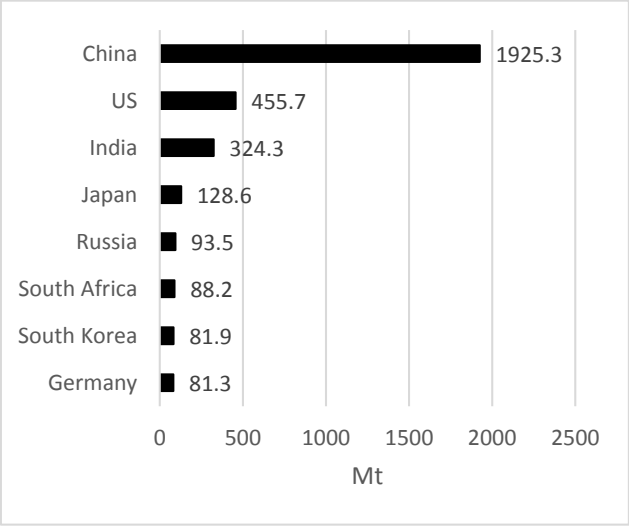

Figure 3. The world's largest coal consumers in 2013 in metric tons. Source: BP Statistical Review of World Energy 2014.

Uncertainties

Energy market projections are subject to much uncertainty, and events that shape energy markets often cannot be anticipated. Also, future developments in technologies, demographics, and resources cannot be foreseen with certainty. For example, large uncertainties remain about whether carbon-capture technology will be economically successful (2, 3, 4). Thus, the promise of *clean coal* (that is, coal or the derivatives of coal such as coal to liquids with substantially reduced emissions) remains a large uncertainty. However, on the North Slope, coal-to-liquids development, even though speculative, could offer several opportunities including the application of carbon sequestration at a coal-to-liquids plant in conjunction with enhanced oil recovery in existing oil fields, and the use of the Trans Alaska Pipeline System to get coal-to-liquids to market (8,9).

The coal share of world energy demand is affected by traded coal, prices, country-specific emission standards, carbon pricing, and taxation. Imposition of a price on carbon would have a negative effect on coal and coal-to-liquids pricing and could ultimately decrease demand for both commodities (4).

Even though major energy companies believe that stronger incentives are needed to curb greenhouse gas emissions, limited progress has been made and policy incentives remain weak.

Combustion of fossil fuels is related to climate change, with increasing climate change risks. The current growth in energy demand based on fossil fuels is unsustainable (2, 5). The extent to which nations act to curb greenhouse gas emissions—through carbon pricing for example—will affect global demand for fossil fuels and define the extent of what will be considered "stranded" oil and gas resources.

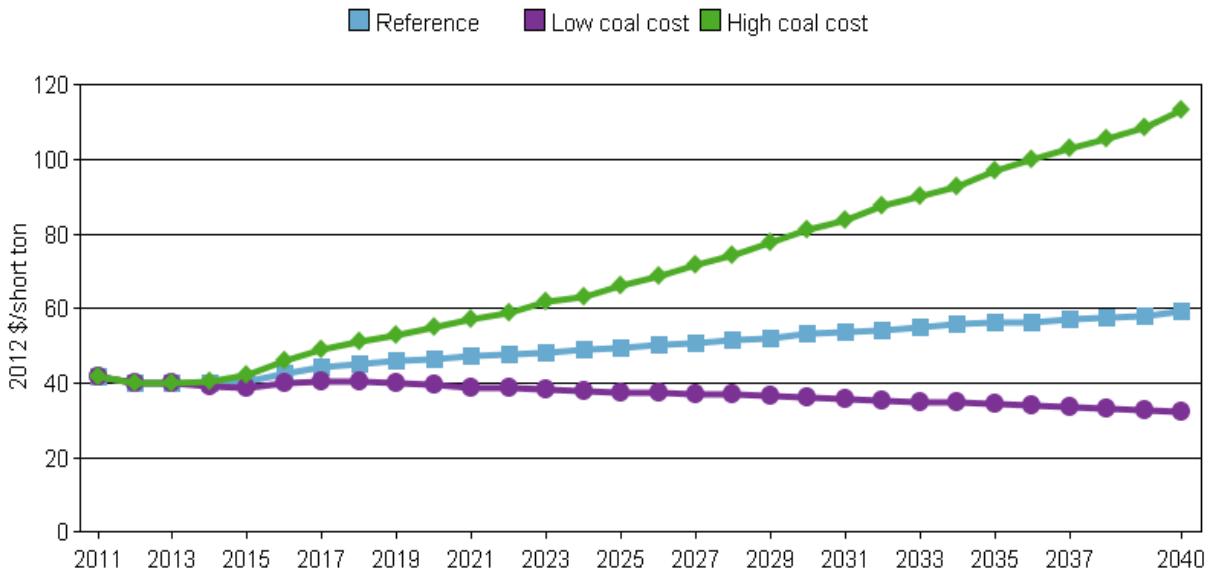

Figure 4. United States average coal prices forecast. Source: U.S. Energy Information Administration.

Analysts expect carbon capture and storage technologies to be developed and applied, but that they will have limited effect on reducing carbon dioxide emissions before 2040 (2, 4, 5).

Mining of rare earth elements is gaining increasing interest in other Arctic countries and has been related to increases in the number of mineral exploration licenses sought in Greenland (11). High demand for valuable mineral resources such as rare earth elements may increase mining exploration interest which may lead to future development of North Slope mineral resources.

Driver interactions

The demand for coal is closely tied to its substitutes, the closest one being gas; the two fuels dominate the power sector. Use of gas is likely to continue to grow at the expense of coal, even though the use of renewable energy sources is also growing. In the U.S. power sector, gas remains competitive with coal, leading to a nationwide transition away from power plants fired by coal to those fired by natural gas, particularly as older coal plants are replaced and emission standards are tightened.

Oil has for decades provided an economic base for the North Slope Borough, but oil production from the North Slope has been declining. The borough will increasingly look for ways to diversify its economic base. The Arctic Slope Regional Corporation (ASRC) is the largest Native-owned business in the region and one of the financially strongest Native organizations in Alaska. ASRC owns vast land holdings with untapped resources including coal.

Resource extraction through mining activities on the North Slope will be closely linked to changes in regulations that currently limit activities. Policies and environmental regulations in turn could be affected by increasing demand and prices of commodities that increase industry interests in mineral extraction on the North Slope. Expansions in existing transportation infrastructure and climate change may also affect the feasibility of greater mineral development on the North Slope.

References

1. BP (2014a). *BP Statistical Review of World Energy 2014*. Retrieved from http://www.bp.com.
2. BP (2014b). *BP Energy Outlook 2035*. Retrieved from http://www.bp.com.
3. International Energy Agency (2014). *Tracking Clean Energy Progress 2014*. Retrieved from http://www.iea.org.
4. Statoil (2014). *Energy Perspectives – Long-term Macro and Market Outlook June 2014*. Retrieved from http://www.statoil.com.
5. U.S. Energy Information Administration. (2014). *Annual Energy Outlook 2014 with Projections to 2040*. Retrieved from www.eia.gov.
6. United States Geological Survey (2011). *Coal Database for Cook Inlet and North Slope, Alaska*. Data Series 599.
7. Alaska Department of Natural Resources, Division of Geological & Geophysical Surveys (1999) Geologic Data Modeling System, Map of prospective mineral areas and significant mineral resources of Alaska. Miscellaneous publication 38
8. Fay, G. and Schwörer, T. (2011). Economic viability of CO2 Sequestration Technology in Alaska: How much would Carbon Capture and Storage add to the per-gallon-cost of producing liquid fuels from coal? Institute of Social and Economic Research. Unreleased.
9. Craddock,W.H. et al. (2014). Geologic Framework for the National Assessment of Carbon Dioxide Storage Resources – Alaska North Slope and Kandik Basin, Alaska. U.S. Geological Survey.
10. Sznopek, J.L., (2006) Drivers of U.S. mineral demand: U.S. Geological Survey Open-File Report 2006–1025, 12 p.
11. Mining in the European Arctic. (2014). Retrieved from: http://www.arcticinfo.eu/images/Facksheet/Factsheets_Final/mining_factsheets_final.pdf

For more information please contact:

Dr. Olivia Lee | UAF - PI
olivia@gi.alaska.edu
(907) 474-6832
http://accap.uaf.edu/?q=projects

Dr. John Payne | Director, NSSI
jpayne@blm.gov
(907) 271-3431

Dr. Denny Lassuy | Deputy Director, NSSI
dlassuy@blm.gov
(907) 271-3212

Dr. Juan Carlos Vargas | GeoAdaptive Principal
jcvargas@geoadaptive.com
(617) 227-8885
www.geoadaptive.com

www.northslope.org