Quantifying coal: How much is there?

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1/8th of the world's coal?

An oft-quoted statistic is that Alaska has 1/8th of the world's coal, around 1/2 of the total from the US. This may well be the best available estimate of Alaska coal **resource** , but it relies on tenuous assumptions and incomplete information. There is no current estimate of world coal **resources** , but the US has about 1/4 of the world's coal **reserves** , and the ratio of coal **resource** may be similar. Also, no single study compares coal **resource** in Alaska to the rest of the US, but comparing a 2005 study of Alaska resources to a 1967 study of US **resource** suggest Alaska has about 1/2 of the coal in the US. If both of these comparisons are accurate, then Alaska's 1/2 of the US's 1/4 of world coal, or 1/8th of the world's coal.

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These assumptions make possible an estimate, but add a great deal of uncertainty, so the real number could be larger or smaller by a significant margin:

_Alaska has 1/2 of the US _resource__ : The two studies in this comparison were conducted with different methodology and decades apart, so a more consistent approach could shift this number either up or down.

_The US has 1/4 of the World _resource__ : This assumes that the resource/reserve ratio is the same for the US as for the rest of the world. However, this ratio is largely a function of how well studied and developed coal is in a given region. If most of the world, like the US contiguous states, is well surveyed for coal, then the US likely has more than 1/4 of the world's coal **resource** since Alaska is poorly studied. If instead most of the world is little studied like Alaska, then the US likely has less than 1/4 of the world's **resource**.

(2012 update: This 1983 publication (http://www.dggs.alaska.gov/pubs/id/464) also claims that Alaska has 1/6th of the world's coal based on a resource-resource comparison. However, it doesn't cite the data used to arrive at this conclusion)

How much coal is there?

And how much of that coal is economically practical to mine?

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The short answer for Alaska: There is only a few percent of the nation's recoverable reserves in Alaska, but there is a vast but little explored coal resource in the arctic that may mean Alaska has half or more of the coal in the US.

The details are complicated, depending not only on the underlying geology, but also on coal prices, mining technology, subsidies, politics, and potential cap-and-trade or carbon tax schemes.

Geologically, coal is far more abundant worldwide than either oil or natural gas. However most of the data available quantifies coal recoverable reserves - that portion of a region's coal deposits that are well-mapped and also determined to be economically mineable under current conditions. There are vast coal deposits not included in these calculations, including many of those in Alaska, Russia, and China. In the past 30 years, new studies and measurements have shown a dramatic increase in the amount of coal known to be present in Alaska, particularly in the Western Arctic (WesternArcticCoalDeposits.html). These remote deposits have only been poorly explored, and it is unknown how much of this coal will prove to be economically feasible to mine.

Note: Before reading this page we recommend you first read our companion articleCoal Resource and Reserve Terminology (CoalTerminology.html). All terms and concepts related to coal resources and reserves are discussed there. If you move your mouse over terminology in this article, a brief definition will appear (in most browsers.) All statistics from the US have been

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converted from short tons to metric tons. Also check out our new (March 2013) article "Alaska Coal Resource: Potential for Future Development (/Issues/AlaskaCoal/alaska-coal-resources-reserves-export-carbon-dioxide.html)"

World Coal Resources and Reserves

During the 1973-74 OPEC oil crisis (http://en.wikipedia.org/wiki/1973_oil_crisis) there was a flurry of renewed interest in calculating American and worldwide coal resources. The coal resource-related terminology and definitions (CoalTerminology.html) in use today date largely from that period. At the time it was not uncommon to estimate the world's total coal resource, including estimates from the USGS of 14.5 trillion tons (1975) (http://pubs.er.usgs.gov/usgspubs/b/b1412), and the World Energy Council (http://www.worldenergy.org/) (WEC) of 10.8 trillion tons (1974).

Nowadays, estimates are only given for worldwide recoverable reserves , or "proved reserves." These estimates are largely based on voluntary reporting from most of the world's 70 coal-containing countries, supplemented with publicly available data for countries that either don't report or are not members of the WEC. Recent estimates hover around 840 billion tons (http://www.worldenergy.org/wp-content/uploads/2012/10/PUB_Survey-of-Energy-Resources_Interim_update_2009_WEC.pdf). However, this data doesn't include proprietary exploration data (http://

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books.nap.edu/openbook.php?record_id=11977&page=52) by mining companies, and each country may define recoverable reserves in a different manner.

US and Alaska Coal Reserves

The most recent estimate from the WEC places US recoverable reserves at 243 billion tons (http://www.worldenergy.org/documents/coal_1_1.pdf). This represents over 1/4th of the world total of 840 billion tons. Of those US reserves, a 1975 USGS assessment (http://pubs.er.usgs.gov/usgspubs/b/b1412) of coal resources in the US found Alaskan recoverable reserves (5.3 billion tons) to be about 3% of the total US recoverable reserves at the time (192 billion tons). Similarly, the EIA arrived (http://www.eia.doe.gov/cneaf/coal/page/acr/table15.pdf) at a figure of around 1% using data from 2008.

US and Alaska Coal Resources

In 2005, a group of USGS geologists prepared a detailed summary of existing data and estimates concerning coal in the three major coal fields in Alaska; “Northern Alaska - Slope” (the location of the Western Arctic coal fields (WesternArcticCoalDeposits.html)), “Central Alaska - Nenana” (the location of Usibelli Coal Mine (UsibelliCoalMine.html)), and “Southern Alaska - Cook Inlet” (the location of the proposed Chuitna Coal Mine (ChuitnaCoalMine.html) and a proposed underground coal gasification (UndergroundCoalGasification.html) plant.) They

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estimate that these three coal fields contain 87% percent of the coal resources in Alaska. In this report they calculate the identified coal resource of Alaska to be 117-127 billion tons. This is very close to the 118 billion tons estimated by the USGS in 1975. However, the 2005 study estimates the hypothetical resource of these three coal basins to be 4.5-5 trillion tons of coal. In contrast the USGS in 1975 estimated the hypothetical resource of all of Alaska to be 118 billion tons for a total resource of around 236 billion tons.

The discrepency between Alaska's recoverable reserves as a proportion of US recoverable reserves (a few percent) and Alaska's total resource as a proportion of US total resource (over half) is dramatic.

How have Alaska's coal deposits multiplied 45 times in three decades?

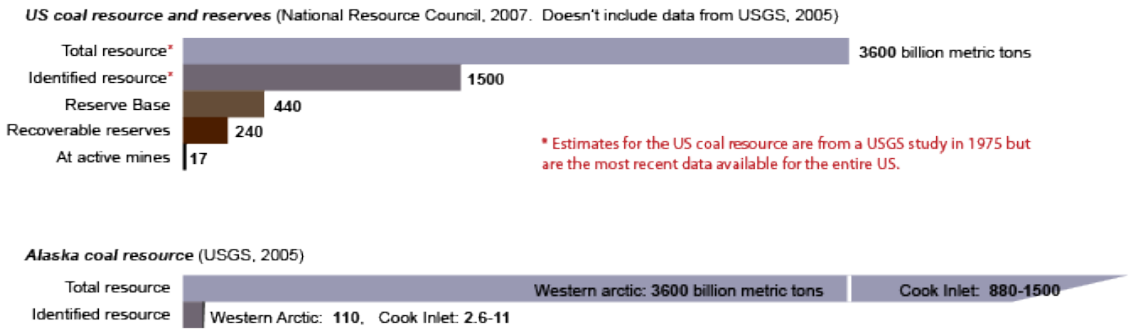
This discrepancy arises from two factors; the elasticity of coal-related terminology (CoalTerminology.html) and the addition of a large body of new data over the last 35 years. The first point concerns estimates of deep underwater coal in the Cook Inlet coal basin. In 1975 the USGS estimated that there might be up to 1.4 trillion tons of coal (http://www.dggs.dnr.state.ak.us/webpubs/dggs/aof/text/aof074.PDF) in this category. The vast majority of this coal was found at 5000-10,000 ft under the surface. The authors of this original study stressed that this coal was therefore classified as speculative resource , and that "much of this coal is not recoverable by known methods and

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technologies". However, the authors of the 2005 USGS assessment chose to classify this in the hypothetical resource of the state. This is primarily a question of semantics, since both studies agree the coal is present, and according to the USGS has been repeatedly confirmed by the large numbers of boreholes drilled in the search for natural gas in Cook Inlet (/Issues/AlaskaOilandGas/Natural-Gas-Cook-Inlet.html).

A 2013 report (/Documents/Alaska%20Coal%20Reserves_3-14-13.pdf) looked at the coal resources and reserves of several proposed coal projects in Alaska and found that hard numbers are difficult to pin down.

There's more coal in the arctic than we previously believed.



HOW MUCH COAL? (/figures/HowMuchCoal/) — How much coal is there?

Prior to the last couple decades, the last time Alaska's arctic was assessed for coal by the USGS was in a study in 1967 (http://pubs.er.usgs.gov/usgspubs/b/b1242B). At this time, the majority of the assessment was made by searching for coal

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outcrops on the surface. In the intervening decades a large number of oil shafts, boreholes, exploration shafts, etc. have been sunk throughout the North Slope and have basically all struck coal. The 2005 USGS assessment of the presence of up to 3.5 trillion tons of coal in the North Slope is based on a mapping of these sites, many of which are widely seperated1. This coal is definitely present, but the sparse mapping data causes it all to be classified as hypothetical resource. With further exploration, some of this coal could be reclassified as identified resource , and then potentially added to the reserve base.

Therefore an increase in available data has led to a dramatic change in the calculation of Alaska's hypothetical coal reserves. Additional data could further enlarge this estimate or reduce it. There are plans by the Alaska Division of Geological & Geophysical Surveys' (http://www.dggs.dnr.state.ak.us/) (DGGS) to update the Alaska portion of the USGS National Coal Database Resource System (http://energy.er.usgs.gov/products/databases/USCoal/) (NCRDS) which nominally contains all coal information for the US. However, the Alaska data has not been updated since the 1967 assessment.

On a similar note, the National Resource Council published the following nationwide recommendation in 2007: (http://www.nap.edu/catalog.php?record_id=11977)

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> “A coordinated federal-state-industry initiative to determine the magnitude and characteristics of the nation’s recoverable coal reserves, using modern mapping, coal characterization, and database technologies, should be instituted with the goal of providing policy makers with a comprehensive accounting of national coal reserves with 10 years.”

Economics of arctic coal development

There is a vast amount of coal in Alaska, primarily in the North Slope (WesternArcticCoalDeposits.html). However at present, almost none of this coal is classified within the recoverable reserves of Alaska or the US. This is fundamentally a question of economics since that is a defining factor in determining reserves. There are a number of reasons why coal in Alaska is less attractive from an economic perspective than for example the massive Powder River coal basin (http://en.wikipedia.org/wiki/Powder_River_Basin) in Montana/Wyoming. These restrictions include a lack of infrastructure, lack of transportation (primarily railroads and ice-free ports), and difficulties associated with climate. In particular the permafrost is problematic both because of logistical issues and from the perspective of mining reclamation (CoalMineReclamation.html). However the impacts of climate change in Alaska may in the future both reduce the amount of permafrost and open up new shipping passages.

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The current economic considerations of coal development in Alaska have been highlighted by the fact that over the course of the last few years, the mining giant BHP Billiton (BHPB) has been exploring coal deposits on the North Slope as part of the Western Arctic Coal project in conjunction with the Arctic Slope Regional Corporation (ASRC).

However, in September of 2009 the company terminated its agreement with ASRC stating that:

> "…while the Western Arctic Coal Project (WesternArcticCoalDeposits.html) holds large coal resource potential, BHPB's internal economic hurdles required for long-term development were not being met within today's financial environment"

References

1 Sable, E.G., and Stricker, G.D., 1987, Coal in the National Petroleum Reserve in Alaska (NPRA)–Framework geology and resources, in Tailleur, I.L., and Weimer, Paul, eds., Alaskan North Slope geology: Bakersfield, Calif., Pacific Section, Society of Economic Paleontologists and Mineralogists Special Publication 50, p. 195-215.

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Further Reading

> Coal Resources of the United State (USGS 1974) (http://pubs.er.usgs.gov/usgspubs/b/b1412)

> World Energy Council Survey of Energy Resources 2009 Interim Update (http://www.worldenergy.org/wp-content/uploads/2012/10/PUB_Survey-of-Energy-Resources_Interim_update_2009_WEC.pdf)

> Coal: Research and Development to Support National Energy Policy (National Resource Council 2007) (http://www.nap.edu/catalog.php?record_id=11977)

> The National Coal Resource Assessment Overview (USGS, 2009) (http://pubs.usgs.gov/pp/1625f/)

> Alaska Coal Geology, Resources, and Coalbed Methane Potential (USGS, 2005) (http://pubs.usgs.gov/dds/dds-077/)

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