ALASKA COAL AND CARBON DIOXIDE EMISSIONS

Coal Seam in Alaska

Alaska has a rich coal resource

Summary

Alaska has an enormous coal resource, and if this resource were heavily exploited, it would make a tremendous contribution to global greenhouse gas emissions, primarily in the form of carbon dioxide (CO2). If all of Alaska's hypothetical coal resource were mined and burned, that alone might double the earth's atmospheric carbon dioxide.

At present, Alaska's modest coal mining makes a tiny contribution to global CO2, producing less than 1/10,000th of annual global CO2 emissions. As a state, Alaska has the potential to develop vast coalfields, but it is also disproportionately impacted by global climate change driven primarily by man-made CO2 emissions. In developing its coal resource, Alaska faces a complex economic and ecological question.

Alaska Coal's Current Global CO2 Contribution

Carbon dioxide is the primary driver of climate change, and coal is the single largest source of this carbon. In 2010, coal provided 27% of the world's energy production and contributed 43% of all human

carbon dioxide emissions. Alaska's enormous coal resource is closely tied to the future of global carbon dioxide emissions. If global coal use expands, Alaska could potentially become a coal superpower.
In the worldwide energy supply, coal is second only to oil. In 2011, 7.8 billion metric tons of coal were mined and consumed globally. Alaska's contribution to the global coal market is currently miniscule, with only Usibelli Coal Mine operating. In 2010, Usibelli mined roughly 2 million tons, representing about 0.03% of total global production. Based on our calculations, Alaska's grade of coal produces roughly 1.7 tons of CO2 from each ton of coal, during burning. Alaska's 2010 mined coal volume produced about 3.4 million tons of carbon dioxide, or about 1/100th of 1% of global human CO2 emissions.

The Future of Alaska Coal and Carbon Emissions

CO2 and Coal

How much CO2 is released per ton of coal? Burning coal, or any hydrocarbon, not only releases the elements that the original fuel contained, but also combines them with oxygen from the atmosphere. In coal, the important "fuel" elements are carbon and hydrogen. During combustion, the carbon in coal combines with oxygen from the atmosphere, producing carbon dioxide.

Each carbon atom from coal (atomic weight: 12) couples with two oxygen (atomic weight: 16 each) and is emitted into the air as a molecule of CO2 (atomic weight: 44). Thus, for each ton of carbon in coal, 3.667 tons of CO2 are released. Since coal does not consist entirely of carbon, but in fact includes hydrogen, sulfur, water, and ash, the mass of CO2 produced per ton of coal is actually much less than that figure. In the case of Usibelli coal, due to its particular carbon content, one ton of coal produces 1.7 tons of CO2.

A more representative output per ton of coal is 2.2 tons of CO2, calculated by averaging EPA emissions factors for bituminous and subbituminous coal. The balance of weight in the coal is hydrogen, oxygen, and impurities, including water. As for the hydrogen in the coal, it bonds with more atmospheric oxygen and is emitted as water.

Alaska coal's contribution to climate change depends on the amount of coal actually produced and burned. Alaska's coal resource is known to be vast compared to current mining activities, but it is little studied. It is unlikely to be mined heavily in the foreseeable future. This is due to a combination of logistical factors; geology and location of the beds; market forces; and the fact that it is understudied. In

the near future, Alaska's global coal emissions could increase by 25 million tons per year if the Chuitna Coal Project is developed.

Coal development could potentially provide economic development and tax revenue to Alaska. As oil resources on state land (currently the source of almost all government revenue) diminish, resources such as coal could potentially fill the gap. However coal mines have a much larger local environmental impact than oil and gas wells, and coal is taxed at a much lower rate than oil and gas. Natural gas is a more attractive resource both environmentally and economically, but would require a major investment in a pipeline to bring it to market. If carbon pricing or carbon taxes are implemented at a national level, Alaska could be saddled with fossil fuel infrastructure that cannot pay off its costs -- the carbon footprint of coal makes it especially vulnerable to this possibility.

Alaska as a state has a very small current coal economy, great sensitivity to climate change, and yet the potential to become a coal superpower. In a classic Tragedy of the Commons dilemma, Alaska may benefit economically from development of its coal resource, even as the impacts of global climate change fall disproportionately on the state. The profit gained from a ton of coal mined and sold may be greater than the cost incurred by the state in climate-change impacts, per ton coal mined and burned, even though the total costs of climate change to the state may dwarf the state's coal economy. This is because Alaska will incurs costs for all global carbon emissions, not simply for the emissions of its own coal.

In a scenario where coal development is a major economic boon to Alaska, coal revenues could help fund Alaskan efforts to adapt to climate change and provide greater net benefit than the marginal cost of its contribution to climate change. However, it is unclear whether coal development itself would be economically beneficial or harmful for Alaska.

Simplistic arguments that "development of a resource is always good" have been thoroughly disproven by extensive historical cases in which regions and their populations have not experienced widespread benefit from development. One facet of this paradox is known as the Resource Curse, in which large social and environmental costs are borne within resource-rich regions, but much of the generated or extracted value accrues to out-of-region operators and transient worker groups with little interest in long-term regional well-being. In another dimension, environmental impacts and infrastructure costs of coal development could end up as a net loss for the state, regardless of carbon emissions, due to insufficient coal revenues to offset these costs.

That said, economic benefits from resource development are also widespread throughout the world. Alaska's oil development is a world-leading example of natural resource whose development has been generally linked to economic well-being in the state, through mechanisms like the permanent fund.

Alaska Coal & Carbon Dioxide Emissions

Annual Coal Production	**Coal Produced (tons/year)**	**Could power the world for...**	**CO_2 produced (tons/year)**	**Fraction of World Annual Energy (2011)**
Alaska Production (2010)	~2 million	< 30 minutes	3.4 million**	< 1/100th of 1%
World Production (2010)	7.8 billion	14 weeks	17 billion**	27%
Coal Stocks	**Coalfields (metric tons)**	**Would power the world for...**	**CO_2potential (metric tons)**	**Could raise global average temperature by:**
Estimated Alaska Recoverable Resource*	510 billion	18 years	1 trillion	3° F
Estimated US Recoverable Resource	1.6 trillion	56 years	3.5 trillion	8° F
Total Alaska Resource	5.1 trillion	180 years	11 trillion	15° F
World Resource	14 trillion	500 years	31 trillion	25° F

*510 billion tons of recoverable resource is estimated at 10% of Alaska's total estimated resource. This would give Alaska a reserve-to-resource ratio comparable to more explored coal regions. Alaska's currently identified recoverable reserves are only 5.3 billion tons, but this is not meaningful because most of the state's coal beds are not well-studied.

**Emissions per ton vary by coal grade and composition. Coal from Usibelli Coal Mine (Alaska's only mine) is a low-sulfur subbituminous coal that produces roughly 1.7 tons of carbon dioxide per ton of coal, due to its particular carbon, oxygen, hydrogen, water

and impurities content. This table uses 1.7 as the factor for current Alaska mining and 2.2 as a more representative factor for world coal and for Alaska's statewide coal.

Conclusion

In conclusion, Alaska coal is at present a marginal contributor to CO2 emissions. Although Alaska has the potential to become a coal superpower and contribute dramatically to global emissions, this will not occur in the immediately foreseeable future. At present, the economics of Alaska's coal production are functionally decoupled from the economics of state climate change. While Alaska may make coal development choices which are economically significant to the state in the near future, such as the development of Chuitna, these choices are very modest on the stage of global carbon emissions and climate change.

Source : http://www.groundtruthtrekking.org/Issues/AlaskaCoal/AK-Coal-carbon-dioxide-emissions.html