Coalbed Methane

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Ground Truth Trekking

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Summary

Coalbed methane (also called coal mine methane) refers to methane gas that is trapped within minuscule fractures in coal seams. Once viewed solely as a hazard of coal mining (/Issues/AlaskaCoal/CoalMining.html), this gas has received recent attention for its use as an energy source, as well as its impact as a climate changing greenhouse gas when released through mining. Extraction of coalbed methane has often created significant problems with maintaining safe, clean water for humans and wildlife.

DRILLING RIG — Coalbed Methane drilling rig (Louisiana) — Get Photo (/photos/drilling-rig/)

Background

Methane (http://en.wikipedia.org/wiki/Methane), the primary component of natural gas, is the principal gas found within most coal seams. Smaller amounts of other gases, such as carbon dioxide and nitrogen, may also infiltrate coal seams. The actual amount and purity of gas can vary widely between coal seams, and is dependant on the geologic formation, type of coal (/Issues/AlaskaCoal/TypesOfCoal.html), porosity of the coal, depth, pressure, and temperature.

Both chemical and biological processes produce coalbed methane, and there is ongoing debate about the relative importance of these two pathways. Younger and softer coals tend to have more of the biogenic gas, which is generated by bacterial respiration. Only older harder coals have had the tens of millions of years required for chemically producing methane. Fresh production in coal by microbes might possibly be

sufficient to sustain methane extraction as a “renewable resource”. However, creation of new gas appears to be very slow, and traditional extraction techniques destroy the living conditions of the relevant microbes. At least one company believes (http://billingsgazette.com/news/state-and-regional/wyoming/article_e3463c00-6616-11df-9108-001cc4c002e0.html) that they can speed up and optimize the process enough to produce commercially relevant amounts of methane.

Significant amounts of water accompany methane production and the pressure of the water traps the gas within the coal. In order to extract the gas, the coal must first be “de-watered” and the water disposed of (see Water Issues below). Once the water has been removed, the gas can be pumped to the surface for collection.

Energy Source

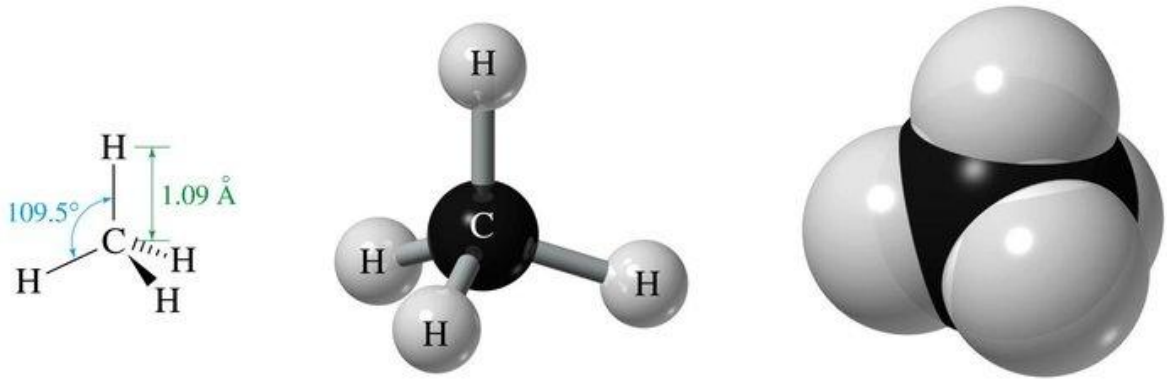
Currently, coalbed methane represents about 10% of the natural gas produced in the US and its contribution is rising. In 2007, the US produced 1.7 trillion cubic feet of the gas (http://www.eia.gov/dnav/ng/hist/rngr52nus_1a.htm), from approximately 20,000 wells. The Department of Energy estimates the “proven reserves” of coalbed methane in the US at around 22 trillion cubic feet (http://www.eia.gov/dnav/ng/hist/rngr51nus_1a.htm), but the estimate includes only 16 states and is based only on deposits that are currently economically recoverable. The DOE survey does not include Alaska, but the USGS estimates the state possesses reserves on the order of 1 trillion cubic feet (http://pubs.usgs.gov/dds/dds-077/). Much of it

is found in the difficult-to-access coal fields of the Arctic (/Issues/AlaskaCoal/WesternArcticCoalDeposits.html). The USGS also broadly estimates the total coalbed methane resource in the US at around 700 trillion cubic feet (http://energy.usgs.gov/factsheets/Coalbed/coalmeth.html). Note that “resources” refers to the amount of gas that is present under the earth and “reserves” refers only to that portion which might be currently recoverable (see our resource/reserve terminology article (/Issues/AlaskaCoal/CoalTerminology.html)).

Environmental Concerns

The vast majority of coalbed methane in the US is released through small wells similar to those used in the natural gas industry. The footprint of these tens of thousands of wells and their associated infrastructure and roads is an inevitable impact of coalbed methane extraction. Exploitation of this resource also has consequences for our environment through contribution of released methane to climate change, and the dissemination of contaminates in waste water.

Greenhouse gas emissions



METHANE — Chemical representations of methane — Get Photo (/photos/methane/)

The release of coalbed methane during standard coal mining (/Issues/AlaskaCoal/CoalMining.html) presents both a safety hazard and an environment problem. Methane is flammable and combustible, and a very potent greenhouse gas. The US is the second largest global emitter (http://www.epa.gov/cmop/faq.html) of uncaptured coalbed methane, releasing over 140 billion cubic feet in 2005. Increasingly, underground mines are attempting to capture this gas from their ventilation systems and either use it on-site or sell it. This change has been driven by both increasingly stringent environmental regulations and a rising price for natural gas.

In terms of greenhouse gas emissions, the intentional production of coalbed methane is less polluting than mining coal, but it is more polluting than harvesting traditional sources of natural gas. The presence of significant amounts of carbon dioxide mixed with the methane in coalbed sources contributes to the climate impact. There have been some preliminary

attempts to combine coalbed methane extraction with carbon capture and sequestration (/Issues/AlaskaCoal/LowCarbonCoal.html); separating the gases after extraction, and then re-injecting the carbon dioxide into the well to displace more methane and trap the carbon dioxide in the coal. The process has not been attempted on a commercial scale, but is being increasingly studied as an option, especially in light of a possible future carbon tax or cap-and-trade scheme (http://en.wikipedia.org/wiki/Emissions_trading).

Water Issues

The most prominent concerns about coalbed methane extraction pertain to water. The “de-watering of the coal” produces large amounts of water at the surface, from 7,000 to 30,000 gallons (http://waterquality.montana.edu/docs/methane/cbmfaq.shtml#why_are_people_concerned) per day, per well. Because in some locations, coal seams function as aquifers (http://en.wikipedia.org/wiki/Aquifer), the removal of the water can lower the accessibility of groundwater in the area. In other regions, the water found within the coal is very salty, or contaminated with chemicals or other dissolved solids. Disposal of contaminated water is an ongoing environmental problem associated with coalbed methane extraction. A large number of operations now re-inject the water back down the well after the gas is extracted which adds to cost but mitigates some of these problems.

Coalbed methane extractors often employ the controversial technique of "hydraulic fracturing (http://en.wikipedia.org/wiki/Hydraulic_fracturing)", sequentially fracturing the coal along the seam under high fluid pressure in order to free additional gas. In 2004, the EPA determined (http://www.epa.gov/safewater/uic/pdfs/cbmstudy_attach_uic_final_fact_sheet.pdf) that this process poses minimal risk to groundwater supplies and human health. Since that time, however, there have been (http://www.earthworksaction.org/pubs/200201_NRDC_HydrFrac_CBM.pdf) explosions, contamination of drinking water supplies, and chemical exposures associated with hydraulic fracturing.

Coalbed Methane in Alaska

Coalbed methane has received a lot of attention (http://energy.usgs.gov/OilGas/UnconventionalOilGas/CoalbedGas.aspx) in Alaska over the last 15 years, in particular in the Matanuska-Susitna Valley (http://www.gasdrillingmatsu.org/index.html), but is not currently under production anywhere in the state. The USGS has drilled a few disappointing test wells (http://pubs.usgs.gov/of/2009/1064/) near Fort Yukon, and others near Wainwright in the NW Arctic that were more promising. The extraction of coalbed methane in Alaska faces significant logistical hurdles, primarily related to the disposal of water. The permafrost that overlies many of Alaska's coal fields will be problematic both for gas extraction, and for possible impoundment or re-injection of water into the ground. Low-quality water cannot be released

into fish-bearing streams, and even high-quality water will be impossible to disperse on the surface or place back into the ground when the temperature is below freezing.

In July 2010, Usibelli Coal Mine Inc (/Issues/AlaskaCoal/UsibelliCoalMine.html). recieved a permit (http://www.adn.com/2010/07/06/1356217/usibelli-could-get-ok-to-look.html#ixzz0t1BqPJMV) from the state to explore for coalbed methane deposits in the Healy basin of Interior Alaska, just east of Denali National Park. The Denali Citizens Council then appealed the state's "Best Interest" finding, but this appeal was rejected (http://www.adn.com/2014/02/23/3342796/alaska-supreme-court-rejects-appeal.html) in March 2014. Usibelli would like to extract the gas to provide energy for their coal mining operations, but they are also considering providing the gas to Railbelt utilities (/Issues/Infrastructure/Railbelt-Electrical-Grid.html) if they discover a large enough deposit. Work was slated (http://www.worldcoal.com/news/cbm/articles/Coal-bed-methane-in-Alaska-CBM84.aspx#.VCBt4xaGdrs) to begin during summer 2014 and a test well was sunk (http://www.petroleumnews.com/pntruncate/66053729.shtml) in September of that year.

Further Reading

> Wikipedia article on coalbed methane (http://en.wikipedia.org/wiki/Coalbed_methane)

> Coalbed Methane (CBM) FAQ from the University of Montana (http://waterquality.montana.edu/docs/methane/cbmfaq.shtml)

> EPA Coalbed Methane Outreach Program (http://www.epa.gov/cmop/)