CMM Recovery and Use: Opportunities at Western U.S. Mines

Coal mines located in the Western United States (U.S.) -- including Wyoming, Montana, New Mexico, Colorado and Utah -- are an important opportunity for coal mine methane (CMM) project development. In 2014, coal production from these Western states, extracted from some of the country's gassiest reserves, accounted for just over 50 percent of total coal production in the U.S.[1]. During the same year, underground mine degasification systems produced 2.9 billion cubic feet (Bcf) of high quality CMM available for CMM project utilization (Table 1), of which, only 1.1 Bcf of the drained methane was used. The 1.8 Bcf of high-methane content gas that was not used would provide the equivalent of 1.8 trillion British thermal units (Btu) or 531.5 gigawatt hours (GWh) of power generation capacity. Methane contained in mine ventilation air (VAM) amounted to 3.5 Bcf in 2014. VAM emissions can be destroyed through oxidation technologies or used as combustion air for internal combustion engines, which use low concentration methane as supplemental fuel. Additional CMM project development using commercially available technologies at Western mines can help to reduce methane emissions from coal mining activities.

Western Mines: Important Source of CMM

Western mines represent a significant portion of total U.S. methane emissions from coal mining. In 2014, Western mines in Colorado, New Mexico and Utah liberated 13 percent of total vented mine degasification emissions and 4 percent of total VAM emissions from all U.S. underground mines. Western mines (including Montana) represented 67 percent of CMM emissions from U.S. surface mines – with Wyoming accounting for 59 percent of the total volume.

Table 1. Emissions from Underground Western Mines (MMcf CH_4, 2014)

State/Mine	VAM Emissions	Degas	Total*
Colorado			
Bowie No. 2	976	218	1,194
Elk Creek	31	1,063	31*
Twentymile	22	--	22
West Elk	811	546	1,268*
New Mexico			
San Juan	975	769	1,744
Utah			
Dugout Canyon	41	--	41
West Ridge	652	334	986
Wyoming			
Bridger	2	--	2
TOTAL	3,510	2,930	5,288

Source: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014* (2016)

*NOTE: Total reflects emissions minus onsite destruction or use.

Large methane capture and utilization projects in the coal mines of Appalachia provide mining companies with a significant energy source and/or additional revenue. Implementation of CMM utilization or destruction projects at Western mines have the potential for similar results, and would decrease methane emissions.

[1] EIA Coal Data Browser - http://www.eia.gov/beta/coal/data/browser/#/topic/33?agg=0,2,1&rank=g&geo=vvvvvvvvvvvvo&mntp=g&linechart=COAL.PRODUCTION.TOT-US-TOT.A&columnchart=COAL.PRODUCTION.TOT-US-TOT.A&map=COAL.PRODUCTION.TOT-US-TOT.A&freq=A&start=2001&end=2014&ctype=map&ltype=pin&rtype=s&maptype=0&rse=0&pin=

Using CMM to Meet State Renewable Portfolio Standards and Goals

Several Western coal-producing states, including Colorado and Utah, have enacted alternative energy and renewable energy programs that include coal-associated methane as a targeted renewable or clean energy source.

- ***Colorado*** became the first state to adopt a Renewable Portfolio Standard (RPS) by ballot initiative, when voters approved Amendment 37, the "Colorado Renewable Energy Requirement Initiative", in November 2004. More recently, SB 13-252[2] was passed in 2013, which included CMM as an eligible energy resource for utility providers. According to Colorado's RPS, electricity generated from CMM must also be demonstrated to be greenhouse gas neutral over a five-year period. The state's RPS requires utilities to generate varying percentages of power from eligible energy resources, based on their sector type. By 2020, each sector must generate electricity from eligible energy sources in the following proportions of their retail sales: 30 percent for investor-owned utilities (IOU), 20 percent for electric cooperatives serving 100,000 or more meters, 10 percent for electric cooperatives serving fewer than 100,000 meters and 10 percent for municipal utilities serving more than 40,000 customers.

- ***Utah*** established a renewable portfolio goal in the "Energy Resource and Carbon Emission Reduction Initiative" enacted in March 2008. Under this act, to the extent that it is cost-effective to do so, beginning in 2025 retail electric sales of each electrical corporation and municipal electric utility shall consist of "qualifying electricity" or renewable energy certificates (RECs) equal to 20 percent of its adjusted retail electricity sales. In early 2010, the Utah legislature passed H.B. 192[3] "Renewable Energy – Methane Gas", which amended the Act's definition of "renewable energy source" to include "methane gas from an abandoned coal mine or a coal degassing operation associated with a state-approved mine permit" as part of waste gas or waste heat captured or recovered for use as an energy source for an electric generation facility.

Colorado and Utah legislatures have expanded or amended "renewable energy sources" definitions to include CMM

CMM Markets and Project Opportunities

The largest and most prevalent CMM emission reduction projects in the U.S. involve the capture and sale of produced gas directly to natural gas pipelines. This option is particularly attractive when the mine is located near existing infrastructure, such as in New Mexico or Wyoming, and meets the minimum pipeline quality and quantity requirements. Using CMM to fuel electrical generation via gas turbines or internal combustion engines is another way to generate revenue by selling energy into the electricity grid. Alternatively, mines can reduce costs by using generator sets and/or boilers to power onsite equipment. Other proven uses for CMM include low-level heat for coal drying or heating mine ventilation air and water during the winter months, feedstock fuel for manufacturing and processing end uses, as well as for vehicle fuel in the form of liquefied or compressed natural gas.

[2]Colorado Senate Bill 13-252
http://www.leg.state.co.us/clics/clics2013a/csl.nsf/fsbillcont3/D1B329AEB8681D4D87257B3900716761?Open&file=252_enr.pdf

[3]Utah State Legislature H.B. 192 Renewable Energy - Methane Gas – Watkins, C.
http://le.utah.gov/~2010/htmdoc/hbillhtm/HB0192.htm

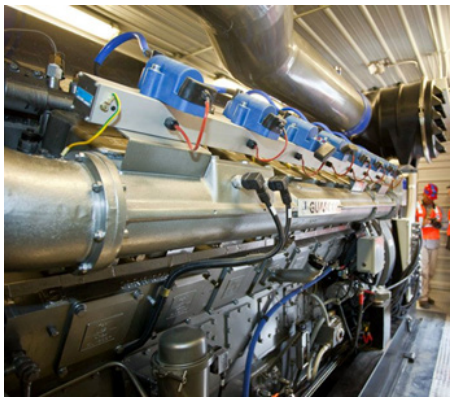
Methane emission reduction credits or offsets associated with CMM projects may be sold into voluntary carbon registries (e.g., Verified Carbon Standard, Climate Action Reserve) and compliance carbon markets (e.g., California Air Resources Board cap-and-trade offset program). Carbon credit revenues can be generated for emission reductions from both active underground and surface mines, as well as abandoned underground coal mines.

The U.S. Environmental Protection Agency's Coalbed Methane Outreach Program (CMOP) is a voluntary program with a goal of reducing methane emissions from coal mining activities. Our mission is to promote the profitable recovery and utilization of CMM, a potent greenhouse gas (GHG) that contributes to climate change if emitted to the atmosphere. When collected and used for energy, CMM is a valuable fuel source.

Case Study: Western CMM Capture Project

Elk Creek Power Generation and Methane Destruction

The first of its kind in the West, Oxbow Mining LLC's Elk Creek project, commenced operations in 2012 in Colorado with an electric generation capacity of 3 MW. Aspen Skiing Co. invested $5.5 million[4] in the $6 million project in order to offset its electricity use. Other project partners include Oxbow's sister company, Gunnison Energy Corporation, which owns the gas rights in the mine area, and Vessels Coal Gas Inc. which manages the project. Power from the project is being purchased by Holy Cross Energy, a utility which serves the Aspen area.



Guascor Gas Generator at Elk Creek Coal Mine Methane Destruction and Utilization Project (*compliments of Aspen Skiing Co.*)

This project drains methane from sealed areas of the mine—through an underground drainage system—to reduce emissions into working areas of the mine. Surface equipment then utilizes the methane for 3-megawatt electricity (MWe) power generation with excess gas combusted.

Combustor and one of three 1-MWe power generators being placed at Elk Creek mine (*compliments of Vessels Coal Gas*)

[4] Aspen Skiing Co. - https://www.aspensnowmass.com/we-are-different/programs-and-practices/green-operations