

## CASE STUDY

# Methane Recovery at Surface Mines in the U.S.

## Background

Methane released from coal and surrounding rock strata due to mining activities is coal mine methane (CMM). Methane emitted from surface mines is surface mine methane (SMM). There are three potential sources of fugitive methane emissions associated with surface coal mining. These are:

- Methane emitted by the coal excavated and processed during mining activities
- Methane emitted by the coal and other gas bearing strata in the overburden and/or underburden exposed by mining activities
- Methane emitted by coal in the overburden which is excavated and stored on site in waste piles

Despite the fact that 66% of US coal comes from surface mines, SMM emissions constitute only 18% of U.S. CMM emissions from active mines. This is a result of the relatively low gas content of the coals that are mined from surface mines. The lower gas content of these coal seams is likely related to the shallow depth of burial, and the fact that some are lower rank with commensurately lower gas sorption capacity. Mines in the Powder River Basin (PRB) are the most productive surface mines in the U.S. and thus estimated to be the highest emitters of SMM.

The PRB has proven methane reserves of over 2.5 trillion cubic feet<sup>1</sup>. Because of shallow drilling depths, the PRB has been the focus of extensive coalbed methane development efforts. Pre-mine drainage methane recovery at PRB mine sites could make a significant contribution towards mitigating methane emissions from surface mines.

## Project Overview

One surface mine has elected to recover and sell SMM. Beginning in 2002, the North Antelope Rochelle Mine (NARM) in Wyoming, owned by Peabody Energy,

engaged in a program to degasify coal in advance of surface mining operations through its subsidiary Peabody Natural Gas (PNG). In 2002, during the initial phase of the degasification program, PNG drilled, developed, and operated the Piney Canyon Project. The project consisted of 47 wells and a gathering system located within NARM's operating mine permit boundary.

These wells are drilled on leases located within the [Bureau of Land Management's Conflict Administration Zone \(CAZ\)](#) Coal and Coalbed Natural Gas [South Pod](#). Each of the three CAZ pods (North, Middle, and South) are based on an expected 10-year mine-out zone around each surface mine where CBM development is already underway or is anticipated. CAZs were established on federal lands in Wyoming as an incentive to accelerate CBM production by encouraging CBM operators to drill wells and extract as much CBM as possible in the time available to allow uninterrupted coal mining operations. CBM wells within CAZs are eligible for a 50 percent royalty rate reduction on CBM production for the life of the well.



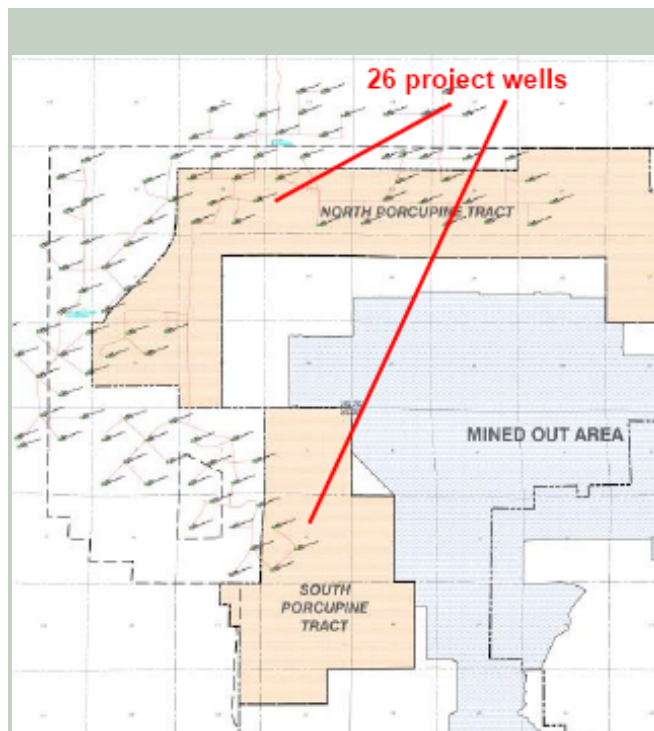
**North Antelope Rochelle Mine**  
(Photo courtesy: Peabody Energy)

<sup>1</sup> US Energy Information Administration, [www.eia.gov](http://www.eia.gov)

PNG's Piney Canyon Project captured methane that would have otherwise been emitted from the coal mine and sold it in the gas market. The project was registered with the Verified Carbon Standard (VCS) in 2007 and operated through March 2009, generating 982,588 tonnes of carbon credits in the form of Voluntary Carbon Units (VCUs). The project's methane production from the crediting period of November 2007 through March 2009 was 2.85 bcf.

Peabody embarked on a second phase of SMM recovery, the Porcupine Project, in 2009 when Peabody subsidiary Western Roundup Resources LLC (WRR) acquired oil and gas leases with 108 methane wells from Bill Barrett Corporation (BBC). BBC drilled the wells beginning in 2005, and in order to accelerate CBM production in advance of coal mining, BBC installed vacuum equipment at each well.

By May 2009, when WRR purchased the wells and established the Porcupine Project, a significant portion of the methane gas reserves had been produced. Of the



**Porcupine Project Wells**  
(Map courtesy: Peabody Energy)

108 wells acquired, 26 were immediately adjacent to the NARM's active mining operations (see beige area on map) and were determined to be actively draining gas from the area to be mined.

Project Specifications	
Name	North Antelope Rochelle Mine Coal Mine Methane Capture and Use Project: Phase II – Porcupine Project
Site	Campbell County, Wyoming, United States
Owner	Western Roundup Resources LLC
Dates of Operation	May 2009 - December 2010
Equipment	25 hp liquid-ring compression/vacuum units, 5 hp submersible water pumps, connections to gas and water gathering systems, electronic meters to collect and record continuous readings of gas production volumes, operating pressures, and water production
End-use	Pipeline sales
Emission Reductions	135 thousand tons CO <sub>2</sub> e

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## Technology and Operation

At the Porcupine Project, SMM was collected by CBM wells. Each well was equipped with a liquid-ring compression/vacuum unit driven by a 25 horsepower (hp) motor, a 5 hp submersible water pump, a 2" standard orifice-plate meter run for gas measurement, electronic flow measurement equipment to collect operating data and an automatic telemetry system to relay data to a central database. A gathering system collected gas from multiple wells and delivered it by pipeline to Anadarko Petroleum Corporation's sales point.

Gas produced from the Porcupine Project's 26 wells was contaminated with air drawn from the coal mine, with methane concentration ranging from 67 to 95%. The SMM was blended with high quality gas produced by third party oil and gas operators and sold. The project generated 135,030 VCUs (408 mmcf methane production) before it's termination in December 2010. The project ended due to declines in gas volumes and quality caused by NARM's encroaching mining operations, as well as a depressed gas market.