



STATEMENT OF QUALIFICATIONS

Raven Ridge Resources, Incorporated (RRR) is an independent energy consulting and exploration firm founded in 1988. The firm provides a range of technical and project management services to the oil, gas, and public sector entities worldwide. RRR specializes in assessment and development of conventional and non-conventional energy resources, particularly coalbed and coal mine methane. The firm is experienced in carrying out detailed geologic, economic, and technological assessments needed to develop this natural gas resource in an efficient and environmentally sensitive and sustainable manner. RRR’s work on coalbed methane began in 1988 by evaluating resource potential of coalbed methane occurrences in the western USA. RRR’s first coal mine methane projects began in 1990 with a mission to Poland funded by the USEPA to assess the potential for economic development and utilization of coal mine methane. The company has demonstrated ability and qualifications in the development of other non-conventional energy resources, including tight gas sands, shale gas and underground gasification of coal.

Coalbed Methane Experience and Qualifications

RRR began working in the coalbed methane industry in the mid-1980s. RRR has provided wellsite services, performed analytical services, resource evaluations, mapping, operations management, and/or conducted investigations on hundreds of properties throughout the U.S. and abroad. Through our work on a wide variety of coalbed methane and conventional oil & gas projects we have earned a reputation as a leading consulting firm in the energy industry. RRR is experienced in all phases of geological and geophysical data evaluation. The company performs economic analyses including reserve estimates, reserve valuation, and market considerations. RRR has provided a wide variety of coalbed and coal mine methane consulting services for projects in the following U.S. basins and regions:

San Juan	Raton	Gulf Coast (TX)
Black Warrior	Illinois	Hanna
Piceance	Appalachian	Western Washington
Uinta	Cook Inlet	Red Desert
Powder River	Sand Wash	Green River
Arkoma	Maverick Basin (TX)	

Countries in which RRR has provided coalbed and coal mine methane consulting services and experience include:

Poland	India	Russia	Zimbabwe
Ukraine	Czech Republic	Japan	Australia
China	Mexico	Bulgaria	Thailand
Romania	Canada	Belgium	Kazakhstan
France	Germany	Spain	Venezuela
Mongolia	Philippines	England	Turkey
Viet Nam	Indonesia	Colombia	Republic of South Africa

Relevant Coalbed Methane and Unconventional Gas Project Experience

-  Beginning in 2015 through Present, in conjunction with U.S. TDA, and on behalf of Colombian client, RRR is finalizing a technical and economic assessment of the feasibility of developing CBM and natural gas in Córdoba, Colombia. RRR has completed the bankable feasibility report which is the culmination of a project which began with drilling a 550 meter borehole to gather information and data which was used to evaluate the potential of commercial development of coalbed and conventional natural gas resources.
-  In 2014 RRR with SGS Horizon were requested by a major international oil and gas company to review and provide an independent analysis of the results to date of its non-operated, multi-year, CBM exploration and development program. The results of the independent review were used to guide the oil and gas company in its decisions regarding continued participation in the development of the field. Data reviewed included exploration sampling, testing, and logging, seismic data, reservoir simulation studies, and multi-well production testing results.
-  On behalf of the U.S. Trade and Development Agency, RRR organized and led a Reverse Trade Mission (RTM) from Indonesia with a focus on Unconventional Gas and Coalbed Methane. The goal of the mission was to introduce the Delegation of high level government officials and industry leaders to U.S. technology and services, and existing federal and state policies that promote the development and exploitation of the resource. The RTM met with industry and government representatives at three separate locations within the United States; Washington, D.C., Houston, Texas, and Pittsburgh, Pennsylvania. Field visits were also organized to two sites, Cheniere's LNG export facility in Sabine Pass, Louisiana, and Range Resources field operations in the Marcellus Shale in Southwestern, Pennsylvania.
-  RRR conducted detailed technical assessments at three large surface mines in East and South Kalimantan (Indonesia) for Enel Trade SpA, investigating the feasibility of draining methane from targeted seams in advance of mining. At one of the mines, RRR carried out a training program for the mine staff in coal desorption testing and analysis, with RRR supplying all of the necessary equipment and software. In addition, RRR contributed to the Environmental Impact Assessment that was prepared at one mine, describing the environmental impacts and potential mitigants of incorporating a coal mine methane recovery and use project at the mine site. RRR also supervised the assessments at two other surface mines on Kalimantan, investigating the potential for development of the coal mine methane resource.
-  RRR conducted a feasibility study for a project located in eastern Bulgaria. The feasibility study, partially funded by the U.S. Trade and Development Agency (TDA), investigated the technical, market, and economic potential of coalbed methane occurring within a license block (439 square km) located in the Dobroudja Coal Basin. In addition to the study, RRR provided the expertise used in drilling the first CBM exploration borehole in Bulgaria.
-  Beginning in January 1997 through mid-1999, RRR undertook a major coalbed methane resource assessment in Turkey for DanOil, LLC and its joint venture partner Data Su. We were asked to evaluate the commercial coalbed methane potential for a 6,100 square mile lease area. This effort culminated in the preparation of a detailed resource estimate and recommended drilling targets.

The project required total of four trips to Turkey, which involved training Turkish staff in the fundamentals of coalbed methane, logging and sampling of two coal exploration coreholes, gathering data, and evaluation of an adjacent lease area. Following these missions, RRR compiled and interpreted the data collected, and prepared an assessment of the potential for development of coalbed methane in the area of interest. Due to the geologic complexity of these methane resource areas, the resource estimate was prepared by dividing these areas into individual blocks based on geologic structure and coal seam depths for calculation of the in-place resource. Using this approach, we were able to prepare a detailed resource estimate and recommend drilling targets. RRR then presented the findings of this project to numerous major and large independent oil and gas companies on behalf of Dan Oil and partners.

✎ RRR assessed coalbed methane exploration work performed to date in the Shangani River valley in northern Zimbabwe. The project, performed for Union Carbide Management Services, included evaluating previous coal and coalbed methane resource estimates for the region. RR modified these estimates based on adsorption testing performed RRR's laboratory, and on desorption data that was reprocessed using RRR's statistical methods.

Prior to this assessment, James Marshall of RRR visited the Wankie coal mine in Hwange, Zimbabwe, as a side trip during a six-week cultural and business exchange in Zaire sponsored by Rotary International. This time spent in Zimbabwe and Zaire helped familiarize RRR with geological and general conditions in sub-Saharan Africa.

✎ RRR and its partner Calvin Resources, Inc. negotiated an exploration area agreement with Union Pacific Resources Corporation that covered over 3,500 square miles and built a database that incorporated geologic, geophysical, land and engineering data on several thousand wells. The database was used to develop multiple computerized maps and cross-sections that led to the drilling of a successful coalbed methane test well in late 2000. RRR oversaw the design, drilling and testing of the test well. The successor to Union Pacific Resources Corporation, Anadarko Petroleum Corp., re-purchased the rights to the property before the testing was completed.

✎ Under contract to TimberWest Forest Corp., RRR evaluated the potential for commercial development of CBM on their properties on Vancouver Island. RRR first carried out an extensive resource evaluation of their holdings utilizing all available data and information. From this data we developed a reservoir model which was used to project possible production decline curves for each area, from which we performed an economic evaluation. Finally, RRR helped management to determine the best strategy for moving forward in development of the resource.

Coal Mine Methane Experience and Qualifications

RRR has conducted numerous evaluations concerning the potential for recovery of methane from coal mine properties. These analyses range from preliminary evaluations using publicly available data to in-depth evaluations incorporating extensive resource and economic data supplied by the mine. We have performed these studies for private-sector mining company clients as well as the U.S. EPA. We have also examined in detail the recovery of methane from abandoned coal mines in the U.S. and internationally, and have developed a methodology for estimating emissions of methane from abandoned mines. In addition, we have helped firms verify, report, and market carbon credits, an increasingly important service as companies move forward with greenhouse gas emissions trading initiatives.

Mining and energy companies to which RRR has provided a variety of CMM services:

RAG America Inc.	Arch Minerals	Peabody Energy
BHP Billiton	Oxbow Minerals	Bowie Resources
Andalex Resources	AES	Mitsui & Co. Ltd
Cline Mining	Anglo American	Sumitomo Corp.
Mongolyn Alt Corporation (MAK)		

Relevant CMM Project Experience

-  RRR completed the study “Pre-feasibility Study for Coal Mine Methane Recovery and Utilization at Mopanshan Mine, Guizhou Province, China”, which investigates the technical and economic potential for employing a pilot project comprising a series of surface drilled boreholes to drain gas from gassy coal seams in advance of mining, as well as surface drilled gob vent boreholes post mining. The study was published in December 2014 and is available on the USEPA website at (<http://www.epa.gov/coalbed/docs/PrefeasibilityStudyCMMRecoveryUtilizationMopanshanMine.pdf>).
-  Raven Ridge conducted an exhaustive review of laws and regulations that govern the extraction and use of methane occurring in coals seams. In almost every country in which gassy coal is mined, issues over ownership and the rights to extract and use the gas for commercial purposes has raised conflicts between the miners and other mineral rights owners. The findings of this effort were published July 2014 in “Legal and Regulatory Status of CMM Ownership in Key Countries: Considerations for Decision Makers” (<http://www.epa.gov/cmop/docs/CMM-Ownership-Policy-White-Paper-July2014.pdf>) and a sister publication “Legal and Regulatory Status of CMM Ownership in Key Countries: An Overview Provided for Decision Makers in Mongolia” (<http://www.epa.gov/coalbed/docs/Mongolia-CMM-Ownership-Policy-White-Paper-July2014.pdf>). These publications have been used in Mongolia and Colombia to develop policy related to ownership and management of coal and gas resources.
-  Raven Ridge contracted with the Mongolia Nature and Environment Consortium, a Global Methane Initiative grant recipient, to conduct research related to the occurrence and magnitude of CMM/CBM in Mongolia. To insure successful completion of the project, Raven Ridge introduced proprietary technology to measure the amount and composition of gas contained in coal samples, and trained Mongolian scientists and engineers in use of equipment and methodology needed to conduct resource assessments and methane emission forecasts. The project culminated in the publication of “Coal Mine Methane (CMM) Resource Assessment and Emissions Inventory Development in Mongolia” (https://www.globalmethane.org/Data/MNEC-CMM-Grant-Final-Report_FINAL.pdf). This document, released in May 2014, is the seminal publication on the CMM/CBM resource potential of Mongolia.
-  The report “Pre-feasibility Study for Coal Mine Methane Recovery and Utilization at Baganuur Mine, Mongolia,” available on the USEPA website at (<http://www.epa.gov/coalbed/docs/2013%20Coal%20Mongolia%20Baganuur%20PFS.pdf>), was developed by RRR and published in December 2013. The prefeasibility study evaluated utilization of pre-drained CMM at an open cast coal mine for on-site use to fuel an internal combustion power generation facility located in close proximity to the mine’s surface facilities. A series of 19 wells are proposed,

positioned along the western rim of the pit, where the total estimated CMM production is 54.3 million m³ of methane over 10 years which is available for use to generate electricity.

- ✎ RRR completed the study “Pre-feasibility Study for Coal Mine Methane Recovery and Utilization at Naryn Sukhait Mine”, at the open cast coal mine in the South Gobi coal basin of Mongolia. The study examined the potential for employing vertically drilled wells to capture methane gas prior to mining for use as fuel to generate power at the mine. The study was published in March 2013 as is available on the USEPA website at http://www.epa.gov/coalbed/docs/Mongolia_%20Naryn%20Sukhait%20Prefeasibility%20Study_FINAL.pdf).
- ✎ The study, “Pre-feasibility Study for Fuhong Coal Mine, Guizhou Province” was completed by RRR and published in March 2013. The study was performed to examine the potential for implementing a methane recovery and utilization project, through the use of cross-measure boreholes drilled from within the mine workings to capture methane gas and reduce the potential for coal and gas outbursts. The study was published and is available on the USEPA website at https://www.globalmethane.org/Data/FUHONG%20MINE_EN.pdf).
- ✎ The study, “Pre-feasibility Study for Coal Mine Methane Recovery and Utilization at Yanjing Mine” was completed by RRR and published in March 2013. The study was performed to examine the potential for implementing a seven well pilot gas drainage program in which the coal seams are hydraulically fractured to stimulate gas production and lessen the potential for coal and gas outbursts. The study was published and is available on the USEPA website at https://www.globalmethane.org/Data/Yanjing%20Mine_EN.pdf).
- ✎ As a part of the work we conduct for the USEPA’s Coalbed Methane Outreach Program, RRR suggested that guidance was needed for CMM project developers. Based on market studies that were a part of recently published feasibility and feasibility studies conducted at various mining complexes in coal rich provinces of China, the 174 page study published in 2012, titled, “China’s Energy Markets: Anhui, Chongqing, Henan, Inner Mongolia, and Guizhou Provinces”
✎ <http://www.epa.gov/cmop/docs/2012ChinaEnergyMarket.pdf>) covers the energy markets and policy issues that must be understood in order to successfully produce and sell energy in these provinces. RRR is updating the report for re-publication in 2015.
- ✎ RRR reviewed and proposed revisions for ArenaEco’s Pre-Feasibility Study for Zhdanovskaya Mine in Ukraine for the United States Environmental Protection Agency.
- ✎ RRR provided advisory to the Guizhou International Cooperation Center for Environmental Protection Feasibility Study for Coal Mine Methane Recovery and Utilization at Qinglong and Zhongling Mines, Guizhou, China.
- ✎ In 2012 RRR conducted a study of an underground coal mining complex in Viet Nam. The purpose of the study was to determine the technical and economic feasibility of employing state-of-the art gas turbines fueled by low concentration CMM and VAM to supplement power required for the mining and coal processing operations. The study comprised detailed analysis of the underground coal mining complex’s future plans for two active mines and two presently under construction. Historical coal production and correlated methane emissions data were used to forecast the increase in the complex’s VAM emissions which will be expected as coal production is increased over the next

decade. Reservoir simulation software was used to forecast CMM that will be produced using the technological approach employed by the mining company to drain gas from gassy coal seams.

-  RRR completed a study, “Feasibility Study of CMM Utilization for Guizhou Nengfa Power Fuel Development Co., Ltd. Linhua Mine Located in Guizhou Province, People’s Republic of China”. This study investigates the technical and economic potential for employing directionally drilled surface to in-seam boreholes to drain gas from extremely gassy and outburst prone seams. Data available from the existing gas drainage system was used to forecast future production using proposed technology and future coal extraction rates. The study was published in early 2011 and is available on the USEPA website at (http://www.epa.gov/cmop/docs/Nengfa_FeasibilityStudy.pdf).
-  RRR conducted a pilot drilling program in the Philippines in advance of mining at an open pit coal mine in 2010. The project was conducted in preparation for mounting a drilling campaign aimed at producing gas and earning CERs under the newly revised CDM protocol ACM0008. RRR was responsible for drafting the revision to the protocol that now allows for claiming carbon credits derived from gas drainage projects conducted at open pit mines.
-  RRR conducted a study to determine the technical and economic potential of producing gas in advance of mining at a coal property being developed in Indiana. Production data available from a neighboring CBM field that produces from correlative coal seam reservoirs was used to generate a stochastic forecast of expected production from the mining property.
-  RRR performed a technical and economic study to determine the feasibility of draining gas in advance of mining at a room and pillar coal mine located in Oklahoma. Subsequently, RRR designed and conducted a pilot directional drilling program on behalf of a carbon emissions trading company.
-  RRR completed the study “Feasibility of CMM Utilization for Songzao Coal and Electricity Company Coal Mines,” working with Chongqing Energy Investment Group (CQEIG) as their coal mine partner. The feasibility study showed that installation of a LNG plant utilizing 100 million cubic meters of gas that is presently being emitted to the atmosphere is feasible and economically attractive. This study is available to the public at http://www.epa.gov/cmop/docs/feasibility_study.pdf. A LNG plant is under construction and will cost an estimated \$110 million USD.
-  RRR performed a mid-term evaluation of the UNDP/GEF project “Russia – Removing Barriers to Coal Mine Methane Recovery and Utilization”; with follow up work in the capacity as international technical advisors to the project.
-  RRR has worked with several clients as a technical advisor to identify coal mine methane utilization opportunities in Russia, Ukraine, and Kazakhstan for carbon financing under Kyoto mechanisms.
-  RRR coordinated and analyzed the flow testing of a well drilled by Peabody Natural Gas into an abandoned Peabody coalmine in Franklin County, Illinois. This information was used along with a detailed geologic mine model to calibrate the simulated prediction of gas production through time. The flow test combined with the simulation was the key to determining the volume of the mined area being drained by the well. RRR then conducted similar analysis for another abandoned mine property in Illinois controlled by Peabody.

In addition, RRR helped Peabody in valuing an existing coal mine methane production project for purchase, which included 42,000 acres and 8 mine properties with existing production, and an additional 49,000 acres and 16 mine properties not currently under production.

✎ RRR has provided geologic and engineering experience and expertise to many U.S. underground gassy coal mines, from the Cumberland Mine in southwestern Pennsylvania, to the West Elk, Sanborn Creek, and Bowie mines in Colorado, the Willow Creek Mine in Utah, and the San Juan Mine in New Mexico. These services range from desorption testing, to coal mine methane production forecasting (gob wells and pre-mine drainage wells), CMM reserves estimations, and the modeling of methane liberation associated with coal mining.

RRR uses state of the art reservoir simulation software, GEM from the Computer Modeling Group, for both CBM and CMM project and reserves analysis. This software has been used to build both simple and complex mine models to investigate mine gas recovery scenarios. Models of active mines can, once calibrated, provide methane liberation forecasts within various locations of the mine and can be used to investigate the effect of various methane mitigation strategies such as gob drainage and pre-mine methane drainage.

✎ Under contract to Alkane Energy PLC (formerly Coalgas UK, PLC), RRR determined methane reserves contained in abandoned underground coal mines within the Alkane license areas in the U.K. Alkane was seeking to establish numerous sites above abandoned coal mine workings that would draw medium heating value gas from the mine void space for use as fuel for local industry, or for generating power through the use of internal combustion engines for distribution through the electric grid. We performed simulation modeling of methane emissions from these mines using computational fluid dynamics software. RRR also prepared production rate schedules and determined cash flow projections that Alkane used in business planning and capital solicitation.

✎ RRR began working for the U.S. EPA in Eastern Europe in 1989, when RRR first conducted missions to Poland, and then to Czechoslovakia, to identify opportunities for coalbed methane recovery and utilization. Then in 1992, RRR traveled to Ukraine and Russia to conduct a similar mission. During this last mission, RRR visited the Kuznetsk Basin in western Siberia, the Donetsk Coal Basin (most of which is in Ukraine) and the L'vov-Volyn Basin in Ukraine, and compiled extensive geologic, coal, and coalbed methane information on these basins. Following publication of the 1994 report Reducing Methane Emissions from Coal Mines in Russia and Ukraine: The Potential for Coalbed Methane Development, RRR undertook subsequent U.S. EPA missions to Ukraine to identify opportunities for coalbed methane projects at specific mines in the Donetsk Basin, specifically the Skochinsky Mine. We performed a preliminary technical and economic analysis of methane utilization potential at this mine. At the same time, RRR developed profiles of six mines in the Kuznetsk Basin, highlighting their potential for coal mine methane project development. Following, we continued to provide assistance to the Alternative Fuels Center in Ukraine, which included training in the use of an economic model for determining the feasibility of various coalbed methane projects.

In addition, RRR managed a project for U.S. EPA analyzing the potential for reducing methane emissions from the Kirov and Pervomaiskaya Mines in Russia, by cofiring methane with coal in boilers at the mine. These studies required extensive analysis of options for improving coalbed methane extraction from the mines, and a thorough understanding of the process for combusting recovered methane in boilers for the purpose of space and hot water heating at the mines.

Also, under contract to EPA, RRR has worked with what was originally the Russian Coalbed Methane Center as it became a private, not-for-profit organization (evolving into Uglemetan), helping them develop a business plan and marketing materials in order to attract investors to Russia and the Kuzbass. RRR has continued its involvement with Uglemetan, by reviewing proposals which have been prepared for potential funding sources, as well as continuing to offer advice as the project develops.

✎ Separate and distinct from its U.S. EPA work in Ukraine, RRR, as an equity partner in CBM Energy Limited, developed a coalbed methane prospect in Ukraine, comprising almost 640,000 acres. This required travel to Ukraine and extensive data collection. RRR calculated coal reserves and recoverable methane reserves within the area of interest, prepared a financial analysis, and designed a pilot exploration and development program. RRR was also involved in the negotiations with the regional pipeline company and potential end-users, which resulted in letters of intent from the organizations. Unfortunately, due to political issues within the government, the project was ultimately abandoned.

✎ RRR has been actively involved in coalbed methane activity in China since 1990 as a member of a U.S.EPA-led mission to assess the opportunities for coal mine methane recovery and utilization. We began providing geological expertise to a Global Environmental Facility (GEF) project in 1991, which was administered by the United Nations Development Programme (UNDP). UNDP's goal was to evaluate the potential for coalbed methane development in China. Our personnel continued to support the project, participating in three missions in 1995 and 1996. RRR's role in the project included identifying equipment to be procured, constructing laboratory equipment, and conducting technical workshops and training. The program resulted in several methane recovery and use demonstration projects and has since been completed.

✎ RRR provided an expert to a United Nations Development Programme mission to India for the purpose of developing a "project brief". This document described a plan for a coalbed methane demonstration project that calls for developing a gas recovery program at two underground coal mines. The recovered gas would fuel an internal combustion power generation station and a compressed natural gas vehicle refueling station. The Global Environmental Facility (GEF) accepted the program as a funding candidate.

As a result, the RRR expert led a second mission to prepare a Project Document that detailed the activities and proposed a budget. GEF approved the project and funded it for a total of \$US19.2 million. Project implementation began in 1998.

✎ RRR has also conducted follow-on coalbed methane missions to China for U.S. EPA. In 1994 and 1995, RRR undertook missions to China on behalf of U.S. EPA, and used data gathered during these missions to prepare a comprehensive 1996 report on the potential for coalbed methane development in China. The report discussed coalbed methane resource estimates for various basins within China and the potential for increasing its recovery and use.

✎ RRR also supported efforts by U.S. EPA and the China State Administration of Coal Industry (SACI) to increase coalbed methane development by attracting foreign investment in coalbed methane projects. More recently, RRR assisted U.S. EPA/SACI in a joint project to develop and market "data packages" for selected coal mining administrations that are promising in terms of coalbed methane project potential. These data packages present detailed information on the current state of coalbed

methane development in the area of interest, including resources, current methane production, technologies used, market potential, and investment required. Each data package includes a technical and economic analysis of various project options. Most recently, RRR assisted the China Coalbed Methane Clearinghouse to develop an Investment Guide for coal mine methane project opportunities in China.

✎ Evaluated a portfolio of 13 mines using a risk assessment technique to assign probability that the projects will produce forecasted quantities of CERs; was used to determine a basis for a negotiated purchase price for the projects.

✎ In addition to coalbed methane projects in China for the United Nations and U.S. EPA, RRR undertook a project for J-Coal as a key participant in an Asian Pacific Economic Cooperation (APEC) mission to China during which a site was selected for a demonstration of coal mine gas recovery. Our primary role in the project was to estimate reserves and evaluate the technical feasibility of coalbed methane recovery.

✎ In cooperation with Sumitomo Mining Corporation, RRR helped to better understand the potential for coal mine methane recovery from the abandoned Akabira Mine on the island of Hokkaido, Japan, which was once one of the gassiest mines in the world. Undertaking the study required RRR to gain a thorough understanding of the geologic and structural setting of the region, and the production history of coal and methane at the mine. RRR estimated remaining coal reserves at the mine, and then estimated the remaining gas resource by calculating the original coal resource and the gas contained therein, and then subtracting the gas contained in the mined-out coal and the gas migrating within the coal from a halo surrounding the mined-out areas, and from surrounding strata.

Based on RRR's resource estimates and recommendations, Sumitomo Mining Corporation has implemented a project to recover methane from the Akabira Mine for power generation to help meet the power needs of the surrounding area.

✎ Private sector projects have been the focus of RRR's efforts of over the last few years. In 2002 RRR was retained by Far East Energy Corporation to evaluate its project in Guizhou Province. This was to be an integrated coalmine gas production and electric power generation project which was later determined to be uneconomic because of deal structure.

✎ In 2003, RRR was retained by Sino-American Energy, Inc. to evaluate the plans for its Jincheng CBM/CMM project in Shanxi province. Mr. Pilcher remains as an advisory board member and continues to work with Sino-American in developing future plans and consults with the Jincheng Anthracite Mining Company on project implementation.