Conducting Pre-Feasibility Studies for Coal Mine Methane Projects

Module 1 – Introduction and Objectives

Welcome

The United States Environmental Protection Agency (EPA) developed this course in support of the GMI and in conjunction with the United Nations Economic Commission for Europe (UNECE).
This course introduces principles for assessing the potential of developing projects to capture and/or use Coal Mine Methane (CMM). The introduced general approach should be underpinned by mine-specific data and analyses, allowing the principles to be tailored to the unique conditions at each mine. Ideally, such an assessment will lead to project development and implementation.

What is the GMI?

The Global Methane Initiative (GMI) is a voluntary, multilateral partnership that aims to reduce methane emissions and to advance the abatement, recovery, and use of methane as a clean energy source.

GMI Partner Countries account for nearly 70% of total global manmade methane emissions, which is equivalent to approximately 5,000 MMTCO2e.

Who Can Benefit from this Training?

In most cases, assessment of CMM project potential through a pre-feasibility study will be carried out by a project developer or another 3rd party in partnership with a mine.

Project Developers

Role in CMM Project Development: Design, build and operate most CMM projects

After this training, project developers will: Understand a systematic approach and the key elements of a study that will be the foundation of a “bankable” document

3rd Parties

Role in CMM Project Development: International Centres of Excellence on CMM, Coalbed Methane (CBM) clearinghouses and other independent experts prepare studies in support of project development

After this training, 3rd parties will: Be able to improve the quality and value of pre-feasibility studies by working with project developers, mining companies or other stakeholders

Mining Company Personnel

Role in CMM Project Development: Provide access to gas and land, are recipients of energy recovery from CMM projects, and may self-develop/co-develop projects

After this training, mining company personnel will: Be able to anticipate the technical and market data required for pre-feasibility and feasibility studies

Government Officials

Role in CMM Project Development: Regulate and incentivize project development and operation

After this training, government officials will: Understand the purpose, scale and benefits of CMM projects

Conducting Pre-Feasibility Studies for CMM Projects: Course Modules

Module 1: Introduction and Objectives

Module 2: Mine Background Information and Evaluation

Module 3: Resource Assessment

Module 4: Improvements to Gas Drainage

Module 5: Identifying Benefits of Improvements

Module 6: Gas Production Forecast

Module 7: Market Analysis, Financial Analysis and Report Preparation

Module 8: GMI Pre-feasibility Study Case Study – Liulong Mine, China

Module 1: Introduction and Objectives Title Slide

What You Will Learn

In this module, you will learn about:

- Mine methane as a safety hazard, climate pollutant and energy resource
- Mine methane use options
- Use of a pre-feasibility study as a tool to assess project viability
- Key concepts for conducting pre-feasibility studies

Time needed to complete this module – Approximately 20 minutes.

Methane Hazards and Climate Pollution

Methane in mines poses safety risks due to its explosiveness when mixed with air.

In addition, methane is a potent greenhouse gas. While methane's lifetime in the atmosphere is much shorter than carbon dioxide's (CO_2), it is 28 times as efficient at trapping radiation than CO_2 over a 100-year period.

Methane is also the main precursor of ground level ozone pollution and thus affects air quality.

However, methane is also an energy resource that can be captured and used.

CMM Capture

Benefits of capturing and recovering CMM include:

- Generating a source of local, clean-burning energy
- Enhancing mine safety by reducing in-mine concentrations of methane
- Increasing mine productivity
- Adding revenue to the mine through sale or use of the gas
- Reducing greenhouse gas emissions and improving air quality

CMM Use Options

Viable CMM use options depend on a range of factors, including gas quantity and quality, energy prices, access to the gas, incentives and other factors.

Worldwide, CMM is most often used as the following:

- Power Generation/Combined Heat & Power (CHP)
- Pipeline Injection/Town Gas
- Direct Thermal
- Ventilation Air Methane (VAM)
- Flaring
- Transportation Fuel/Compressed Natural Gas (CNG)

Uses of CMM Use Globally

The most common types of CMM projects in 2019 (excluding Abandoned Mine Methane [AMM] projects) are

- Power/CHP: 68
- Pipeline Injection/Town Gas: 28

- Direct Thermal: 23
- VAM: 9
- Flaring: 8
- Transportation Fuel: 1

If project economics do not allow for a positive return on investment, CMM can be flared, if allowable, for safety and methane emission reduction benefits.

Pre-feasibility Study as a Tool

Several type of studies can be used to evaluate the viability of methane recovery projects.

Desk Study

Objective:

- First order analysis based on limited data

Characteristics:

- Basic assumptions
- Simple financial modeling

Pre-Feasibility Study

Objective:

- More detailed analysis with site-specific information

Characteristics:

- More detailed review of gas resources
- Review of gas drainage
- Gas production forecast
- More thorough financial analysis

Feasibility Study

Objective:

- “Bankable” document (i.e., sufficient to secure project financing)

Characteristics:

- Thorough report investigating the economic and technical feasibility of project development
- "Bankable" document sufficient for 3rd party financing

Pre-feasibility studies are most common because they offer a robust yet cost-effective option to initially assess a project's technical and economic potential.

What Does Project Financing Require?

Financing requires "investment grade," or "bankable," documentation including:

- Thorough and complete technical assessment of the feasibility of the project
- Robust financial analysis backed by an auditable and well-constructed financial model based on realistic assumptions

Is a Pre-feasibility Study "Bankable?"

Bankable is a term used to characterize a document's usefulness in securing investors in a project. Generally, the more rigorous and site-specific the analysis, the more likely it will be to secure project investment.

A pre-feasibility study is generally not considered a bankable document for a CMM project because:

- Geologic review is limited in scope
- Improvements to gas drainage or ventilation are preliminary and require a more thorough engineering study
- The CMM utilization project is conceptual and costs are estimates

The pre-feasibility study does provide a reasonable approximation of project requirements and costs, and it leads to development of a full feasibility study (which is generally considered bankable).

Are You Ready to Initiate a Pre-feasibility Study?

These critical first activities help to ensure the success of the pre-feasibility study, whether it is carried out by a project developer, the mining company, or a 3rd party.

Clarify study objectives & scope

Answer these questions to clarify the objectives and scope of the study:

- Is it a pre-feasibility or full feasibility study?
- Is it at one mine or multiple mines?
- What are the expected outputs of the study?

Confirm commitment of mine management

Confirm with the managers of the mine that you will:

- Obtain access to the site
- Have support from mine staff
- Be provided with sufficient data

Verify project type

Verify the type of project. For example, clarify:

- VAM or CMM drainage?
- Energy recovery or destruction only?
- Use energy on-site or off-site?

Steps in a Pre-feasibility Study

1. Assess regional and national coal industry and methane emissions: Understand the project's economic viability
2. Identify regulatory barriers: Consider the project's potential regulatory viability
3. Request, obtain and validate data from mine: Obtain data to determine the scope of work
4. Assess gas resources: Determine the project viability
5. Review existing gas drainage practices: Review current practices to develop alternatives
6. Evaluate potential CMM markets: Determine possible end uses of the gas captured
7. Identify and assess project risks: Determine if alternatives must be considered due to risk
8. Identify best end use option: Maximize the revenue of the project
9. Define assumptions and perform financial economic analysis: Determine realistic expectations for the project
10. Review results, adjust assumptions, and develop a recommendation: Make adjustments to recommendations based on all available data

These components will be covered in more detail in subsequent modules.

Pre-feasibility Study Report Outline

A pre-feasibility study report includes the following:

- Executive Summary
- Background and Introduction

- Summary of Mine Characteristics
- Gas Resource Assessment
- Market Information Overview
- Technical Possibilities Assessment
- Project Cost Estimate
- Cost-Benefit Analysis
- Conclusions
- Recommendations

Module 1 Summary

In this module you learned about:

- The role that methane plays as a greenhouse gas
- CMM capture and use
- Pre-feasibility studies as a tool for CMM projects
- Components of a pre-feasibility study

Looking ahead - The components of a pre-feasibility study will be explored in greater detail in the upcoming modules. This course also includes a practical example of a pre-feasibility study conducted in Liulong Mine, China to help link theoretical concepts presented in the training with a practical example.

Thank you!

You have completed Module 1.