

# Overview of Tools and Resource Available Through GMI and CMOP

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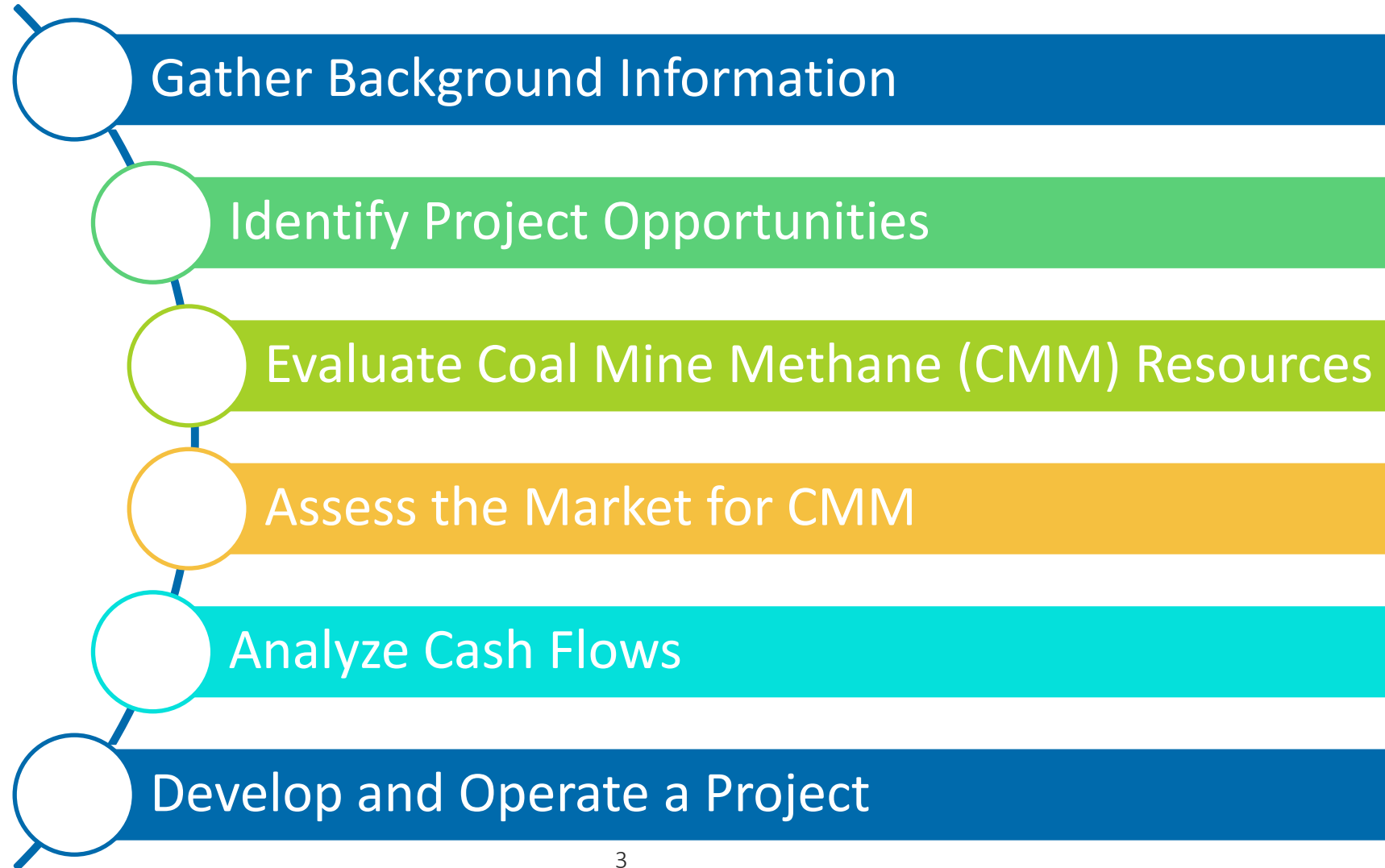


# Tool and Resourced Developed by U.S. EPA

- EPA supports development of tools and resources:
  - **domestically** through its Coalbed Methane Outreach Program (CMOP)
  - **internationally** through support of the Global Methane Initiative (GMI) and collaborative work with international Partners
- Many domestic and international tools mirror each other
- Some of the tools were initially developed by EPA under CMOP and then adapted for international users in collaboration with Partners and Project Network members
- EPA also collaborates with UN Economic Commission for Europe (UNECE) on developing and releasing sector-relevant products, such as Best Practice Guidance
- Objective: Offer a platform for disseminating best practices



# Type of Tools and their Relevance

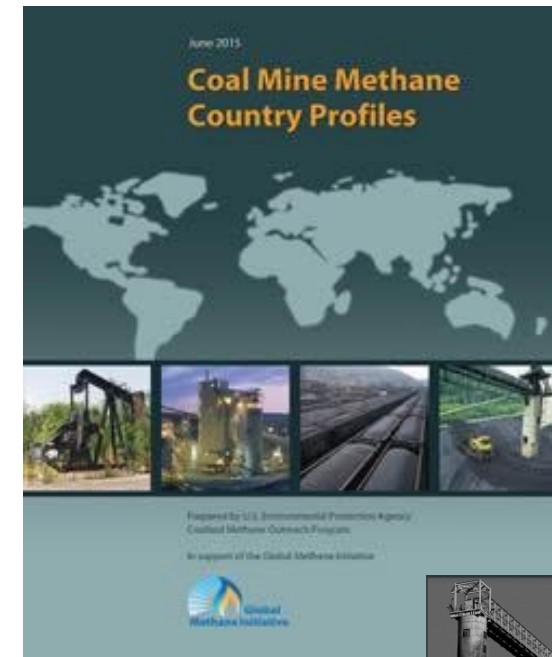


# Gathering Background Information

## GMI Resource:

### ■ [CMM Country Profiles:](#)

- Comprehensive profile of CMM sector for 37 countries (2016)
- 6 countries were updated in 2020 (China, India, Kazakhstan, Mexico, Vietnam, Turkey)
- On-line resource updated regularly
- Partners and Project Network can submit relevant and updated information



## CMOP Resource (U.S.-only):

### ■ Report [Coal Mine Methane Developments in the U.S. \(PDF\):](#)

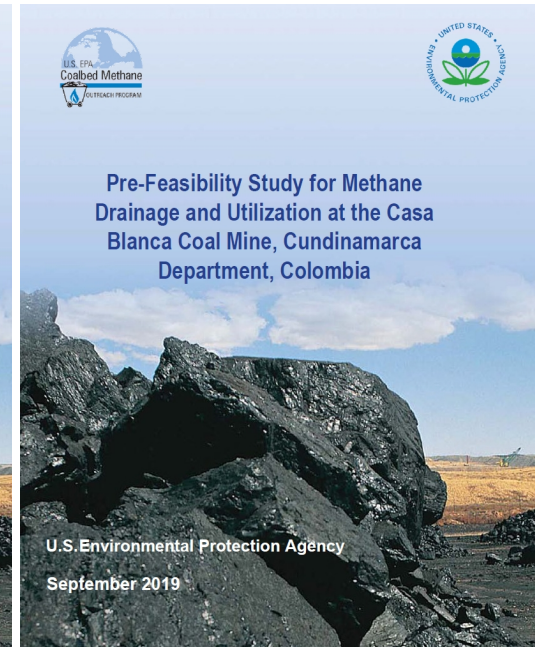
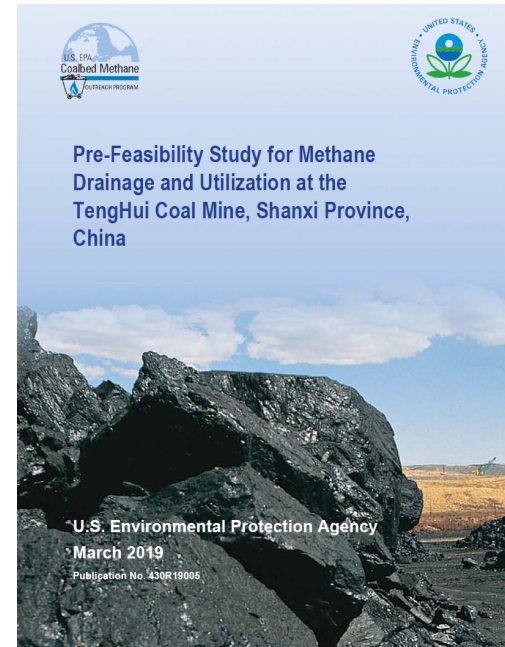
- Provides overview of U.S. CMM emissions, CMM use, federal and state policy incentives, emergence of carbon market
- Periodically updated, latest update in 2019



# Identifying Project Opportunities

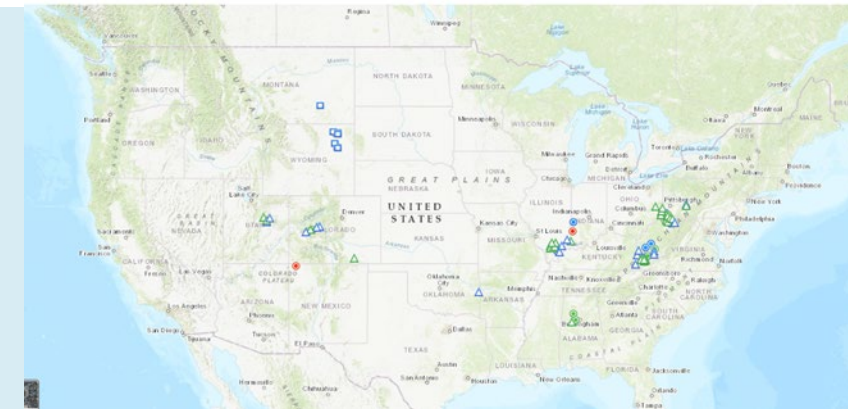
## GMI Resource:

- Prefeasibility and feasibility [studies](#) in GMI countries:
  - Over 50 studies in 11 GMI Partner countries
  - Most recent studies in China, Colombia, India
  - Available on GMI/CMOP websites



## CMOP Resource (U.S.-only):

- Online [map](#) of U.S. CMM Opportunities:
  - Annually updated based on data submitted by coal mines to the U.S. Greenhouse Gas Reporting Program and data from the U.S. Greenhouse Gas Inventory



# Evaluating CMM Resources

## GMI Resource:

- [Training](#) on how to conduct prefeasibility studies:
  - To assess CMM opportunities (in progress)
  - To assess AMM opportunities (initiated)
  - Seeks to help develop CMM mitigation projects, for which a prefeasibility study is a necessary step

Module 1

Are You Ready to Initiate a Pre-feasibility Study?

Clarify study objectives & scope → Confirm commitment of mine management → Verify project type

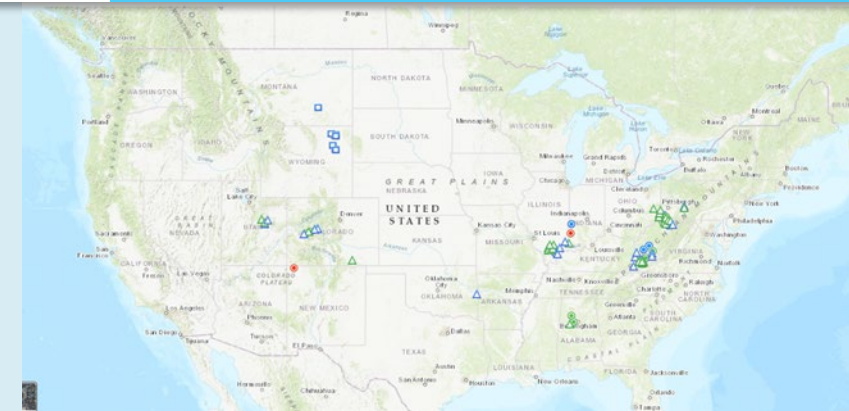
Steps in a Pre-feasibility Study

- 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. Hover to preview

## CMOP Resource (U.S.-only):

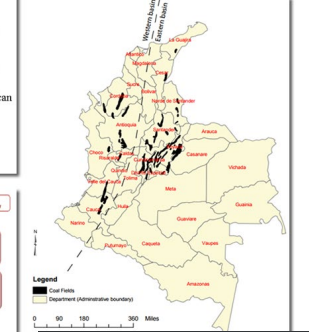
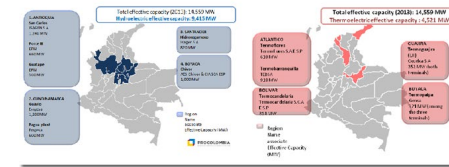
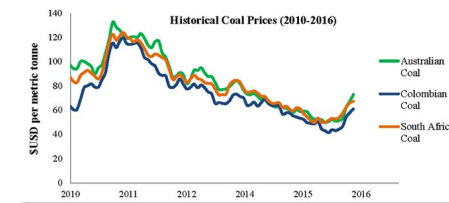
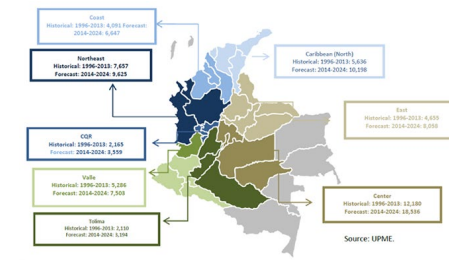
- Online [map](#) of U.S. CMM Opportunities:
  - Annually updated based on data from the U.S. Greenhouse Gas Reporting Program and the U.S. Greenhouse Gas Inventory
  - Accompanied by a report that profiles the 35 gassiest U.S. coal mines
  - Companion table that includes additional mines with gas drainage operations



# Assessing the Market for CMM

## GMI Resource:

- CMM market [studies](#) for select countries:
  - Summarize current CMM and coalbed methane (CBM) projects and CMM emissions
  - Identify opportunities for CMM mitigation and utilization projects
  - Outline challenges and benefits of implementing CMM and CBM projects
  - Completed studies for India and Colombia in 2019



## CMOP Resource (U.S.-only):

- Publication [State Renewable Energy Programs \(PDF\)](#)
- Publication [Emerging Financial and Regulatory Incentives for CMM Emission Reduction Project Development \(PDF\)](#)
  - Both updated in 2019



Coal mine methane (CMM) is a major source of anthropogenic greenhouse gas (GHG) emissions, accounting for an estimated 9% of global methane emissions in 2005. Considerable progress has been made, as of 2017, in the United States in reducing CMM emissions, which have dropped below 1990s levels. Many U.S. coal mines are now capturing and using, selling, or destroying the gas. Emerging state and federal financial and regulatory incentives enable coal mines to develop and operate CMM emission reduction projects for both economic and environmental reward. Mines benefit financially from avoided energy costs and/or from revenues generated from CMM recovery and use or destruction, while reducing GHG emissions.

**Potential Markets for CMM**

The largest and most prevalent CMM emission reduction projects in the United States involve capture and sale of produced gas directly to natural gas pipelines. Using CMM to fuel electrical generation via gas turbines or internal combustion engines is another potentially profitable way to generate revenue by selling energy into the electricity grid. Alternatively, mines can reduce costs by using power generated onsite to run ventilation fans and other equipment.

Other uses for CMM include producing heat for coal drying or heating mine ventilation air during the winter months, feedstock fuel for manufacturing and processing end uses, and vehicular fuel (e.g., liquefied or compressed natural gas). Methane emission reduction credits or offsets associated with CMM emission reduction projects may be sold into emerging carbon markets (see next page). Carbon credit revenues can be generated for emission reductions from both active and abandoned coal mines.

**State Alternative Energy and Renewable Portfolio Standards**

Several major coal-producing states have enacted alternative energy and renewable energy programs that include coal-related methane as a targeted renewable or clean energy resource.

**State Programs that include CMM**

- Colorado, Indiana, Ohio, Pennsylvania, Utah

• In 2004, Colorado created a Renewable Portfolio Standard (RPS) by ballot initiative requiring utilities to generate or purchase enough renewable electricity to supply 10-30% of their electric sales by 2025. Legislation enacted in 2013 expanded the list of "eligible energy resources" to include CMM.

• Established in 2012, Indiana's Voluntary Clean Energy Portfolio Standard Program provides utilities with incentives to voluntarily increase the amount of clean energy resources - which includes coal bed methane - in their electricity portfolio, with a goal of 15% by 2025.

• Ohio's Alternative Energy Resource Standard (AERS) was created by S.B. 221

# Analyzing the Cash Flows

## GMI Resource:

- CMM Cash Flow [Model](#):
  - An Excel-based tool that allows coal mine operators and owners, project developers, equipment vendors, and other interested parties to evaluate the financial viability of recovering and utilizing CMM from gob wells, abandoned mine drainage wells, or mine ventilation air
  - Last updated in 2019

## CMOP Resource (U.S.-only):

- CMM Cash Flow [Model](#):
  - Same tool as above but with U.S.-based assumptions
- Report [Coal Mine Methane Finance Guide \(PDF\)](#)
- Publication [Greenhouse Gas Emissions Trading Programs that Include Coal Mine Methane \(PDF\)](#)





# Developing and Operating a Project

## GMI Resource:

- CMM Mitigation and Utilization Technologies [Database](#)
  - A list of technologies, tools and providers for methane combustion, drainage gas purification, VAM utilization, modeling and analysis, drilling technologies, CMM to LNG.
  - Updated in 2017
- CMM Project [List](#):
  - The most comprehensive list available of CMM projects globally

## CMOP Resource (US-only):

- Industry contact [list](#)
- CMOP [webinars](#) on specific technologies or providers:
  - Latest webinar in 2020 on VAM technologies



## Coal Mine Methane Mitigation and Utilization Technologies and Project Profiles

### Methane Combustion

Gas Engines	
COMPANY	DESCRIPTION
	<i>Mines often vent medium quality gob gas instead of using it, because gob gas requires enrichment and treatment prior to pipeline injection. However, fuel for power generators does not require pipeline quality gas. Generally, IC engines can be adapted to generate electricity using coal mine gas with a methane concentration as low as 25%. Regulations in most countries require a minimum of 25% CH<sub>4</sub> concentration for utilization and some require 30% CH<sub>4</sub>. While all internal combustion engines powered by CMM are capable of producing electricity, several also have the capability for waste heat recovery and co-generation. There has been considerable consolidation among engine manufacturers in recent years and the list below in some cases includes different brands produced by the same manufacturer.</i>
Caterpillar <a href="http://www.cat.com/power-generation">http://www.cat.com/power-generation</a> 888-614-4328 toll free in United States and Canada +1 (309) 675-2337 International <a href="http://www.cat.com/en_US/support/contact-us.html">http://www.cat.com/en_US/support/contact-us.html</a>	Caterpillar has introduced a range of larger, more efficient gas generator sets that can be fueled by CMM, landfill methane, or natural gas. The CMM fueled CAT™ G3520C Gas Engine produces 2077 kW with an efficiency of about 40% and NO <sub>x</sub> ratings as low as 0.5 g/bhp-hr. Minimum methane concentration for gas engines may be as low as 25%. Large installed base of CMM power generation, mainly in Australia and China. <a href="http://www.cat.com/power-generation">http://www.cat.com/power-generation</a>



United States Environmental Protection Agency (EPA)  
Coalbed Methane Outreach Program Webinar

## Ventilation Air Methane Projects in the United States: Barriers and Potential Opportunities

February 27, 2020



# Conclusions

- A multitude of tools are available through GMI to assist project developers, project hosts or coal mines to capture and use CMM
- This presentation focused on project-relevant tools and has not covered reports and information that offer policy recommendations, such as best practices for AMM and CMM ownership
- We would like to include more tools and serve as a platform for disseminating tool and resources
- Please reach out if you are interested offering translations or have suggestions for additional tools and resources GMI website could add

# Thank you!

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