Tools to assist with evaluating CMM project opportunities in active mines and AMM resources

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U.S. Geological Survey

Methane in coal mines

- Coal mine methane (CMM) is a safety concern in active coal mines. It can be captured prior or during mining to:
  - Generate energy
  - Reduce environmental footprint
  - If not - released to atmosphere as a “mine waste”

- After closure, significant amounts of methane (AMM) can continue accumulating in abandoned coal mines or in sealed areas as a “mine waste”
  - Add value to operations and help with their energy transition efforts
  - Reduce environmental and health impacts

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Bottlenecks for techno-economic assessment

- Mine environment and mining geology are complex – almost every situation is unique
- Expertise and understanding of emissions and gas accumulation in mines are limited – training needed
- Standard tools and approaches are not applicable for CMM and AMM resource assessments
  - Methane Control and Prediction Software (Karacan, 2010)
  - Probabilistic assessment methodology for CMM and AMM resources (Karacan and Warwick, 2019)

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Tools

- Methane Control and Prediction (MCP) Software (Karacan, 2010)
  - A practical software built using prediction and classification artificial neural networks. Executable dynamic link libraries (DLLs) were developed using C++ to work with MS Access
  - Contains two main software model categories
  - These models have both deterministic and stochastic options to allow better control of design parameters
  - https://www.cdc.gov/niosh/mining/works/coversheet1805.html - contains the software and links to technical papers related to its development and other information

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Tools

- Methane Control and Prediction (MCP) Software (Karacan, 2010)

Software can be used for a specific prediction or as part of a methodology to help with techno-economic analysis

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Tools

- Methane Control and Prediction (MCP) Software (Karacan, 2010)

Gob Gas Venthole Production Performance Prediction Model Output

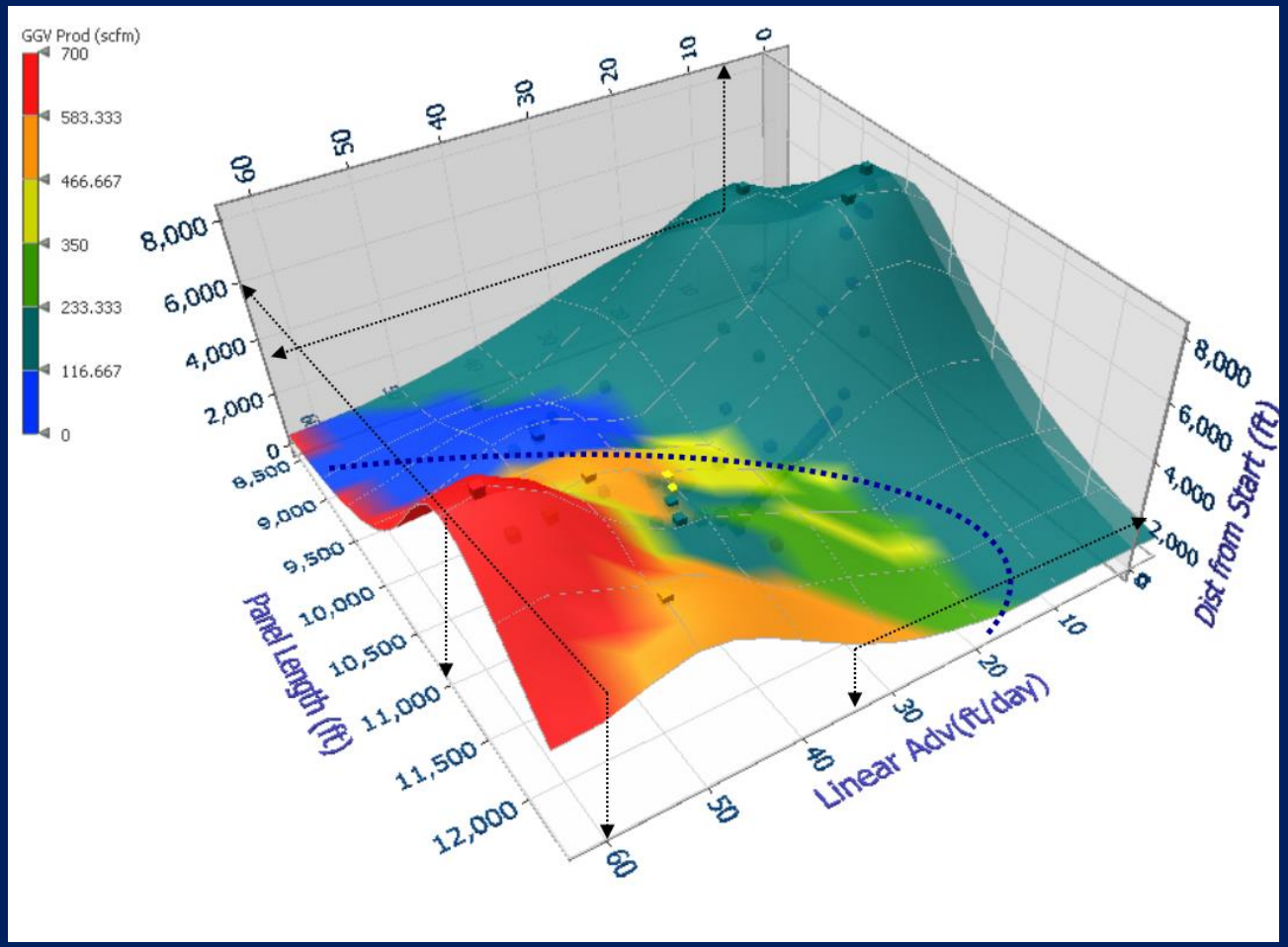
Input Values:

Is Panel Completed?	Active
Is There Face Advance?	Advancing
% of Panel Completed:	80
Linear Advance Rate (ft/day):	60
Surface Elevation (ft):	1050
Average Overburden (ft):	800
Casing Diameter (inch):	7
Distance of Slotted Casing Bottom to Coal Top (ft):	40
Distance to Tailgate (ft):	250
Distance from Panel Start (ft):	370
Panel Length (ft):	11000
Panel Width (ft):	1250
Barometric Pressure (in Hg):	28.1
Average Exhauster Vacuum (in Water):	-43

Output:

GGV Prod (scfm)	316.3122
Methane Conc (%)	55.6583

Re-Run Model | Return to Menu | Help



Response surface for flow rate for different inputs

Tools

- Probabilistic assessment methodology for CMM and AMM resources (Karacan and Warwick, 2019)
  - https://www.usgs.gov/centers/gemsc/science/assessing-emissions-active-and-abandoned-coal-mines?qt-science_center_objects=0#qt-science_center_objects
  - https://pubs.er.usgs.gov/publication/70203460
- A four-step probabilistic approach, with different data availability options, which aims to predict CMM and AMM resources and potential production timeframe
- Active project – national and international collaborators are welcome to participate

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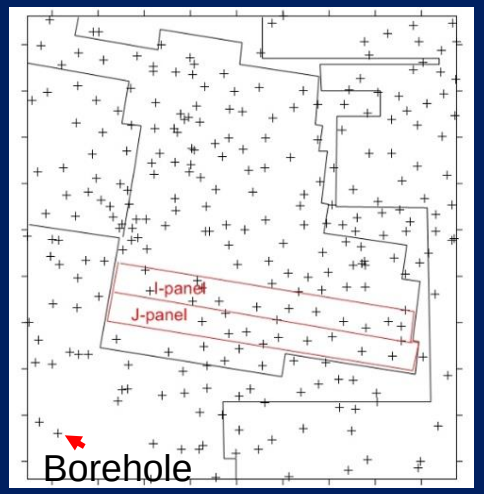
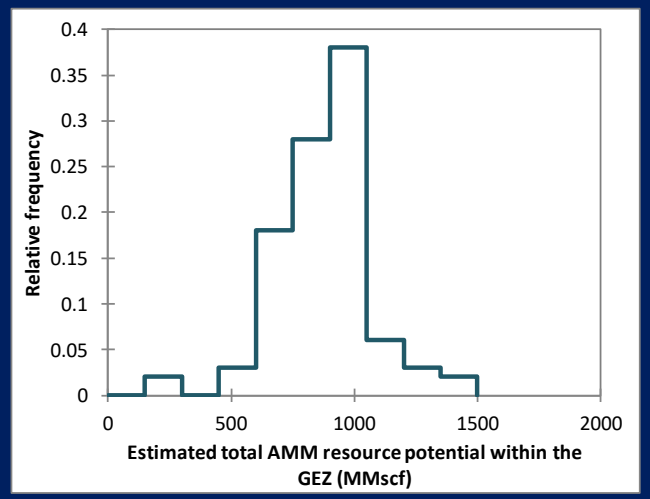
Tools

- Probabilistic assessment methodology for CMM and AMM resources (Karacan and Warwick, 2019)
  - USGS methodology provides estimates of resources and production
  - Use of multiple tools: A recent application of USGS methodology for geologic assessment, MCP for production estimates and US EPA's CMM/AMM cash flow model for economic analysis enabled techno-economic evaluation of mitigating emissions from a coal mine





Assessed area (left) and probabilistic prediction of AMM resource (right)

Thank you

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