Estimating Future AMM Emissions

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Capture and Use of Abandon Mine Methane and Mine Reclamation and Revitalization of Post Mining Areas
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Outline and Acknowledgement

- Introduction
- CMM and AMM methodology
- Results and uncertainty
- Conclusions

This study was born out of discussions on emissions and mine depth during GMI Coal Subcommittee meetings

- U.S. Environmental Protection Agency
- Pacific Northwest National Laboratory
- Raven Ridge Resources, Inc
- Ruby Canyon Engineering

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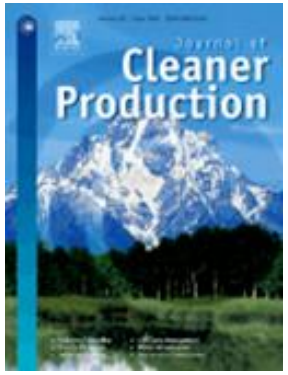
Introduction

- Coal mines get deeper every year and methane emissions grow with increasing mining depth
- As the world produces more coal, and mines are depleted, coal producing countries will also abandon more mines
- Abandoned mine methane emissions have a high degree of uncertainty in many national emissions inventories due to lack of data
- Our study* estimates future global AMM emissions



* Kholod, N., Evans, M., Pilcher, R.C., Roshchanka, V., Ruiz, F., Coté, M., Collings, R., 2020. Global methane emissions from coal mining to continue growing even with declining coal production. Journal of Cleaner Production. https://doi.org/10.1016/j.jclepro.2020.120489

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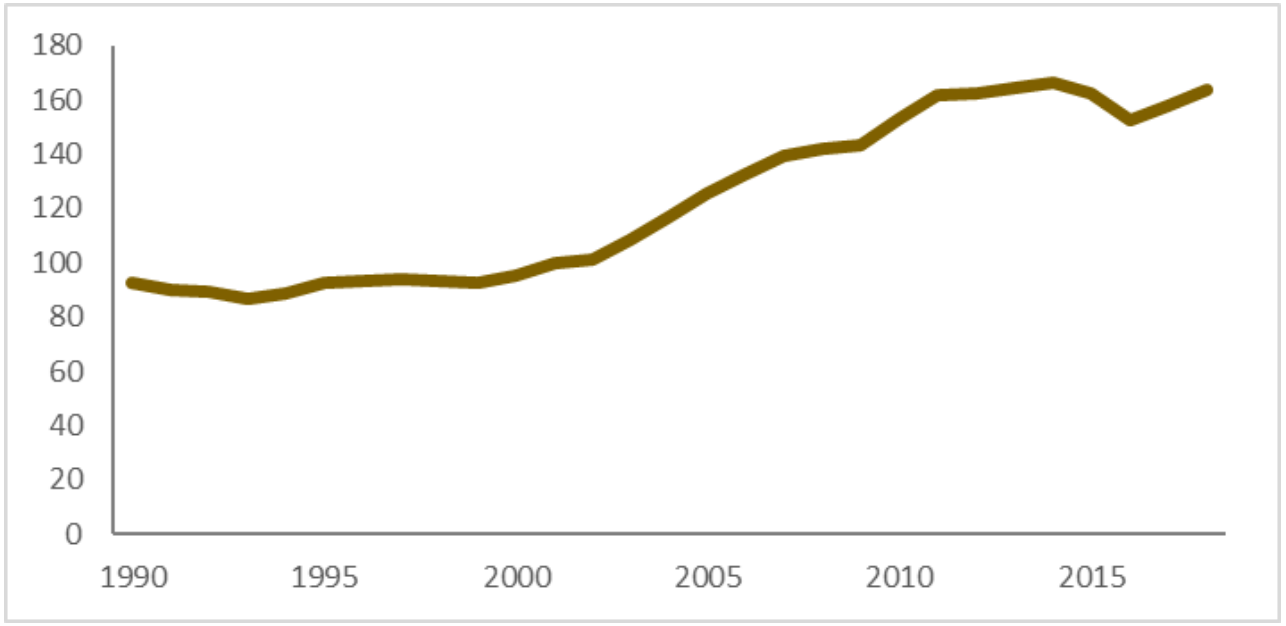
Coal Production and AMM

- If coal production increases, countries will abandon more coal mines in the future because of mine reserves depletion
- If coal production decreases, countries will also abandon coal mines because of low demand

Regardless of the coal production scenario, the number of abandoned coal mines and AMM will increase

Global coal production, EJ (IEA)



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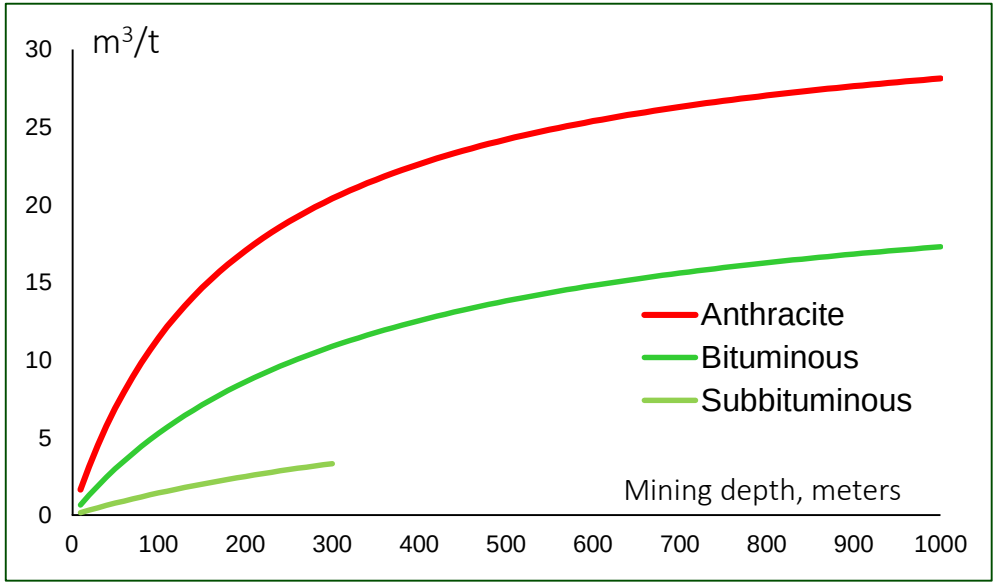
CMM Methodology

- To estimate future AMM emissions, we first need to estimate CMM emissions
- Split hard coal by underground and surface
- Estimate the rate of change in mining depth
- Establish emission factors at given depths and for different coal



Gas content depends on coal rank and mining depth

Relative emissions from coal mining (m^3/t) are not the same as gas content (m^3/t), through they are measured in the same units.

Additional emissions occur from coal pillars left and from methane in coal seams from surrounding strata

Using data on coal production, emissions and mining depth data, **emission factor coefficient** is estimated to be 1.7

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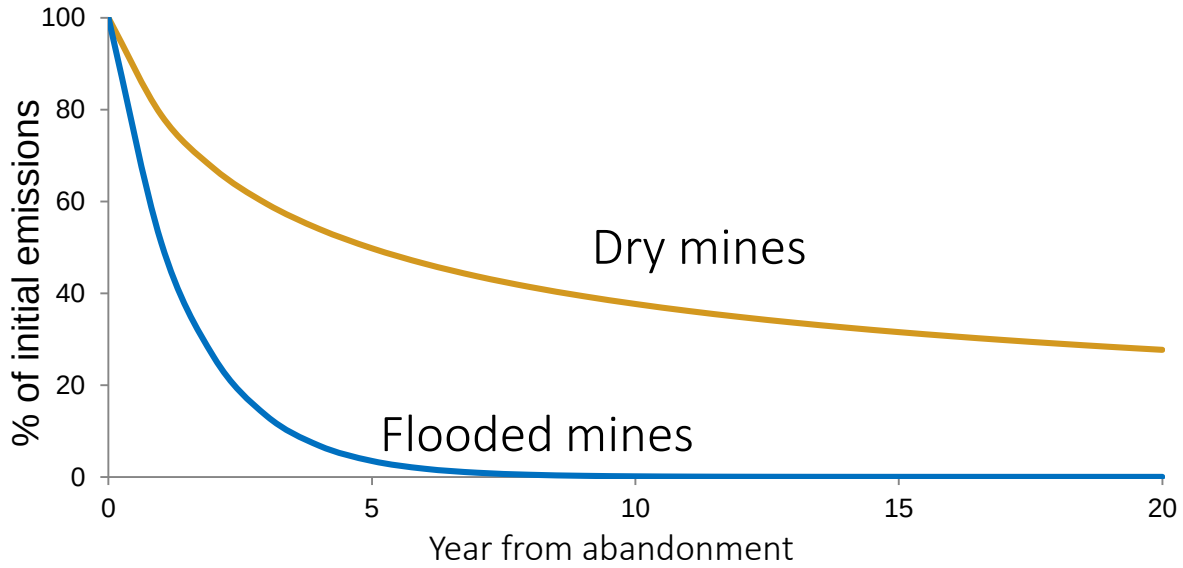
AMM Methodology

- Calculate initial emissions from abandoned mines based on the CMM methodology
- Calculate the global average coal abandonment rate
- Make assumption on the decline rates in emissions over time in dry and flooded mines
- Calculate the emissions from the coal mines abandoned in the past (1971-2010)
- Calculate future AMM emissions from dry and flooded mines



Coal abandonment rate = Abandoned coal production (capacity) / Total coal production (capacity)

Global abandonment rate =
5% of coal production (capacity) per year

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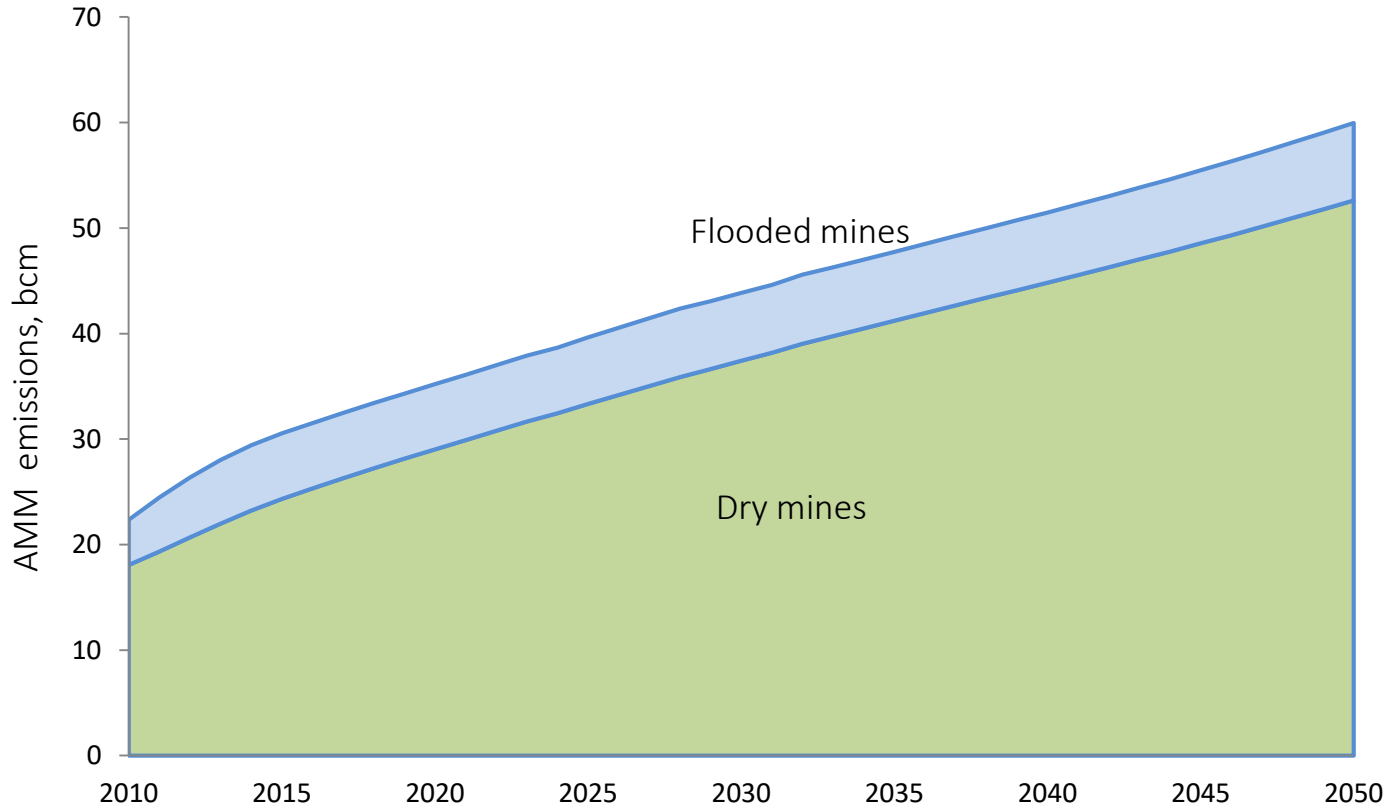
Global AMM Emissions: Reference Scenario

- Total AMM emissions from dry and flooded mines estimate to be 22 bcm/year in 2010
- AMM emission grows to 76 bcm/year in 2050



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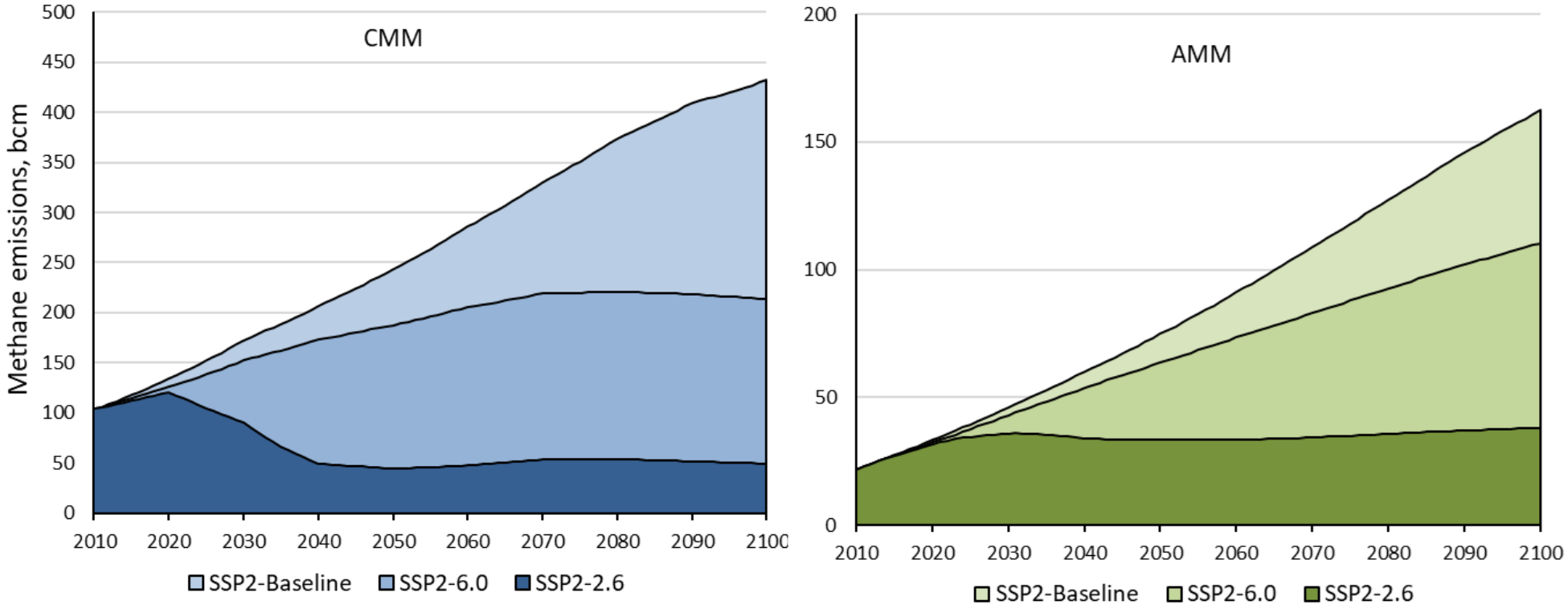
Baseline and Policy Scenarios

- Compare three plausible scenarios: SSP2-baseline (reference case), SSP2-6.0, and SSP2-2.6
- AMM emissions continue to grow even if coal production and CMM decline



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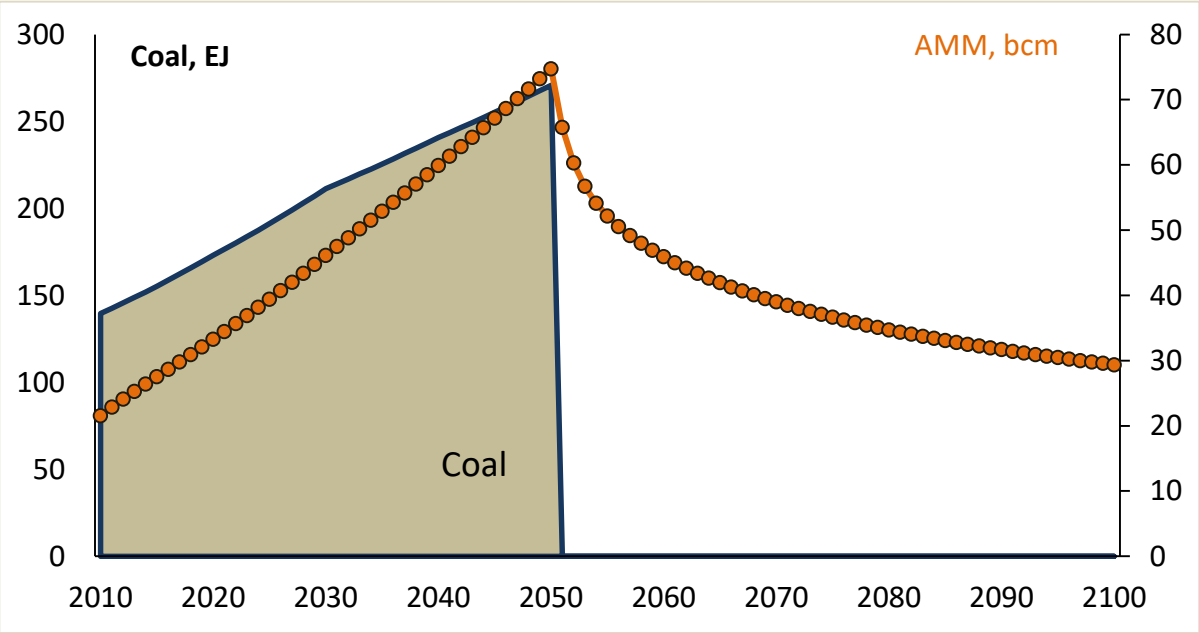
Importance of AMM

- AMM increase faster than underground coal production and CMM
- Growth from 2010 to 2050:
  - Coal – 90%; CMM emissions – factor of 2.4; AMM emissions – factor of 3.5
- AMM does not disappear even if the world stops producing coal
- In 2100, AMM emissions would be about 40% from their level in 2050



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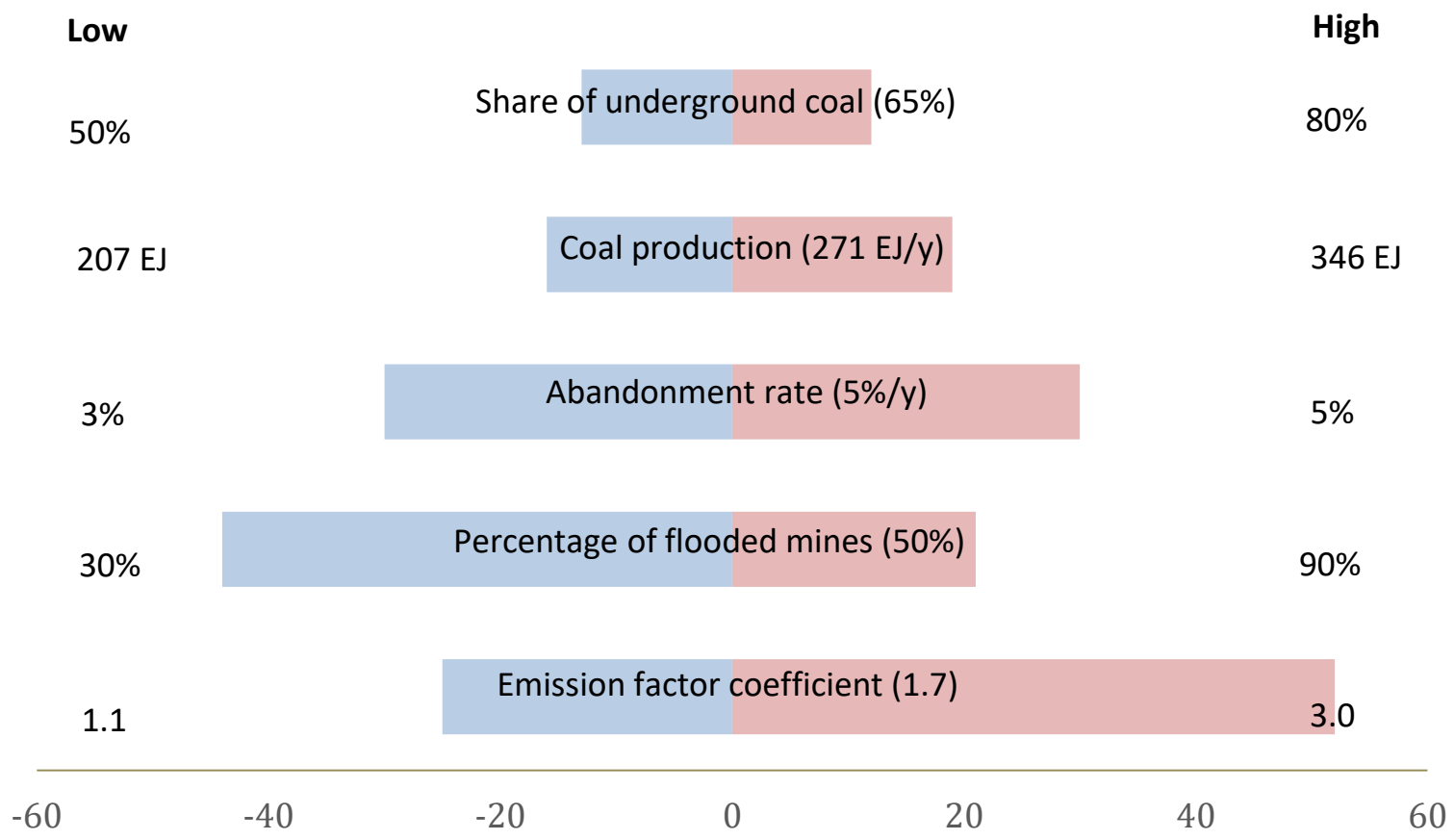
Uncertainty

- Difference from the reference estimate of 76 bcm, bcm per year



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Improving Inventories

- Methodology and data used in this study could help improve future inventories and emission factors
- AMM methodology can help in capturing more complete emissions, mitigation opportunities
- Methodology can also be used to cross-check more detailed, bottom-up estimates
- Data needs: Inventory of abandoned coal mines

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Conclusions

- Global methane emissions from coal mining to continue growing even with declining coal production
- AMM emissions will remain significant through the end of the century
- Policy makers should be aware of future CMM and AMM emissions to utilize this energy resource and mitigate emissions
- Utilization of CMM and AMM is important because of their many co-benefits, including mine safety and improved air quality
- There is a need for better data from key coal-producing countries

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