ABANDONED COAL MINE METHANE REDUCTION

Lessons from the United States

October 2023

Summary for Policymakers

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Authors

Rixin Zhu*, Nina Khanna †, Jessica Gordon*, Fan Dai*, and Jiang Lin†

* California-China Climate Institute, University of California, Berkeley

† Lawrence Berkeley National Laboratory

About the California-China Climate Institute

The California-China Climate Institute was launched in September 2019 and is a University of California-wide initiative housed jointly at UC Berkeley's School of Law (through its Center for Law, Energy, and the Environment) and the Rausser College of Natural Resources. It is chaired by Jerry Brown, former Governor of the State of California, and vice-chaired by the former Chair of the California Air Resources Board Mary Nichols. The Institute also works closely with other University of California campuses, departments, and leaders. Through joint research, training, and dialogue in and between California and China, this Institute aims to inform policymakers, foster cooperation and partnership, and drive climate solutions at all levels.

About Lawrence Berkeley National Laboratory

Lawrence Berkeley National Laboratory (Berkeley Lab) is one of the U.S. Department of Energy's 17 national laboratories. Berkeley Lab's mission is expanding the frontiers of knowledge and delivering solutions for science and mankind. Its research focuses on discovery science and solutions for clean energy and a healthy planet. Founded in 1931, Berkeley Lab's scientific expertise has been recognized with 16 Nobel prizes. The University of California manages Berkeley Lab for the U.S. Department of Energy's Office of Science.

Acknowledgments

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SUMMARY FOR POLICYMAKERS

Methane is a short-lived greenhouse gas with more than 80 times the global warming impact of carbon dioxide over a 20-year timeframe. Additionally, methane is flammable and a key precursor to certain air pollutants. Therefore, reducing methane emissions is key to slowing climate change impacts in the near term, as well as managing public safety and air pollution hazards. The United States (U.S.), which has largely transitioned away from coal, still has many abandoned coal mines, and these are a significant source of methane emissions. In 2021, U.S. abandoned coal mines produced an estimated 330,000 metric tons of methane – about 12.5% of the country's methane emissions from coal mining.

Reducing methane emissions from abandoned coal mines ("abandoned mine methane") is challenging for many reasons. It requires accurate modeling and monitoring, financial investment and incentives to support mitigation and utilization projects, and collaboration among different stakeholders. However, the benefits of addressing this issue are huge: significantly slowing near-term climate change, diversifying energy sources, revitalizing local economies, and alleviating health and environmental hazards.

The U.S. has been at the forefront of efforts to mitigate and utilize abandoned mine methane. This paper analyzes the policies and programs, implementation mechanisms, and lessons learned from the U.S. in reducing abandoned mine methane. The analysis focuses on two major questions: (1) What approaches has the U.S. taken to identify and mitigate abandoned mine methane emissions?; and (2) How has the U.S. incorporated abandoned mine methane mitigation into a broader policy framework for abandoned coal mine remediation? By addressing these questions, the analysis seeks to provide insight for other regions on best practices for potential adoption, as well as challenges that may need to be overcome.

APPROACHES TO REDUCING AND UTILIZING ABANDONED MINE METHANE

In scaling up its efforts to reduce and utilize abandoned mine methane, the U.S. has adopted three key approaches:

1. **Accurate modeling and monitoring**. This is important for identifying abandoned mine methane emission sources and ensuring effective mitigation of climate impacts. The U.S. has modeled abandoned mine methane emissions for over two decades and designed a modeling methodology for its own national greenhouse gas inventory as well as international climate guidelines. Although national monitoring programs for abandoned mine methane are lacking, certain states conduct monitoring to quantify emissions reductions from mitigation and utilization projects.

2. **Implementing mitigation and utilization projects**. Beyond reducing greenhouse gas emissions, utilizing abandoned mine methane as a clean energy source can stimulate economic development in communities affected by coal mine closures. In the U.S., financial incentives, including government investments and market-based mechanisms, significantly drive these projects. Regulatory incentives, such as recognizing abandoned mine methane as a renewable energy source and clarifying property rights, also facilitate project development.

3. **Fostering effective collaboration among government agencies, industry stakeholders, and local communities**. This is essential for providing local communities with tailored solutions to mitigate and utilize abandoned mine methane. A notable example is the U.S. EPA's Coalbed Methane Outreach Program, which promotes abandoned mine methane recovery through industry collaboration. Collaborative initiatives, such as the Energy Communities Interagency Working Group, also engage stakeholders nationwide and support community-focused projects in different states.

ABANDONED MINE METHANE MITIGATION IN THE BROADER POLICY FRAMEWORK

In the U.S., policies for abandoned coal mines initially tackled health and environmental risks and only later incorporated economic development concerns. Today, abandoned mine methane mitigation and utilization are part of an integrated approach the U.S. takes to address abandoned coal mine issues.

Alleviating Health and Environmental Hazards

Addressing the risks of explosion and air pollution linked to abandoned mine methane is a key aspect of managing health and safety challenges for abandoned mine lands. Mitigating abandoned mine methane aligns with this goal. The U.S. has been tackling health and safety concerns since the 1970s by funding reclamation efforts and abandoned mine methane prevention. These efforts are ongoing, with many states actively involved in supporting abandoned mine reclamation and abandoned mine methane mitigation projects. Recent initiatives, including President Biden's Bipartisan Infrastructure Law, allocate significant resources for abandoned mine land reclamation, marking a substantial investment in addressing health and safety issues.

Supporting Economic Revitalization

Abandoned mine methane holds promise as a clean energy resource that can offer economic benefits to communities affected by the decline of coal mining. Additionally, abandoned mine methane projects create jobs in communities, aiding local economic revitalization. The U.S. has adopted several strategies to revitalize economies in communities through initiatives prioritizing abandoned mine land remediation, economic activity, and job creation. Furthermore, following the passage of key legislation, the Biden-Harris Administration has increased its funding support for economic revitalization and abandoned mine methane projects.

U.S. LESSONS LEARNED

Lessons gleaned from abandoned mine methane efforts in the U.S. have important implications for the development of related policies and programs, both in the U.S. and around the world.

For modeling and monitoring, data inadequacy remains a challenge; abandoned coal mines do not report emissions data, and there are gaps in parameters for emission prediction. Similarly, monitoring gaps persist for abandoned mines that lack methane utilization projects, and technical limitations hinder the ability of satellite or aerial surveys to pinpoint emissions from individual mines. One key lesson is that challenges with measuring abandoned mine methane can be addressed both on the ground and in the air: through ground-based technologies like vehicle-mounted methane detection systems, as well as satellite and aerial survey instruments whose precision can be enhanced through further research and development. Secondly, market-based incentives, including carbon cap-and-trade systems, encourage mitigation and utilization projects

by attracting financial investment. Thirdly, overcoming regulatory obstacles is essential and can be achieved through transparent procedures around mine ownership, methane rights transfer, and designating abandoned mine methane as a renewable resource. Further, recognizing the diverse benefits of utilizing abandoned mine methane and integrating such efforts into broader economic and coal mine reclamation policies can yield multiple benefits. Finally, effective interagency collaboration facilitates successful mitigation and utilization efforts.

With its longstanding commitment to abandoned mine methane mitigation and utilization, the U.S. has been active in tackling the substantial environmental, climate, and economic impacts associated with abandoned coal mines. A comprehensive framework that can be drawn from U.S. experience – comprising regulatory measures, substantial financial investment, interagency cooperation, active local engagement, regular modeling and monitoring, and other instruments – offers a model for jurisdictions worldwide. Jurisdictions can take this framework into account when formulating effective and sustainable policies to curb abandoned mine methane emissions.

In conclusion, five principal lessons learned from the U.S. that could be useful for China and other jurisdictions are as follows:

- A comprehensive abandoned mine methane policy package should include investment, regulations, financial incentives, and interagency collaboration frameworks.

- Continuous investment in abandoned mine methane projects and innovative monitoring technology are crucial for capitalizing on the multiple potential benefits of abandoned mine methane mitigation.

- Regulatory barriers to developing abandoned mine methane mitigation and utilization projects can be addressed through both regulatory (e.g., royalty and tax relief) and legislative approaches. Market-based financial incentives (e.g., a cap-and-trade program) are also needed to encourage investment.

- Collaboration among different stakeholders (e.g., government agencies, academics, and companies) and direct governmental engagement with communities are needed to ensure that local communities benefit from abandoned mine methane mitigation and utilization projects.

- Integrating abandoned mine methane mitigation and utilization into a broader framework is important for facilitating a sustainable economic transition for historically coal-dependent communities and the lands where they work and live.