



# **VIRGINIA DEPARTMENT OF ENERGY**

## **EVALUATION OF POLICY OPTIONS TO**

### **ENCOURAGE THE CAPTURE AND BENEFICIAL**

#### **USE OF COAL MINE METHANE**

Report to the Governor, the Chairmen of the House Committee on Commerce and Energy and the Senate Committee on Commerce and Labor, the Secretary of Commerce and Trade, and the Secretary of Natural and Historic Resources

November 15, 2023

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## Report Overview

This report is created pursuant to HB 1643 and SB 1121 that were passed by the 2023 Virginia General Assembly. The bills stated that it is the policy of the Commonwealth to encourage the capture and beneficial use of coal mine methane. The bills also directed the Department of Energy to evaluate policy options to encourage the capture and beneficial use of coal mine methane which is the subject of this report. Here is the full statutory language:

*§ 1. That it is the policy of the Commonwealth to encourage the capture and beneficial use of coal mine methane, defined as methane gas captured and produced from an underground gob area associated with a mined-out coal seam that would otherwise escape into the atmosphere. The Department of Energy (the Department) shall evaluate policy options to encourage the capture and beneficial use of coal mine methane. Such evaluation shall include an analysis of federal and state policies, including tax incentives, and programs that incentivize the capture and beneficial use of coal mine methane, impediments to coal mine methane qualifying for carbon offset markets, and the extent to which such policies may result in a net reduction in methane emissions. Such evaluation shall consider the environmental benefits and economic development potential of the capture and use of coal mine methane. The Department may retain a consultant to assist in its evaluation. The Department shall solicit input from interested stakeholders, including coal mine methane producers, other business interests, and environmental groups. The Department shall report its findings and recommendations to the Governor, the Chairmen of the House Committee on Commerce and Energy and the Senate Committee on Commerce and Labor, the Secretary of Commerce and Trade, and the Secretary of Natural and Historic Resources by November 15, 2023.*

[Note: The statutory language instructs the agency to determine the extent to which policies may result in a net reduction in methane. In addition to determining that the options examined result in methane reductions, the agency has focused on carbon dioxide equivalent (CO<sub>2</sub>e) emissions as this is a generally accepted metric for accounting for all types of emissions and their differing climatic impacts when determining the overall greenhouse gas (GHG) impact of different actions.]

In executing this evaluation of policy options, the agency conducted independent research and met with stakeholders, including coal mine methane producers, other business interests and environmental groups.

## Background on Coal Mine Methane

### What is Coal Mine Methane (CMM)

Methane is a greenhouse gas found in and around coal seams that can be released to the atmosphere during coal mine operations and after mines have shut down. Methane (CH<sub>4</sub>) is more potent than carbon dioxide (CO<sub>2</sub>), with one ton of CH<sub>4</sub> emissions being roughly equivalent to 28 tons of CO<sub>2</sub> emissions when looking at the 100-year global warming potential of the molecule. The complete combustion of methane results in the release of 2.75 tons of CO<sub>2</sub>, a decrease of 25.25 tons of CO<sub>2</sub>e emissions. Where the methane captured is being used as a resource to produce goods or services there are additional benefits as it reduces the demand for other resources.

All methane released during and after mining operations is known as coal mine methane (CMM) (Karacan et al., 2011). CMM can be released in a number of ways, including but not limited to,

exposed coal seams or open pit leakage, ventilation systems (Ventilation Air Methane or VAM) and drainage systems from underground coal mines and abandoned mines (International Energy Agency - IEA, 2023). Methane emitted from domestic and international coal mines represents approximately 17% of the world's total anthropogenic GHG emissions.<sup>1</sup> In underground mines, methane emissions are higher than in surface mines because deeper coal seams contain more methane (IEA, 2023). Underground coal mining is the most important source of fugitive methane emission with 70% emitted through mine ventilation.<sup>2</sup>

In Virginia, the majority of coal that is mined is metallurgic coal that is intended for use in steel production (coal used in electricity production is referred to as thermal coal). As opposed to thermal coal, where demand has declined due to the emergence of cheaper and/or less emitting electrical generating resources, such as natural gas and solar, there is currently no viable large-scale alternative to met coal that is either less expensive or has a lower environmental impact. As a result, the met coal market has been strong in recent years and is expected to remain so for the foreseeable future. Therefore, degassing of mines is likely to continue at comparable levels to today with commensurate amounts of CMM emissions.

## Benefits of CMM Recovery

Coal mine methane (CMM) extraction is critical to mine safety and ventilation will occur regardless of whether the CMM is captured and utilized. Abandoned mines will continue to leak methane into the atmosphere as well. The capture and use of CMM has advantages for both the local community and the global environment. EPA listed some of the benefits associated with the capture and use of CMM.<sup>3</sup>

**Greenhouse Gas Emission Reduction:** Methane, a highly potent greenhouse gas, is mitigated through capture, contributing to the reduction of greenhouse gas emissions.

**Clean-Burning Energy Source:** CMM serves as a valuable, clean-burning energy source that can be harnessed for various purposes, such as electricity generation, and as an alternative fuel for vehicles and diverse industrial and commercial applications.

**Enhanced Mine Safety:** The reduction in the concentration of explosive gases within the mine enhances safety conditions for miners, mitigating potential hazards and reducing methane-caused work stoppages.

**Additional Revenue:** Captured methane can be sold, providing an additional revenue stream for mine operators and contributing to their financial sustainability.

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<sup>1</sup> EPA, *Assessment of the Worldwide Market Potential for Oxidizing Coal Mine Ventilation Air Methane*. Retrieved from: <https://nepis.epa.gov/Exe/ZyPDF.cgi/6000049W.PDF?Dockey=6000049W.PDF> (October 30, 2023).

<sup>2</sup> Karacan, C. Ö., Ruiz, F. A., Cotè, M., & Phipps, S. (2011). *Coal mine methane: a review of capture and utilization practices with benefits to mining safety and to greenhouse gas reduction*. *International Journal of Coal Geology*, 86(2-3), 121-156. Retrieved from: <https://www.cdc.gov/niosh/mining%5C/UserFiles/works/pdfs/cmmpar.pdf> (October 30, 2023)

<sup>3</sup> Benefits of Capturing and Using Coal Mine Methane. Retrieved from: <https://www.epa.gov/cmop/benefits-capturing-and-using-coal-mine-methane> (October 30, 2023).

## Summary of Activity in Virginia

In 2022 there were 6,110 coal bed methane (CBM) wells (out of 8,092 active wells, including natural gas extraction etc.) in Virginia. There were 71 new coalbed methane wells drilled last year and CBM wells produced 73 billion cubic feet of CMM. Wells are located in Buchanan County (51% of total), Dickenson County (24%), Tazewell County (10%), Russell County (7%), Wise County (6%), Lee County (<1%) and Scott County (<1%). These well are managed by CMM operators who employ hundreds of workers at high wage levels for the region, and they are regulated by the Virginia Department of Energy's Gas and Oil Program.

In 2021, Virginia accounted for more than 10% of the nation's total CMM production with the Oakwood and Nora CMM fields ranked highly for CMM potential. Virginia coal generally contains more methane than coals found in other regions which may increase the value of Virginia-sourced carbon credits. Per DEQ, there are 173,564 metric tons of methane emitted from active (129,821 mt) and abandoned mines (43,743 mt) in the Commonwealth each year. This equates to a CO<sub>2</sub>e of 9.6 million metric tons.

## Federal Developments

### EPA Coalbed Methane Outreach Program

The Coalbed Methane Outreach Program (CMOP) established by the U.S. Environmental Protection Agency (EPA) is a specialized initiative with the primary objective of mitigating methane emissions originating from coal mining operations, specifically the release of methane from coalbeds during mining processes. Recognizing the potent greenhouse gas properties of methane, the program places significant emphasis on reducing its release to combat climate change and advance environmental sustainability.

CMOP is primarily oriented toward the coal mining industry and actively promotes and advances the profitable recovery, utilization and mitigation of CMM. Since 1994, CMOP has collaborated with the U.S. coal mining industry to curtail CMM emissions. As of January 2023, EPA's CMOP is actively engaged with 25 coal mine methane projects situated at 16 currently operational mines and 35 abandoned mine methane projects at 66 previously closed mine sites.

### The U.S. Methane Emissions Reduction Action Plan

Abandoned coal mines are estimated to release approximately 237,000 metric tons of methane annually. The Bipartisan Infrastructure Law has allocated over \$11 billion to eligible states and Tribal communities over a 15-year period for the reclamation of abandoned coal mines, with the aim of mitigating methane pollution. In August, the Department of the Interior (DOI) announced the availability of nearly \$725 million to 22 states and the Navajo Nation, thereby increasing the total funding accessible to coal communities in 2022 to nearly \$1 billion.

These resources are intended to achieve several objectives, including the stimulation of economic revival, the provision of opportunities for both current and former coal workers and the restoration of lands and waterways affected by past coal mining activities.

### Effort to Incorporate CMM in the 45Q Tax Credit

As an element of the Bipartisan Budget Act passed in February 2018, the United States Congress extended and substantially enhanced tax credits for the utilization and storage of CO<sub>2</sub> under Section 45Q of the Internal Revenue Code but the amendments did not incorporate methane. The changes encompassed widening the credit to include all carbon oxides rather than just CO<sub>2</sub>, elevating the tax credit amount, instituting a commencement-of-construction deadline (initially set for January 1, 2024 and later extended to January 1, 2026), along with a 12-year claim period. The previous cap of 75 million tons was eliminated, and the amendments enabled tax credits for direct air capture and CO<sub>2</sub> utilization. Additionally, owners of capture equipment gained the ability to claim credits and transfer them to the entity responsible for CO<sub>2</sub> storage, thereby introducing increased flexibility to ownership structures. In June 2023, H.R. 3982 was introduced by Rep. Miller (R-WV), Rep. Sewell (D-AL), Rep. Reschenthaler (R-PA) and Rep. Deluzio (D-PA) to add methane capture as an eligible application. It is still pending in the House of Representatives.

## Virginia Developments

### SB 565

SB 565, passed in the 2022 General Assembly, directed the Department of Environmental Quality (DEQ) to convene a workgroup of stakeholders to determine the feasibility of setting a statewide methane reduction goal and plan to achieve the same.<sup>4</sup> The primary focus of the workgroup was on natural gas transmission and infrastructure; however, other significant sectors are examined as well.

The workgroup identified three potential goals for the Commonwealth in relation to methane.

1. Improved methane emissions inventory across all sectors of Virginia's economy.
2. Targeted funding for emissions control projects.
3. Create a statewide goal, although this would only occur if appropriate baselines, sector targets and other key data points could be established.

### HB 2178

HB 2178, passed in the 2023 General Assembly, extended the green job tax credit to methane extracted in Planning District 2, an area of southwest Virginia that includes a number of active mines that are engaged in CMM capture. The credit allows a \$500 income tax credit for the creation of green jobs paying an annual salary in excess of \$50,000.

### Environmental Justice

Per § 2.2-235 of the Code of Virginia, “[i]t is the policy of the Commonwealth to promote environmental justice and ensure that it is carried out throughout the Commonwealth, with a focus on environmental justice communities and fenceline communities”.

The coalfields region of Virginia has seen reduced economic activity in recent years due to the decline in the thermal coal market. Many of the census tracts in the area qualify for economically distressed statuses, such as the Justice 40 designation associated with the federal Bipartisan

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<sup>4</sup> Va Department of Environmental Quality, *Senate Bill 565, Enactment Clause 4: Study Assessing The Feasibility Of Setting A Statewide Methane Reduction Goal And Plan*. Accessed at <https://rga.lis.virginia.gov/Published/2023/RD482/PDF> (retrieved on October 23, 2023)

Infrastructure Law (BIL) and the Inflation Reduction Act (IRA) and the historically economically disadvantaged community (HEDC) status created by the Virginia Clean Economy Act (VCEA).

Additionally, the region has experienced environmental degradation as a result of historic coal extraction, including methane released from abandoned mines. An unexpected release of methane or seepage of methane from a mine through cracks in the strata can potentially pose a fire or health hazard. Due to these factors, many of the areas where CMM operations are or could be located would be considered environmental justice communities and CMM operations could be viewed as having positive effects for these communities through reduced environmental harms and increased economic opportunity. Where programs are pursued they should include meaningful involvement from the affected communities and could incorporate measures to address any identified concerns regarding environmental impact. For example, new infrastructure could be required to minimize impact on sensitive ecosystems or prime farmland, or these factors could be included in a life cycle analysis (LCA).

## State Policies

Among the leading 15 coal-producing states, Pennsylvania, Ohio, Utah, Indiana and Colorado have incorporated CMM into their renewable or alternative energy standards and California includes CMM flaring in its carbon credit program (National Mining Association, 2018). Various states have employed distinct methods to integrate CMM into their renewable or alternative energy portfolio standards. In the cases of Pennsylvania and Ohio, both states classify CMM as an "alternative" energy resource rather than categorizing it under the label of "renewable" energy resources.

**Pennsylvania** was the first state to incorporate CMM into its Alternative Energy Portfolio Standard (AEPS) and signed it into law in 2004 (Pennsylvania General Assembly, 2004). The AEPS considers all sources, renewable and alternative resources, as alternative energy. Under the AEPS requirement in Pennsylvania, each electric distribution company and generation supplier needs to supply 18 percent of its electricity from alternative energy resources and eight percent from "Tier I" (which includes CMM) resources. The AEPS provides a range of incentives to encourage the recovery and utilization of Coal Mine Methane (CMM). These incentives encompass alternative energy credits (AECs), alternative compliance payments (ACPs), alternative energy tax credits and state grant programs.

**Ohio** introduced the Alternative Energy Resource Standard (AERS), which consolidates renewable energy resources and advanced energy resources under a single classification known as "alternative energy resources." This classification includes methane gas emitted from both abandoned and operational coal mines as an alternative energy resource. According to the AERS, electric utilities are mandated to source 12.5 percent of their retail electricity supply from alternative resources by the year 2026 (The Public Utility Commission of Ohio, 2019).

**Utah** includes methane gas from abandoned coal mines or operating coal mines as a qualifying renewable energy source under the state's Energy Resource and Carbon Emission Reduction Initiative, which sets each electric utility a goal of 20% of electricity sales from eligible renewable resources by 2025 (Utah State Legislature, 2010).

**Indiana** enacted the Clean Energy Law in 2011, which introduced the Clean Energy Portfolio Standard, commonly referred to as the Comprehensive Hoosier Option to Incentivize

Cleaner Energy (CHOICE) program (Indiana Office of Energy Development, 2019). The Clean Energy law considers coal bed methane as clean energy among 21 qualifying clean energy sources. The state's utilities are given incentives for voluntarily increasing clean energy sources in their electricity portfolio with a minimum threshold of 10% of electricity generation coming from qualifying clean energy sources by 2025.

**Colorado** created the "Colorado Renewable Energy Requirement Initiative" in 2004 through a ballot initiative, the first state to do so (Colorado S.B. 13-252, 2013). CMM is now recognized as a qualifying energy source for utility providers. As part of the Renewable Energy Standard (RES) mandate, electricity generated from CMM must also demonstrate greenhouse gas (GHG) neutrality over a five-year period.

These states have demonstrated that CMM can be a viable source of electrical generation with proper policies and implementation in place. There are still challenges in leveraging CMM as a qualifying resource for clean energy programs, for example, where programs do not contain mandated price floors it can be difficult for operators to make the necessary investments in new projects as there is no guaranteed level of revenue.

### CARB Compliance Offset Program

The primary market for carbon offsets is the California Air Resources Board's (CARB) Compliance Offset Program, which is part of California's cap-and-trade program.<sup>5</sup> The Cap-and-Trade Regulation establishes a declining limit on major sources of GHG emissions throughout California. CARB creates allowances equal to the total amount of permissible emissions (i.e., the "cap"). Each year, fewer allowances are created and the annual cap declines. Compliance offsets are tradable credits that represent verified GHG emissions reductions. Covered entities may use compliance offset credits to satisfy a percentage of their overall compliance obligation. Compliance entities may use ARB Offset Credits to meet up to four percent of their compliance obligation for emissions from 2021-2025 and six percent for emissions from 2026-2030. Starting with 2021 emissions, no more than one half of the quantitative usage limit may be sourced from projects that do not provide direct environmental benefits in California.

CARB issues ARB Offset Credits to qualifying projects that reduce or sequester greenhouse gases (GHG) pursuant to six Board-approved Compliance Offset Protocols, one of which is for CMM. The Mine Methane Capture (MMC) Protocol, which was officially adopted on April 25, 2014, encompasses CMM projects at active underground mines, surface mines and abandoned underground mines, as well as Ventilation Air Methane (VAM) projects at underground mines. The MMC Protocol imposes the condition that projects must meet the Legal Requirement Test, which ensures that the emissions reductions attributed to a project would not have transpired as a result of federal, state or local regulations, or other legally binding mandates. Flaring of CMM does qualify for carbon offsets, provided it meets a strict set of criteria, however, pipeline injection, which is required for most productive uses of CMM, is not a qualifying use. CARB considers the practice of pipeline injection of Coal Mine Methane (CMM) from active underground mines' methane drainage systems as a business-as-usual procedure with the implication that there is reduced scope for additionality. The business-as-usual designation for pipeline injection was based on the state of the market in the late 2000's/early 2010's where market adoption of CMM

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<sup>5</sup> California Air Resources Board Compliance Offset Program. Available at [Compliance Offset Program | California Air Resources Board](#) (retrieved 10/23/2023)

was increasing, costs were low, and incentives, including higher than normal gas prices and a federal tax credit, were high which raised concerns that they would be incentivizing an already highly viable product. Since the protocol's adoption, the massive growth in the shale gas supply has drastically lowered natural gas prices, the Section 29 Alternative Fuel Tax Incentives (which included CMM) has expired and pipeline injection costs for CMM have increased, eliminating the advantages that justified the original exclusion of pipeline injection of CMM for credits. With a weak market for CMM as a product, many of the mines that were capturing CMM for pipeline injection are now ventilating their CMM directly to the atmosphere.

CARB offsets have consistently traded at a high price (August 2023 settle price was \$34/ton CO<sub>2</sub>e) therefore, it is expensive for non-CARB entities to procure CMM given the currently low quantities available.<sup>6</sup>

## Incentive Programs and Protocols

In 2020, the United States hosted two mandatory and three voluntary GHG emissions trading initiatives. Four of these programs provide opportunities for Coal Mine Methane (CMM) emission reduction projects (U.S. EPA, 2021).<sup>7</sup>

### Compliance Programs

COP: Described on Page 7.

### Voluntary Programs

Climate Action Reserve (CAR): This is the most recent addition to the voluntary offset program landscape within the U.S. carbon market. This program sets forth criteria for the creation, measurement, and validation of greenhouse gas (GHG) emissions reduction projects across a range of project types, spanning both the United States and Mexico.

CAR's CMM protocol was first issued in 2009 and was updated in 2012. The CMM Protocol exclusively permits projects within underground mines with gas drainage and Ventilation Air Methane (VAM) projects. Similar to CARB's protocol, the CMM Protocol adopts a performance standard approach where the project effectively eliminates CMM from an active underground mine through any end-use management option (excluding injection into a natural gas pipeline) for offsite consumption, or when it efficiently eliminates VAM through any end-use management option.

The Verified Carbon Standard (VCS): VCS offers a framework for certifying CMM projects as carbon offset initiatives. It encompasses a methodology for measuring the reductions and removals of emissions associated with CMM capture and utilization. VCS has endorsed methodologies created by the Clean Development Mechanism (CDM) of the United Nations Framework Convention on Climate Change (UNFCCC) and CAR.

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<sup>6</sup> CARB *California Cap-and-trade Program Summary of California-Quebec Joint Auction Settlement Prices and Results*, accessed at [https://ww2.arb.ca.gov/sites/default/files/2020-08/results\\_summary.pdf](https://ww2.arb.ca.gov/sites/default/files/2020-08/results_summary.pdf) (retrieved on October 24, 2023)

<sup>7</sup> U.S. Greenhouse Gas Emissions Trading Programs that Include Coal Mine Methane. Retrieved from [https://www.epa.gov/sites/default/files/2021-01/documents/ghg\\_registries\\_2021.pdf](https://www.epa.gov/sites/default/files/2021-01/documents/ghg_registries_2021.pdf) (October 26, 2023)



VCS uses CDM's approved consolidated methodology for CMM projects. Under this methodology, VCS permits all categories of CMM projects, encompassing pipeline sales, boiler utilization, electricity generation, flaring and Ventilation Air Methane (VAM). VCS approves a separate methodology that includes abandoned mine methane (AMM). In addition to addressing the elimination of methane emissions into the atmosphere, VCS also considers the reduction of greenhouse gas (GHG) emissions linked to the use of fossil fuels that would have otherwise been burned in project-related activities.

The American Carbon Registry (ACR): ACR is a nonprofit organization and carbon offset program that specializes in the development and implementation of standards for greenhouse gas (GHG) emissions accounting and carbon offset projects. ACR offers protocols for coal mine methane capture and utilization projects, allowing them to earn carbon offset credits.

ACR utilizes the "Capturing and Destroying Methane from Coal and Trona Mines in North America" methodology, which was released in September 2019, for Coal Mine Methane (CMM) projects. Although ACR can apply to projects worldwide, the CMM methodology is designed as a performance-based framework specifically applicable to mines in North America.

Compared to the CMM methodologies adopted by the COP and CAR, the ACR methodology employs a more streamlined quantification approach and permits CMM pipeline sales as an eligible project type. Additionally, ACR does not impose a maximum volume limit on Abandoned Mine Methane (AMM) projects.

## Applications of coal mine methane

1. **Flaring.** Flaring is the process of burning excess natural gas using a dedicated flare to ignite the methane and other components in the gas. These practices are used by producers for operational, safety and economic reasons. Flaring of CMM – in open or enclosed systems – converts the methane (CH<sub>4</sub>) to carbon dioxide (CO<sub>2</sub>). Methane from abandoned or sealed gob areas of a coal mine has a variable concentration of methane and contains other impurities and is often below pipeline quality. Active mine ventilation systems generally maintain low methane concentrations due to mine safety regulations. In these scenarios, flaring for carbon credits often becomes the most viable option.

CMM flare projects have been implemented to reduce methane emissions and thus earn carbon offset credits. Prior to 2008, there was only one active mine performing flaring. As of January 2023, EPA's Coalbed Methane Outreach Program (CMOP) is aware of 25 coal mine methane projects at 16 active mines and 35 abandoned mine methane projects at 66 abandoned (closed) mines.<sup>8</sup> The increase is primarily due to the CARB Compliance Offset Program (described on page 7). While flaring is mostly conducted at active mines, there is some activity at abandoned mines, for example, the Nature Conservancy (TNC) engages a CMM capture operator to flare off gas from an abandoned mine on one of their properties in southwest Virginia.

2. **Natural gas addition.** CMM can be mixed with pipeline natural gas, referred to as pipeline injection, typically following a purification process, to provide the same services, such as

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<sup>8</sup> EPA Coalbed Methane Outreach Program. Accessed at <https://www.epa.gov/cmop> (retrieved on October 24, 2023)

building heating, industrial gas creation and as a manufacturing feedstock. Each of these processes results in the conversion or sequestration of methane and has GHG emissions benefits. Pipeline injections and other projects targeting beneficial end use (including the applications described below) require more infrastructure and will often have higher project emissions compared to projects destroying the methane through flaring. This can be mitigated through use of captured CMM as a fuel for onsite equipment and project emissions are typically relatively small compared to the impact of the methane emission reductions and there may be other benefits, such as avoided fossil fuel usage, to consider.<sup>9</sup>

3. **Electric production.** Coal mine methane can be used as a fuel for electrical generating facilities. As with flaring, the combustion process converts the methane to carbon dioxide and reduces CO<sub>2</sub>e emissions by almost 90%. CMM-fueled facilities are dispatchable resources that can supply electricity when called upon thus improving system reliability. As the proportion of natural gas that can be combusted declines due to RPS restrictions, CMM could extend the life of gas infrastructure that has already been constructed and paid for by the ratepayer if it was designated as a RPS-qualified fuel or had its own carveout similar to zero-carbon resources that are not otherwise RPS-eligible. CNX, a CMM capture operator, has estimated that it currently extracts enough CMM to generate 100k – 200k mWh of electricity per month (which would equate to a 130MW – 270MW power plant operating at full capacity) and that volume could double with incentives that would enable it to invest in capture opportunities at other mines. Using CMM in electric generation, as well as the other beneficial use cases presented here, increases the use of Commonwealth-based resources and provides energy security benefits, improving Virginia’s strategic energy interdependence and reducing reliance on imported energy resources.
4. **Direct manufacturing feedstock.** CMM can be used as a standalone resource in the manufacturing processes. For example, the foodware and apparel firm Newlight uses CMM as the feedstock to create its AirCarbon product that is a substitute for oil-based plastics. Through the manufacturing process the methane is sequestered in the products thus eliminating the GHG output. Newlight is currently constructing a manufacturing facility in Ohio that will use CMM as a feedstock and the company estimates it will create 112 full-time jobs and 260 construction jobs. Sufficient CMM (3k mcf – 30k mcf per Newlight) is likely available in southwest Virginia to supply a similar facility.
5. **Transportation Fuel.** CMM could be processed into a transportation fuel. This process is already conducted and incentivized for renewable natural gases, such as landfill and wastewater-generated gases, through EPA’s Renewable Fuel Standard and state programs, including California’s Low Carbon Fuel Standard. While these standards have been restricted to bio-based methane, the case for CMM inclusion is strong based on the comparable GHG impact.

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<sup>9</sup> ACR, *Methodology For The Quantification, Monitoring, Reporting And Verification Of Greenhouse Gas Emissions Reductions And Removals From Capturing And Destroying Methane From U.S. Coal And Trona Mines*, August 2022

## Impediments to Coal Mine Methane Qualifying for Carbon Offset Markets

CARB Compliance Offset Program: As mentioned above, flaring of CMM does qualify for carbon offsets, provided it meets a strict set of criteria, however, pipeline injection, which is required for most productive uses of CMM, is not a qualifying use.

Other Protocols and Standards: The protocols for incentive programs often restrict the types of CMM projects that are eligible for credits or exclude it in favor of bio-based methane. Not all protocols follow the same methodology and, as a result, some CMM projects may be eligible under one program but not under another. See the “Incentive Programs and Protocols” section for more information.

## Challenges in Placing CMM to Productive Uses

1. **High infrastructure costs.** To make CMM available as an industrial input or an energy source requires a significant investment in pipelines and processing, including purification, compression and interconnection to end users. EPA estimates that the total capital costs for a CMM project to produce and sell pipeline-quality gas are likely to be several million dollars.<sup>10</sup>
2. **High operating costs.** The workforce, utility and other operational costs of CMM capture, processing and transportation for beneficial use are high and inhibit project development. Combining infrastructure and operating costs, the Global Methane Initiative, a public-private international network that aims to reduce global methane emissions, has estimated that increasing the compensation for a metric ton of CO<sub>2</sub>e methane to \$15 would reduce the emissions from coal mines by 56% which they believe is close to the maximum amount that can feasibly be recovered.<sup>11</sup> Based on that calculation, \$80m in annual investment could reduce the Commonwealth’s CMM emissions from 9.6mm tons CO<sub>2</sub>e per year to 4.2mm tons CO<sub>2</sub>e per year.
3. **Low natural gas prices.** The shale gas boom since 2008 has reduced the financial competitiveness of CMM. This caused a decline in the number of active mines that were performing pipeline injection as CMM cannot currently be produced at comparable costs. Following recent global events, the price of natural gas increased substantially in 2022, however it has since decreased towards the longer-term trend of low prices and it is not possible to predict whether the market will experience a long-term shift to higher prices that would create an opening for CMM over a period of time long enough for infrastructure to be developed.
4. **CARB Offset Prices Favor Flaring** (See CARB Compliance Offset Program, Page 7). Per CNX, the costs for flaring for the least expensive projects applied to the most prolific sources of CMM are typically below \$5/ton CO<sub>2</sub>e, while credit prices in the CARB market

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<sup>10</sup> EPA, *Coal Mine Methane (CMM) Finance Guide* (July 2019)

<sup>11</sup> Global Methane Initiative, *Global Methane Emissions and Mitigation Opportunities*, accessed at <https://www.globalmethane.org/documents/gmi-mitigation-factsheet.pdf> (retrieved on October 15, 2023)

have consistently traded at a much higher level (August 2023 settle price was \$34/ton CO<sub>2</sub>e).<sup>12</sup> This makes it difficult for other buyers to offer competitive prices for CMM.

5. **Pipeline injection of CMM is not an eligible use in many offset programs, including the CARB Compliance Offset Program.** This heavily incentivizes flaring over other potentially productive applications of CMM and eliminates the possibility of receiving both the CARB credit and reimbursement for CMM as a product despite the potential that they could be complementary.
6. **Non-biologically produced methane is excluded from many methane reduction programs.** This prevents CMM from qualifying for programs despite CMM having generally higher concentrations of methane than many of these biological sources. The intent is likely to avoid incentivizing fossil fuel extraction but CMM capture incentives are unlikely to drive additional extraction, particularly in Virginia where new CMM venting is driven by the strong met coal market.
7. **Customer preferences.** Voluntary markets have not been strong for CMM credits as customers have preferences for other forms of carbon credit, such as nature-based offsets, including forest protection or growth schemes or renewable energy certificates. With education and supporting data, such as life cycle analysis (LCA), corporate buyers and other entities may begin to view CMM-based credits more favorably as a means to achieve net-zero emissions or other environmental goals.
8. **Ownership of CMM.** It can be difficult for operators to acquire the rights to capture CMM as they must receive permission from both the surface rights owner and the mineral rights owner. In certain instances, the coal rights may also have been severed thus creating three sets of owners. Identifying all those individuals can be time-consuming and challenging as ownership is not always clear. For example, there are some properties that have multiple heirs many of whom may not be aware of their ownership rights.<sup>13</sup> The Virginia Gas and Oil Act requires compensation to all parties who have ownership or interest in the gas.

## Policy Options

1. **No action.** If no changes were implemented, the beneficial capture of CMM would continue to be dictated by prices in the natural gas market and incentives from non-Virginia based entities, in particular the California Cap and Trade Program. Active mines will likely continue to favor venting into the atmosphere compared to the cost of capture and there would be little economic support for capturing CMM from abandoned mines. This option would not require any funds from taxpayers, ratepayers or others; however, it would not realize any additional environmental benefit and economic development opportunities may be missed.
2. **Mandate capture.** Coal mine operators could be required to capture the methane that is produced during their operations. This would add a cost-burden to an industry that is vital

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<sup>12</sup> CARB *California Cap-and-trade Program Summary of California-Quebec Joint Auction Settlement Prices and Results*, accessed at [https://ww2.arb.ca.gov/sites/default/files/2020-08/results\\_summary.pdf](https://ww2.arb.ca.gov/sites/default/files/2020-08/results_summary.pdf) (retrieved on October 24, 2023)

<sup>13</sup> Coal mine and other operators with existing permitted activity located in CMM fields may provide mineral ownership information to assist applicants.

to the economy of southwest Virginia and may have negative impacts in terms of production and employment. Increased steel prices would have negative ramifications to the wider economy, for example high steel prices have been a key factor in the recent challenges that have beset the offshore wind industry. Mandatory capture may be more viable if paired with measures to create a stronger market for CMM that could offset compliance costs.

3. **Direct incentives for CMM capture.** The Commonwealth could directly fund CMM capture by using taxpayer funds to reduce costs for operators. A cost-benefit analysis would need to be conducted to examine whether the environmental benefits and economic growth associated with the incentives produced a net benefit. Additionality important is where incentives drive new investment or greater emissions benefits rather than simply giving additional income to existing, already viable projects at their current levels. To justify the application of public funds, incentive mechanisms can be structured to reward or exclude projects based on the additional benefits they provide. Registries such as the Climate Action Reserve and ACR have safeguards to prevent “double counting” of credits or the associated emission reductions, including attestation-based documentation, site inspections and penalties for non-compliance.

Incentive options would include:

- a. Tax incentives for CMM that is captured and used to eliminate or reduce the carbon equivalent emissions (based on volume captured and/or CO<sub>2</sub>e reduction).
- b. Grants or tax incentives for CMM capture equipment or other CMM-related infrastructure would reduce operating costs and increase competitiveness. For example, the state and local tax exemption for certified pollution control equipment and facilities, per Va. Code § 58.1-3660, could be extended to CMM-capture equipment.
- c. Pursuit of federal grants on other opportunities that would support CMM project development.

Expanding the existing green job tax credit for CMM outside of Planning District 2 would provide more incentive for CMM capture. CNX has estimated that if the credit were extended to include District 1, direct employment for CMM capture would be around 950 jobs but the credit would offset less than 1% of the cost of CMM capture for the years that the credit is in place. If utilization of CMM (for manufacturing, energy production etc.) also qualified, and the credit was offered in all districts, a strong CMM sector could see five to ten thousand new jobs, but the offset would only be around 4% of the cost of CMM capture for the years that the credit is in place. Therefore, the credit expansion alone is unlikely to drive significant new investment, but it could have an impact in conjunction with other measures.

4. **Focus incentives on greatest emissions reduction.** While flaring or incorporation into the energy sector provides emissions benefits, incentives could be oriented towards those measures that eliminate a higher percentage of the greenhouse gas emissions. These options, including CMM as a feedstock for manufacturing or sequestration, often cannot offer competitive prices versus the combustion options, therefore a CMM incentive that

applies to all users, such as a capture credit, would probably not facilitate these types of projects. Tax credits or other monetary incentives could be structured to either apply solely to projects with greater emissions benefits or apply a sliding scale of value based on the emissions profile of the project. Additionally, the purchase of CMM-based products could be encouraged directly through tax incentives, state procurement mandates or other mechanisms.

5. **CMM Eligibility in renewable portfolio standard.** The renewable portfolio standard (RPS) was implemented as part of the 2020 Virginia Clean Economy Act (VCEA) and requires an increasing proportion of electrical energy to come from RPS qualified resources each year.<sup>14</sup> The RPS currently only permits new wind and solar facilities, with some other types of existing generating assets, including landfill and biomass assets, allowed to continue operation. Non-RPS qualified zero-carbon emitting facilities, such as new nuclear assets, placed into service after July 2030 are also permitted and the amount of electrical production subject to RPS requirements shrinks with each addition of zero-carbon assets. Storage is permissible but is not listed under the RPS as storage assets do not actually generate electricity.

While CMM is neither a renewable nor a zero-carbon resource when used in energy production, the conversion of methane to carbon dioxide in the combustion process for energy production provides a clear benefit in terms of reduced GHG emissions and would appear to meet the ultimate intent of the VCEA and the RPS program. To capture this benefit, CMM could be added as an eligible RPS resource or the allowance for non-RPS qualified zero-carbon resources could be expanded to incorporate CMM, potentially without a restricted service date as facilities already exist that could utilize CMM in their production. Under these scenarios CMM would have to show cost and operational advantages over battery storage, nuclear and other qualifying, dispatchable resources to receive State Corporation Commission (SCC) approval.<sup>15</sup>

In February 2023, PJM, the regional transmission operator (RTO), for Virginia and twelve other states conducted research on resource adequacy through 2030 that showed "increasing reliability risks during the [energy] transition, due to a potential timing mismatch between resource retirements, load growth and the pace of new generation entry".<sup>16</sup> With existing dispatchable resources retiring at a faster rate than renewables are coming online, there is potential for the supply of energy to be insufficient to meet demand. Per Dominion's 2023 IRP, it forecasts a need for additional dispatchable resources including 4GW of new natural gas facilities and it has recently begun the process to permit a 1GW oil and gas peaking facility in Chesterfield County.<sup>17</sup> Environmentalists have objected to

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<sup>14</sup> Va. Code § 56-585.5.

<sup>15</sup> Where there are concerns over CMM costs, a stakeholder suggested that project costs could be capped relative to other resources that provide the same grid service. For example, Dominion's offshore wind project, the now approved CVOW project, was required to meet a certain levelized cost of energy (LCOE) relative to a combined cycle gas turbine. CMM electrical production could be required to meet a certain LCOE threshold compared to solar plus storage or other comparable resources.

<sup>16</sup> PJM, *Energy Transition in PJM: Resource Retirements, Replacements & Risks* (February 2023)

<sup>17</sup> Virginia Mercury, *Dominion to seek air permit for proposed Chesterfield gas plant*, Accessed at <https://www.virginiamercury.com/2023/09/14/dominion-to-seek-air-permit-for-proposed-chesterfield-gas-plant/> (retrieved on October 30, 2023)

these proposed facilities and CMM may offer an environmentally beneficial alternative for a portion of this capacity while addressing the reliability concerns identified by PJM and Dominion.

6. **Create a Virginia carbon offset program.** This could apply to coal mine methane and possibly other GHG reducing measures, such as captured landfill or dairy emissions. In the absence of an associated cap and trade scheme or other industry mandate there is no market for such offsets.<sup>18</sup>
7. **Assist with marketing of CMM offsets.** Many large organizations have ambitious climate goals and they may be unaware of the environmental benefits of CMM capture. Companies that are located or are considering locating in the Commonwealth may be especially motivated to invest in local projects. The Commonwealth could educate the public and organizations on the benefits of CMM capture and market CMM carbon offsets as an alternative to the currently preferred credit types. There have been numerous reports in recent years of voluntary carbon offset credits, most of which are associated with forest protection or growth, that do not deliver the environmental benefits that were claimed. CMM-based credits could provide a credible alternative and the Commonwealth could assist with creating a verification standard that satisfies customer requirements.
8. **Temporary relief from title search.** A process could be implemented that permits CMM operations to commence on a provisional basis while the title search is being conducted for those properties where title holders are difficult to identify. While this could be perceived as an interference with individual's property rights, it could also prove beneficial for those mineral right owners if it facilitates the creation of a revenue stream for their property that may be otherwise idle and potentially unknown to them. An amendment of this nature should be time-limited to ensure compliance with title requirements is actively pursued by operators.

## Recommendations

1. Given its environmental benefits and economic potential, coal mine methane incentives should be considered by the General Assembly. CMM incentives should also be evaluated as a possible alternative to other proposals that are intended to reduce greenhouse gas emissions or generate economic development.
2. The Commonwealth should actively pursue federal funding opportunities related to CMM capture and use. For example, EPA's Climate Pollution Reduction Grants (CPRG) program provides \$5 billion in grants to states, local governments, tribes and territories to develop and implement ambitious plans for reducing greenhouse gas emissions and other harmful air pollution.<sup>19</sup>

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<sup>18</sup> Virginia's membership in the Regional Greenhouse Gas Initiative (RGGI) does not allow offsets. RGGI *Offsets*. Accessed at <https://www.rggi.org/allowance-tracking/offsets> (retrieved on October 24, 2023)

<sup>19</sup> The Department of Environmental Quality (DEQ) will be administering the Commonwealth's portion of these funds and CMM projects would be an eligible use of the funding. Deadlines for submissions in Spring 2024 may make it difficult for suitable projects to be identified within the timeframe for this particular program.

3. CMM should be considered for inclusion in the renewable portfolio standard (RPS) or an equivalent scheme for gas distribution or transportation fuel. While it is not a renewable or zero-carbon resource its capture does provide a clear benefit in terms of reducing greenhouse gas emissions which ultimately aligns with the intent of the RPS and other climate programs. CMM fueled facilities could provide dispatchable power to help balance the intermittent output from renewable sources, such as wind and solar, and maintain reliable service while decreasing overall systems emissions. Additionally, it would likely be cost competitive against battery storage, new nuclear and other emissions-reducing dispatchable resources, thus helping to maintain affordable rates while creating economic opportunities in southwest Virginia. Appropriate verification measures should be put in place with the California CARB Cap and Trade Program or the Pennsylvania Alternative Energy Portfolio Standard (AEPS) as potential models. Finally, as a Commonwealth based resource, CMM can enhance energy security and reduce reliance on imported energy.
4. Additional study of the life cycle analysis (LCA) or carbon intensity of CMM in energy production could be employed to further evaluate the environmental and economic value of incorporating CMM into the renewable portfolio standard or another incentivizing mechanism. This could be performed as part of a more general study to determine the overall emissions profile of different generating resources to accurately evaluate net impacts rather than focusing solely on facility carbon emissions.
5. The Commonwealth should examine measures to market the benefits of employing carbon offsets from CMM as a means for corporations and other actors to achieve their climate goals. Many large organizations have ambitious climate goals and they may be unaware of the environmental benefits of CMM capture. Companies that are located or are considering locating in the Commonwealth may be especially motivated to invest in local projects.

## Conclusion

Coal mine methane is a highly potent greenhouse gas that is venting into the atmosphere at high volumes from active mines through degasification for miner safety and from abandoned mines where it escapes over time from the mined-out areas. The capture of CMM either for flaring or an industrial use has a clear environmental benefit in terms of reduced GHG emissions as the highly potent methane is converted to less potent carbon dioxide or otherwise eliminated. These capture processes also provide job opportunities and capital investment in Southwest Virginia where the decline of the coal industry has seen the loss of a high number of well-paid jobs. Capture of CMM is a viable approach to emissions reduction and job creation and is deserving of consideration and comparison with other efforts to enhance the environment and the economy of the Commonwealth.

## Acknowledgments

The Virginia Department of Energy would like to acknowledge the following organizations for their assistance in preparing this report: Anew Climate, Appalachian Voices, Archaea Energy, CNX,



Dominion Energy Virginia, Keyrock Energy, The Nature Conservancy, Newlight, Noah Horn Well Drilling, Virginia Department of Environmental Quality and the Virginia Oil and Gas Association.

## **Appendix**

### **Appendix 1 - Acronyms**

ACP - Alternative Compliance Payments

ACR - American Carbon Registry

AEC - Alternative Energy Credits

AEPS - Alternative Energy Portfolio Standard

AMM - Abandoned Mine Methane

AERS - Alternative Energy Resource Standard

BIL - Bipartisan Infrastructure Law

CAR - Climate Action Reserve

CARB - California Air Resources Board

CHOICE - Comprehensive Hoosier Option to Incentivize Cleaner Energy

CO<sub>2</sub>e - Carbon Dioxide Equivalent

CMM - Coal Mine Methane

CBM - Coalbed Methane

CMOP - Coalbed Methane Outreach Program

DOI - Department of the Interior

GHG - Green House Gas

HEDC - Historically Economically Disadvantaged Community

IRA - Inflation Reduction Act

LCA - Life Cycle Analysis

MMC - Mine Methane Capture

RES - Renewable Energy Standard

RPS - Renewable Portfolio Standard

UNFCCC - United Nations Framework Convention on Climate Change

VAM - Ventilation Air Methane

VCEA - Virginia Clean Economy Act

VCS - Verified Carbon Standard

CPRG - Climate Pollution Reduction Grants

## **Appendix 2 - Public Comments**

On October 2, Virginia Energy held a public comment session in Lebanon, Virginia for the study on the capture and beneficial use of coal mine methane (CMM). This is a summary of each participants comments.

### **Cathy St. Clair, CNX Resources**

Cathy St Clair is with CNX Resources, the largest natural gas producer in the Commonwealth with operations in Buchanan, Russell and Tazewell counties in Southwest Virginia. CNX shared that they are interested in this study because of the importance it holds in highlighting opportunities in Southwest Virginia (SWVA). CNX emphasized that Virginia could lead the nation by encouraging and incentivizing the capture and beneficial use of CMM as the state has available technology and workforce. Capturing and using the CMM would create jobs in Virginia, help the environment, and increase energy security. Low carbon and low emission attributes of methane can attract business in Virginia. CNX values the positive environmental effects of capturing CMM and is committed to increasing capital investment in Virginia which would create more jobs in the region.

### **Rhudy Keith, Noah Horn Well Drilling**

Rhudy Keith works for the Noah Horn Well Drilling (NWHD). NWHD drills the gas wells for extraction of coal bed methane and gob gas from Coronado Coal Company's Buchanan Mine. They currently employ 110 people but have employed up to 200 workers at times. NWHD appreciates Virginia focusing on the importance of natural gas for the community in SWVA. Capturing and using CMM would help the environment by not letting it get into the air and would create local and state jobs. NWHD also emphasized that encouraging the capture and use of CMM would attract companies like NWHD to hire more people, ultimately boosting the economy and helping the community and industry in SWVA. Companies could be a leader in reducing emissions without killing jobs and increasing costs to customers. NWHD believes the CMM study would highly benefit the SWVA region.

### **Lawton Mullins, Virginia Oil and Gas Association**

Lawton Mullins works with the Virginia Oil and Gas Association (VOGA). The member companies belonging to the Virginia Oil and Gas Association are directly related to the energy industry in Virginia. VOGA believes that companies within VOGA could be leaders in the region in reducing emissions and retaining jobs. Moreover, the capture and use of CMM could benefit the region by incentivizing, recognizing, and bringing manufacturing jobs to the area.

The following comments were received through a Virginia Regulatory Townhall comment forum:

**Commenter:** Anew Climate

**Anew Climate Comments: Evaluating policy options to encourage the capture and beneficial use of coal**

To Whom It May Concern:

Anew Climate, LLC (“Anew”) was formed through the merger of Element Markets and Bluesource in February 2022. Anew is one of the largest climate solutions providers in North America and, through its legacy companies, has a successful track record over the past two decades in developing and marketing carbon credits, renewable natural gas, low carbon fuels, electric vehicle credits, emissions credits, and renewable energy credits, in both compliance and voluntary markets, and in supporting client companies in quantifying and reporting on their greenhouse gas (“GHG”) inventories and developing corporate climate strategies and targets.

Anew applauds the Virginia Department of Energy for evaluating policy options to encourage the capture and beneficial use of Coal Mine Methane (CMM). We appreciate the opportunity to submit the following comments:

**1. Virginia Should Incentivize the voluntary Capture and Use of Coal Mine Methane Because of its Significant Environmental and Economic Benefits**

A well-designed Virginia policy program could significantly reduce the amount of methane that is vented into the atmosphere. This would:

- contribute to federal and state climate goals by reducing US GHG emissions,
- improve local safety and air quality, and
- create new economic opportunities in rural areas facing challenges from the energy transition.

CMM is defined as voluntarily captured methane that is liberated from coal mines. Methane is released before, during and after coal mining activities take place; in active, closed, as well as abandoned mines. For safety reasons, federal laws require mine operators to actively vent methane at underground mining sites to assure that concentrations of this explosive gas do not reach harmful levels. Even after active mining has ceased, waste methane may continue to seep for many years. Under current federal regulations, waste methane from mining activities may be released into the atmosphere unmitigated. This methane is a greenhouse gas that is more than 28 times more potent than carbon dioxide on a mass basis over a 100-year period. According to the US EPA, methane emissions from coal mining and abandoned coal mines accounted for 8% of total US methane emissions in 2019, making it the fifth largest source of this powerful greenhouse gas.<sup>[1]</sup> According to the U.S. EPA’s GHG Inventory, about 41.5 million tons of GHG emissions (CO<sub>2</sub>e) could have been avoided in 2021 through CMM capture from underground coal mines<sup>[2]</sup>.

- In addition, when CMM emissions are not captured, they are not only a potent GHG contributor but also represent a wasted potential source of energy. In 2022, thirteen mines in the US reported destruction or capture devices to EPA’s Greenhouse Gas Reporting Program. 2022 EIA reports cite 539 active US coal mines. Therefore, only

2.4% of 2022 US active coal mines have some form of capture equipment and there is substantial opportunity to leverage this wasted resource under properly incentivized beneficial use programs. [\[3\],\[4\]](#)

Importantly, the majority of CMM potential is in Justice40 areas covering large segments of Virginia, West Virginia, and Kentucky [\[5\]](#). There are significant socioeconomic benefits associated with the development of CMM as it creates jobs in communities that are hit hardest by the energy transition. [\[6\]](#)

## 2. Overview of Existing CMM Capture and Use Incentives

The following state, voluntary, and federal programs and initiatives are focused on creating avenues for beneficial use of CMM as a low carbon fuel resource. While these pioneering programs create a welcome recognition of the benefits of waste gas capture, we highlight that most place restrictions either on the qualifying end use or sourcing (e.g. from abandoned mines only) of CMM, so no comprehensive framework for driving beneficial use of CMM in the US exists today:

- **Pennsylvania Renewable Portfolio Standard** Recognizes CMM as a qualified resource for the generation of Tier 1 Alternative Energy Credits. Under this program, CMM displaces traditionally extracted natural gas for use in power generation, taking full advantage of the thermal and environmental benefits of methane capture for beneficial use.
- CMM is recognized as a recommended resource under the **Colorado Clean Heat Standard** for both its thermal and environmental benefits. The legislation directs gas distribution utilities in Colorado to submit “clean heat plan” to cut CO<sub>2</sub> and methane emissions from delivered gas. Reduction measures include energy efficiency programs, biomethane, hydrogen, recovered methane from active and abandoned mining projects, leak detection, and electrification.
- **Ohio’s Renewable Portfolio Standard** allows for the generation of compliance renewable energy certificates (RECs) associated with pipeline-injected gas from abandoned coal mines.
- Since 2014 California’s Cap and Trade program, AB23, compliance protocol also recognizes the GHG benefits of CMM destruction under a flaring protocol, but crucially the maximal benefit of injecting CMM to a common carrier pipeline for beneficial use is not recognized.
- **The American Carbon Registry (ACR)** has recognized CMM for carbon offset generation since 2014. This protocol does allow for common carrier pipeline injected CMM to qualify under specific circumstances, however these circumstances place significant financial and operational burdens on projects, leading most sites and project developers to elect to flare waste methane [\[7\],\[8\]](#).
- Since 1994, **EPA’s Coalbed Methane Outreach Program (CMOP)** has been working with coal mining sector in the U.S. to reduce CMM emissions. As of January

2023, EPA's CMOP had identified 25 coal mine methane projects at 16 active mines and 35 abandoned mine methane projects at 66 abandoned (closed) mines nationally. Its mission is to promote the profitable recovery, utilization, and mitigation of coal mine methane, which the EPA recognizes as a valuable energy resource<sup>[9]</sup>.

### 3. Recommendation

Programs targeted at supporting the beneficial use of CMM through gas capture, upgrade, and pipeline injection are an essential component of reducing emissions associated with necessary mine safety precautions. Beneficial use of CMM – alongside its GHG impact and social, economic benefits – is a powerful tool for the remediation of coal mines. By incentivizing the capture and use of CMM, state and local governments and communities will reduce costs and impacts associated with environmental mitigation from closed or abandoned mine operations, which do not cease to produce waste methane at the cessation of mining operations. If not captured and put to beneficial use, CMM would otherwise be wasted; released into the atmosphere rather than as an alternative source of methane for power generation, heating, transportation, and key energy transition fuels such as SAF, hydrogen, and ammonia. With proper programmatic support at the state level, CMM could become a driver of economic and environmental success in Virginia.

We therefore recommend that the Virginia Department of Energy design a policy that would incentivize the capture and beneficial use of CMM. As an established leader in the environmental markets with broad experience navigating different policy programs, Anew would welcome the opportunity to engage in further dialogue with the Department to support the analysis of different policy options and scenarios.

Thank you for the opportunity to provide these comments.

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<sup>[1]</sup> US EPA Coalbed Methane Outreach Program: About Coal Mine Methane | US EPA

<sup>[2]</sup> Greenhouse Gas Inventory Data Explorer | US EPA

<sup>[3]</sup> U.S. Environmental Protection Agency. 2023. "Underground Coal Mines. Greenhouse Gas Reporting Program (GHGRP)." Office of Atmospheric Protection. <https://enviro.epa.gov/query-builder/ghg>.

<sup>[4]</sup> U.S. Energy Information Administration. 2023. "Annual Coal Report 2022." <https://www.eia.gov/coal/annual/pdf/acr.pdf>.

<sup>[5]</sup> Map of US Coal Mine Methane Current Projects and Potential Opportunities | US EPA

<sup>[6]</sup> Council on Environmental Quality Climate and Economic Justice Screening Tool: Explore the map - Climate & Economic Justice Screening Tool ([geoplatform.gov](https://geoplatform.gov))

<sup>[7]</sup> American Carbon Registry (ACR). Mine Methane Capture Methodology v.11 (2022)

Capturing and Destroying Methane from Coal and Trona Mines in North America — American Carbon Registry

<sup>[8]</sup> Climate Action Reserve (CAR). (2012). U.S. Coal Mine Methane

Protocol [https://www.climateactionreserve.org/wp-content/uploads/2009/10/CMM\\_Project\\_Protocol\\_V1.1\\_Package\\_031014.pdf](https://www.climateactionreserve.org/wp-content/uploads/2009/10/CMM_Project_Protocol_V1.1_Package_031014.pdf)

<sup>[9]</sup> Environmental Protection Agency (2023). Coalbed Methane Outreach Program (CMOP). <https://www.epa.gov/cmop>

On behalf of CNX Resources, we thank the Virginia Department of Energy for undertaking this important study and would like to thank the General Assembly and the Governor's office for their leadership on the passage of HB1643 and SB1121. We appreciate the opportunity to comment.

CNX Resources is the largest natural gas producer in the Commonwealth of Virginia, with our operations stretching across Buchanan, Russell, and Tazewell counties. Within Virginia we employ approximately 70 employees and have over 400 contractors working at our sites on any given day.

It's important to distinguish traditional coal bed methane from coal mine methane. Coal mine methane (CMM), as defined by the law, is *"methane gas captured and produced from an underground gob area associated with a mined-out coal seam that would otherwise escape into the atmosphere."* The definition of coal mine methane covers mines that emit methane for safety purposes and the methane still emitting from abandoned or closed mines, which would otherwise be going to atmosphere. Whereas Coal Bed Methane (CBM) is a resource unrelated to mining degasification or safety.

CMM is not required to be captured. MSHA requires that a written ventilation plan, with specified content, be developed for each underground metal or non-metal mine. Accordingly, the venting of methane is necessarily standard industry practice.<sup>1</sup> As shown below in Graphic 1.1, CMM accounts for 8% of all Methane Emissions in the US.<sup>2</sup>

There are over 539 operating coal mines and less than 2% of underground active coal mines are capturing and using methane as of 2022, and only 13 mines with capture projects reporting to EPA's Greenhouse Gas Reporting Program.<sup>3,4</sup>

Fewer than 8 active mines are utilizing the CMM for beneficial use today due to high costs of capture and cleaning.<sup>4</sup> One of those happens to be in Virginia at the Buchanan #1 Mine, but so much more can be done. There are still significant methane emissions across Virginia mines, even still at Buchanan. It is a necessary part of the mining activity, and ensuring the viability of these mines should be of utmost importance. Due to the large capital expenses associated with capturing methane, these efforts need to be incentivized or encourage, and if done correctly, can establish an entirely new stream of capital deployment, infrastructure build out and jobs, all while addressing an environmental concern from an otherwise wasted resource. CNX estimates that if CMM capture for beneficial was incentivized, private industry could address the >10M tons of CO<sub>2</sub>e annually liberated from underground coal mines in Virginia by enabling private investors to invest over \$400 million and create 400 jobs in coal communities primarily in Southwestern Virginia.

Currently, there are no federal incentives for the capture and utilization of coal mine methane, unlike the Renewable Fuel Standard for biogas, and only five (5) states currently recognize CMM for their alternative or renewable portfolio standards. For nearly two decades, Pennsylvania has designated CMM as a tier 1 energy source. Other states that include some form of mine methane in their portfolio

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<sup>1</sup> Mine Safety and Health Administration, Department of Labor. 1985. "Ventilation." 30 CFR 57.8520. <https://www.ecfr.gov/current/title-30/part-57/section-57.8520>.

<sup>2</sup> <https://www.epa.gov/cmop/about-coal-mine-methane>

<sup>3</sup> <https://www.eia.gov/coal/annual/pdf/acr.pdf>

<sup>4</sup> <https://enviro.epa.gov/query-builder/ghg>

standards include Ohio, Indiana, Utah and Colorado. Virginia, like several other states, should recognize the positive environmental attributes of this method of capturing methane emissions that would otherwise go into the atmosphere.

Historically, the Section 45K(a) (formerly Section 29)<sup>5</sup> provided a credit for producing fuel from a nonconventional source, measured in barrel-of-oil equivalent of qualified fuel (including methane from coal mines), the production of which is attributable to the taxpayer and is sold by the taxpayer to an unrelated person during the taxable year. The credit was enacted in 1980 by the Crude Oil Windfall Profit Tax Act in response to the energy crisis caused by the cut off of crude oil from the Middle East. The credit, which was extended and modified at different times, ultimately expired in 2007 for qualified fuels produced from coal seams.

Due to this expiration, coupled with the lower natural gas prices due to the advent of unconventional shale development, capture projects for beneficial utilization are decreasing, and in some cases those same mines are now venting to atmosphere and / or pursuing flare projects due to economic conditions as shown in Graphic 1.2<sup>8</sup>.

Under California's program, CARB, California Air Resources Board, coal mine methane does qualify as a valid source for emissions offset, however, only if that methane is destroyed via flaring<sup>6</sup>. It is important to note, that the methane abatement impact of flaring is limited. Despite the incentive at CARB and a handful of other carbon offset markets, today, flare projects capture only ~1.3MM tCO<sub>2</sub>e per year, or 2.5% of methane liberated from active underground coal mining in 2021.<sup>7,8</sup> The increase in flaring is not having a material impact on reducing emissions to atmosphere due to the small scope, low adoption, and temporary nature of the practice.<sup>9</sup>

Due to the methane release occurring during and after active mining of coal, and released methane migrates to the atmosphere within a timeframe that is within life cycle analysis (LCA) boundaries.<sup>10,11</sup> This is important because more and more companies, electric generators, and manufacturers are focusing on life cycle analyses and carbon intensity of feedstocks. When coupled with the global focus on methane emissions reductions, this fuel source and its low carbon attributes can help attract manufacturing and electric generation to the state. For example, CNX has announced projects with Newlight, Adam's Fork ammonia, and the Pittsburgh International Airport where on-site consumption of low carbon intensity gas is a priority that brought investment to OH, WV, and PA respectively. These project developers want to meet their environmental and sustainability goals are looking for ways to utilize energy resources as their feedstock that can be counted toward their emissions avoidance targets – CMM can meet that demand, while utilizing a potent gas that would otherwise be vented into the atmosphere.

Each new MW of solar and wind capacity requires between 35-45 and 120-180 tons of steel respectively. 70% of steel production globally relies on coal for manufacturing. According to Ember, 27% of the

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<sup>5</sup> <https://www.law.cornell.edu/uscode/text/26/45K>

<sup>6</sup> (<https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program/compliance-offset-protocols/mine-methane-capture-projects>)

<sup>7</sup> <https://acr2.apx.com/>

<sup>8</sup> <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2021>

<sup>9</sup> <https://www.youtube.com/watch?v=IVNdd1t7xps>

<sup>10</sup> <https://stacks.cdc.gov/view/cdc/9025>

<sup>11</sup> <https://pubmed.ncbi.nlm.nih.gov/29780220/>



climate impact of steel comes from methane. The capture and beneficial use of CMM will drastically lower the climate impact of the renewable energy supply chain and scope 3 emissions.<sup>12,13,14</sup>

The technology is available, the workforce is here and there is an appetite to capture and use this methane, which creates jobs, helps the environment, and utilizes an energy source that would otherwise be wasted – providing more energy security.

As company, CNX is committed to an Appalachian First vision to energy production. That means produce it here and use it here, first. We need to leverage this resource and strategic advantage that Virginia has to attract better paying jobs to the Coalfields region. Recognizing the positive environmental effects of capturing CMM can translate into significant capital investment for our region. However, the key to unlocking this potential is to treat CMM the same as captured landfill gas and renewable natural gas from a public policy perspective.

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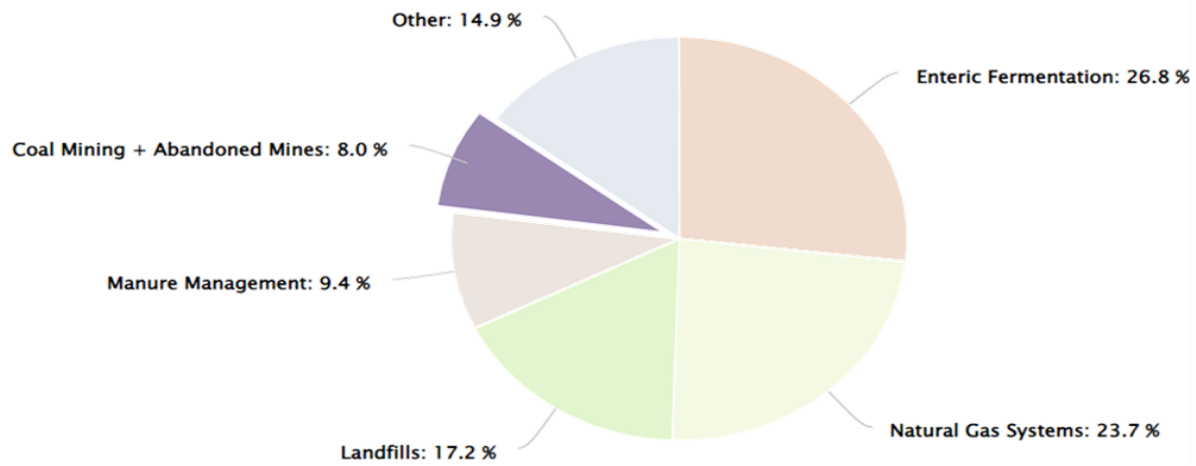
<sup>12</sup> <https://cleantechnica.com/2023/03/27/how-much-steel-will-all-those-wind-turbines-solar-panels-need-can-we-make-it/#:~:text=Each%20new%20MW%20of%20solar>

<sup>13</sup> <https://www.worldcoal.org/coal-facts/coal-steel/>

<sup>14</sup> <https://ember-climate.org/insights/research/why-the-steel-industry-needs-to-tackle-coal-mine-methane/>

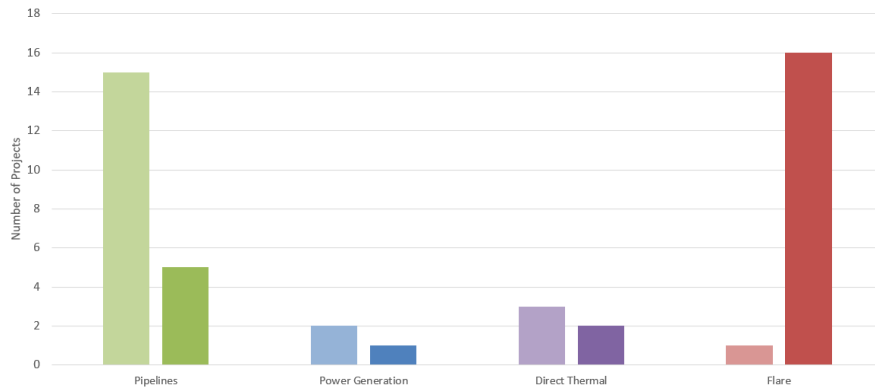
## Supporting Graphics:

Graphic 1.1: Methane Contribution by Sector, 2019



## Pivot from Beneficial Use to Flaring

Graphic 1.2: Drained Gas Projects: 2010 vs. 2022, all of US



Source of graphic: Michael Coté: Recent Developments with Coal Mine Methane and Abandoned Mine Methane Projects in the U.S., presented during the Global Methane, Climate and Clean Air Forum in Washington DC, September 26-30, 2022  
Data sources cited by author: U.S. EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2020; American Carbon Registry, Public Registry of CARB Offset Projects

Graphic 1.2: Pivot from Beneficial Use to Flaring (Drainage Gas Projects: 2010 vs. 2022, all US)

## PUBLIC COMMENT LETTER

**Re: Evaluating policy options to encourage the capture and beneficial use of coal mine methane**

To Whom It May Concern:

Thank you for the opportunity to comment on House Bill 1643 and Senate Bill 1121 as the Department of Energy investigates methods of promoting the capture and beneficial use of coal mine methane. I am Aaron Davis, Senior Engineer with Keyrock Energy, LLC, a methane capture and destruction company with projects spanning six states, including Virginia. Keyrock is responsible for generating more than 35% of all coal mine methane offsets in the United States. With a background in engineering, law, and business, my perspective on the issue at hand is both varied and balanced. In particular, my experience with Keyrock has allowed me to fully appreciate the widespread, positive impact of methane capture and destruction. To that end, I would like to present the following points of comment:

1. Keyrock embraces methane pipeline injection but acknowledges that this is rarely the most feasible option.
2. Methane destruction is an excellent alternative that positively impacts the environment in the present and future.
3. Methane destruction is a proven alternative that promotes and ensures the safety of coal miners.

Arguably, the best use of captured coal mine methane is its injection into pipelines for public and private consumption. Keyrock fully supports pipeline injection and utilizes the same where a project produces quality methane *and* has access to adequate infrastructure that makes processing the gas for injection a viable option. One Keyrock property in Illinois extracts gas from 16 abandoned underground coal mines using over 30 wells and a collection system comprising more than 50 miles of pipeline. Mine gas is transported to a centralized gas processing plant, where contaminants are removed and the gas is pressurized for delivery into the natural gas pipeline. This is the exception, however, not the norm. The reality is that many projects result in gas that is simply not injectable because of its quality and/or quantity. Nearly all methane projects are located in remote areas, such as rural Appalachia. The notorious lack of infrastructure makes construction of a cryogenic

gas improvement facility – and consequently pipeline injection – not only economically impractical, but unfeasible.

While injecting methane into a pipeline may be ideal, conditions (namely methane quality and adequate infrastructure) rarely are. Consequently, methane destruction is a viable alternative. Methane is a known greenhouse gas that is 28 times more potent than carbon dioxide over a 100-year period and 84 times more potent than carbon dioxide over a 20-year period.<sup>1</sup> Methane is continuously emitted from coal mines, both active and abandoned. It leaches into the ground, contaminates water sources, negatively impacts surface vegetation, and creates perpetual concerns for fires and explosions for the surface owners. According to the E.P.A., coal mining *and* abandoned mines produce approximately 8% of the United States' total methane emissions.<sup>2</sup> Destroying methane alleviates these concerns. Further, the by-products of methane combustion are proven to be better and much less detrimental to our environment than the emission of methane. Essentially, coal mine methane destruction can circumvent decades of negative environmental impact.

In addition to its environmental benefits, methane destruction also plays a critical role in ensuring coal miner safety. Mines liberate methane as operations are conducted. As a result, it is continuously monitored and maintained according to state and federal regulations. But despite extensive regulations and oversight, methane has still been the cause of innumerable explosions and fatalities since the inception of mining. As coal mine operations develop, areas that have already been mined are sealed off from the rest of the active mine. Regardless of these precautions, though, all seals leak into the active mine ventilation system and continue to threaten the lives of miners.

For reference, at one active West Virginia coal operation, a sealed area was leaking methane into the active mine. Every barometric pressure drop forced methane through the seals into the active mine. At times, this was so significant that the mine operator was forced to cease production and remove miners from the affected area. Keyrock was contracted to drill into the mine and destroy methane from this sealed area. The requisite permits and licenses were quickly secured and Keyrock was able to drill, apply a negative pressure to the sealed area, and set up a flare to destroy methane. This negative pressure created an equilibrium such that the decreases in barometric pressure no longer resulted in methane leaking into the active mine. The

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<sup>1</sup> See <https://www.factcheck.org/2018/09/how-potent-is-methane/>.

<sup>2</sup> See <https://www.epa.gov/cmop/about-coal-mine-methane#g2>.

MSHA data immediately preceding the flare installation showed that a staggering ~7 million cubic feet of methane per day was being liberated from the mine. However, after the installation of the Keyrock flare, the MSHA data showed that the methane liberation dropped to 5.5 million cubic feet per day (“cfd”). This is an astonishing 1,500,000 cfd reduction in methane liberation!

And the emission of lethal amounts of methane are by no means isolated. Consequently, deadly mine disasters have continued into this century – disasters that never fail to garner an onslaught of media attention and scrutinization of the mining industry. Consider the following recent disasters:

- Sago Mine Explosion
  - 12 fatalities, January 2, 2006
  - This mine’s daily methane emission was 92,460 cfd.<sup>3</sup>
- Darby Mine No.1 Explosion
  - 5 fatalities, May 20, 2006
  - This mine’s daily methane emission was 38,707 cfd.<sup>4</sup>
- Upper Big Branch Mine Explosion
  - 29 fatalities, April 5, 2010
  - This mine’s daily methane emission was 1,067,510 cfd.<sup>5</sup>

We could only speculate as to the lives that might’ve been spared if methane destruction techniques had been implemented at any of these mines.

Of the six states where Keyrock engages in methane operations, Virginia has proven to be the most challenging both in terms of regulatory procedures and the length of time it takes to follow the same (often up to 18 months). In the state of Virginia, a coal mine can secure all the necessary permits and licenses, and comply with all the regulatory requirements to begin mining operations...all while continuously emitting methane, creating imminent risks to the environment and to the lives of miners. But the moment a flare is set up to destroy that same deadly gas and protect the lives of those working at the face of that same coal mine, the methane destruction process comes to a screeching halt. The presence of the flare triggers the involvement of the Virginia Oil and Gas Board and, under the current legislative

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<sup>3</sup> See <https://arlweb.msha.gov/fatals/2006/Sago/ftl06C1-12.pdf>, Page 104.

<sup>4</sup> See <https://arlweb.msha.gov/fatals/2006/Darby/FTL06c2731.pdf>, Page 19.

<sup>5</sup> See [https://www.msha.gov/sites/default/files/Data Reports/Fatals/Coal/Upper%20Big%20Branch/FTL10c0331noappx.pdf](https://www.msha.gov/sites/default/files/Data%20Reports/Fatals/Coal/Upper%20Big%20Branch/FTL10c0331noappx.pdf), Page 71.

framework, its processes and procedures can be exceedingly tedious and time-intensive. The result? Tens of thousands of dollars and countless hours spent in title searching, document drafting, and regulatory hurdle-jumping.

The enormous task of conducting a thorough oil and gas title search is evidenced by the tens of millions of dollars that are currently tied up in escrow waiting for a determination of the proper royalty owner. At the same time, thousands of opportunities for methane destruction are ripe throughout the coal fields where methane poses either a danger to the environment, a threat to human life, difficulties for the landowner, or all three. In addition to the important work of destroying methane, these operations could provide much-needed job opportunities.

There is a tremendous need for viable methane capture, use, and destruction in Virginia. Keyrock is already involved in promising operations within the state, but this involvement has highlighted several serious difficulties. I believe that an alternative could be devised whereby methane destruction operations could commence in a provisional manner as the title searching is being conducted and regulatory compliance is being achieved. It is not uncommon for such temporary or conditional permits to be issued in a variety of circumstances. By issuing such a permit, the state of Virginia could allow the critical function of methane destruction to be performed, subject to oversight, until all requirements are met. This scenario would allow for thorough compliance, as well as the protection of the environment and the saving of lives.

Sincerely,

/s/ Aaron R. Davis

Aaron R. Davis, P.E., J.D., MBA

General Notice: Public Comment Opportunity - Evaluating policy options to encourage the capture and beneficial use of coal mine methane [2678]

Commenter	Title	Comment	Date/ID
<p>Mike Moore, Waste Gas Capture Initiative</p>	<p>WGCI Supports Efforts to Encourage the Capture and Beneficial Use of Mine Methane</p>	<p style="text-align: center;">October 26, 2023</p> <p>To Whom It May Concern:</p> <p>As the Virginia Department of Energy evaluates policy options to encourage the capture and beneficial use of coal mine methane (CMM), I am kindly submitting a comment on behalf of the Waste Gas Capture Initiative (WGCI) in support of the effort of utilizing CMM.</p> <p>Promoting the capture and utilization of CMM, which accounts for around 8% of total U.S. methane emissions annually., offers the potential for Virginia to clean the environment, diversify energy sources, and create jobs simultaneously. According to the EPA, the methane emitted from active mines alone amounted to 33 million tons CO<sub>2</sub>e<sup>100</sup> of methane to the atmosphere. Coal mine methane capture significantly reduces harmful greenhouse gas emissions and creates needed jobs in areas that have been economically impacted by the energy transition.</p> <p>Additional benefits include enhanced energy security, as Virginia has the opportunity to tap into an abundant and underutilized resource. This strategy strengthens the resilience of our energy supply. Despite these benefits, less than 2% of active U.S. coal mines today capture and utilize the vented methane. Encouraging such efforts through policy incentives enables innovative projects that can power homes and industries, driving Virginia's sustainable energy goals forward and making progress toward emissions reduction objectives.</p> <p>Scaling mine methane capture operations is a commonsense and ready solution to support local economies, reduce overall U.S. methane emissions, and strengthen America's energy security. As an organization dedicated to securing America's sustainable energy future through mine methane capture, the WGCI stands ready to support this effort and to be a partner with the Virginia Department of Energy as you undergo this process.</p> <p>Sincerely,</p> <p>Mike Moore Executive Director Waste Gas Capture Initiative <a href="https://wastegascapture.com/">https://wastegascapture.com/</a></p>	<p>10/27/23 12:35 pm CommentID:220483</p>