Testimony to the Pennsylvania Senate Environmental Resources and Energy Committee

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Chairs Yaw and Comitta, and members of the Senate Environmental Resources and Energy Committee, I am Brent Bobsein, Vice President of Sustainable Development at CNX Resources. I appreciate the opportunity to provide testimony on the merits of utilizing waste feedstocks as an alternative fuel.

CNX Resources is a natural gas company headquartered in Washington County, Pennsylvania. We have roughly 470 employees who support our operations and their communities across the Appalachian region. Like many of the panelists, we are deeply committed to driving economic development in Pennsylvania and across this region, but also recognize that we can do it in an environmentally friendly way – this is evident by our Appalachia First vision, our efforts around Radical Transparency and commitments to being good neighbors in our communities through programs like our CNX Foundation and Mentorship Academy.

Innovation and environmental stewardship are two of our core values at CNX and these values inspired the formation of our New Technologies team in 2021 – also known as New Tech. As part of its mission, CNX New Tech is focused on developing and deploying technologies that directly reduce emissions and utilize historically wasted energy sources. Currently, we accomplish these objectives in two main, unique ways relevant to the topic we are discussing today:

1. CNX is a pioneer and industry leader in capturing and utilizing coal mine methane, which is methane that is predominantly vented to atmosphere in almost all cases and exists throughout Pennsylvania even at abandoned mines which have ceased active mining decades ago.
2. CNX has developed proprietary technology and methods of operation that harness the naturally occurring high pressures and heat energy found within deep shale formations, which would be otherwise wasted, capturing this geothermal energy and turning it into useful things like electricity and hydrogen.

<u>Coal Mine Methane Capture and Beneficial Use</u>

Coal Mine Methane, (CMM) is a major source of fugitive methane emissions, which represents eight percent of annual U.S. methane emissions.[1] Mines are legally obligated to ventilate methane to the surface for safety purposes, however, of the 30,000 abandoned mines and 550 active coal mines in the US, less than 1% are capturing the associated methane with the remaining mines typically releasing methane to the atmosphere instead. This presents an opportunity to both mitigate an

[1] U.S. Environmental Protection Agency (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2021

environmental challenge and also to utilize an overlooked potential source of energy that is abundant across the Appalachian region, including Pennsylvania. Current capture rates for CMM are very low, with only three (3) CMM capture and pipeline injection projects in the United States today, one of which CNX operates in Virginia.

Capturing and utilizing CMM prevents methane from escaping into the atmosphere, thereby reducing emissions, creating jobs, and accessing a domestically sourced fuel to help address our growing energy needs. In short, this process turns waste from our industrial sector into a valuable energy resource and could be treated in the same way as Renewable Natural Gas, like the biomethane from agriculture, landfills and municipal solid waste which are incentivized for use in transportation while driving decarbonization within our waste sector.

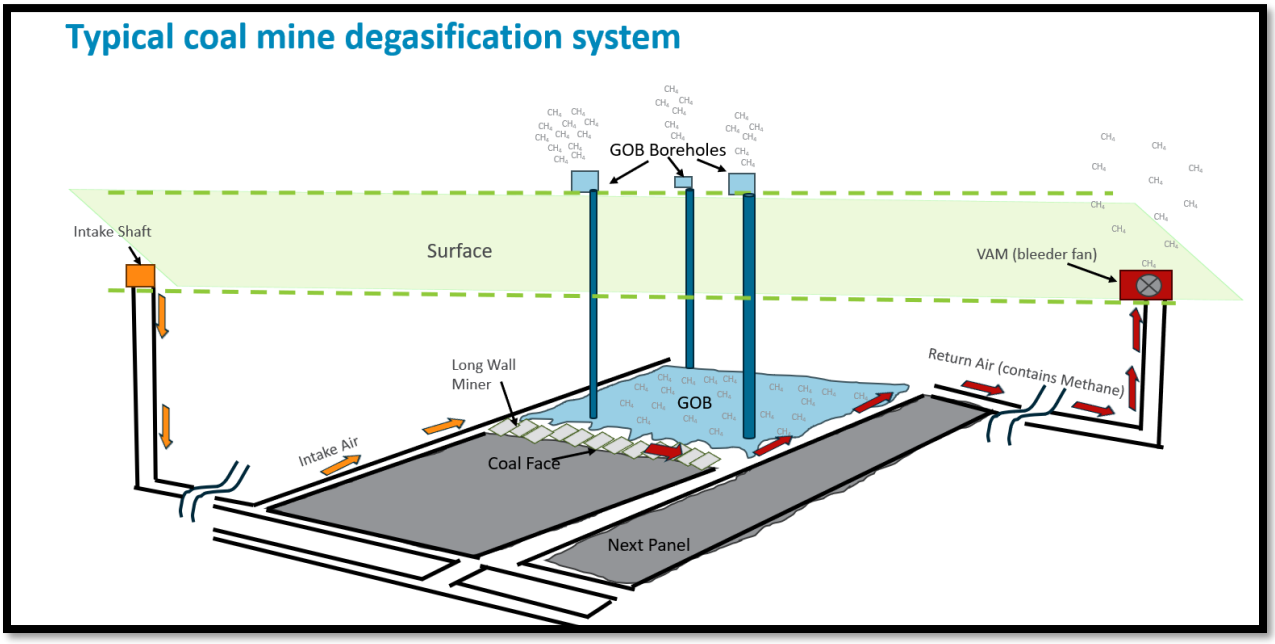

Figure 1: Diagram of Typical Coal Mine Degasification System

Economic Benefits

The development and utilization of CMM can create significant numbers of jobs and economic development in communities across Pennsylvania, including those local areas that have been particularly impacted due to the decline of the coal industry. By both mitigating an environmental concern and turning a waste product into a valuable commodity, we can stimulate economic activity and attract investment to these regions. CMM capture systems involve significant up-front capital expenditures, including, the installation of new gathering and transmission pipeline across long distances, processing stations for removing atmospheric components like co2 and nitrogen, compression facilities, and measurement/telemetry facilities, along with interconnections to existing interstate pipeline systems. In addition, ongoing active mining operations are constantly expanding, which requires the deployment of new and ongoing capture infrastructure.

Energy Security

CMM provides an abundant, reliable and locally sourced energy supply, reducing our dependence on imported fuels. This enhances energy security and ensures a stable energy supply for Pennsylvania. CMM can be integrated into existing natural gas infrastructure, facilitating rapid emissions reductions and new energy supply. This reduces the need for significant new investments in infrastructure and allows for the efficient use of existing assets.

Environmental Benefits

CMM capture has significant benefits to the environment. Currently, CMM is largely unabated and accounts for roughly 14% of Pennsylvania's industrial sector emissions[2]. By reducing the release of methane emissions to the atmosphere through capture and utilization, we can support efforts to improve the air quality in communities throughout Pennsylvania that are impacted by sources of these emissions. In addition to the environmental benefits, CMM can be converted into a variety of alternative fuel sources such as heat, electricity, hydrogen, CNG, and LNG which each have a wide range of applications in transportation, industry, and power generation. Hydrogen, for example, is a versatile energy carrier that can help reduce emissions in multiple sectors, further enhancing the economic potential of CMM.

Geobaric Energy

The term we have coined for harnessing and using naturally occurring pressure and heat energy from deep shale formations is geobaric energy. Typically, under this immense pressure and high temperature, water, gas, and other liquids would dissipate without being utilized. However, CNX has created ways to capture and use this near zero carbon energy safely and efficiently.

This innovative method has led to the development of several cutting-edge systems:
(1) FreeSpin® In-line Turboexpander: In partnership with Sapphire Technologies, this system generates clean electricity from the Earth's energy. By harnessing the high pressures found in natural gas applications, this system efficiently generates clean electricity directly from the source, reducing both emissions and allowing for on-site electric generation. This makes it a valuable solution for sustainable near zero emission energy production.
(2) ZeroHP CNG™: Collaborating with NuBlu Energy, this technology redefines CNG production by eliminating mechanical compressors. Instead of leveraging conventional mechanical compression, ZeroHP CNG exploits high gas pressures found naturally, within deep shale formations.

Currently under development, CNX is expanding its partnership with NuBlu to generate LNG (Liquefied Natural Gas). Our Clean mLNG™ technology aims to provide a micro-scale LNG liquefaction solution by leveraging both geobaric Energy and NuBlu's proven methane-only refrigeration technology. This will further enhance the efficiency and sustainability of LNG production, making it more accessible and environmentally friendly. Our system will enable a cost-effective production of small-scale LNG without compromising performance, and by providing a path to zero Scopes 1 and 2 upstream emissions.

Geobaric energy has a minimal environmental footprint compared to traditional fossil fuels. It can be developed in areas with existing geological formations, reducing the need for extensive land use

[2] Pennsylvania Greenhouse Gas Inventory Report, 2024

changes. Developing geobaric energy projects can stimulate local economies by creating high-skilled jobs in engineering, construction, and maintenance. It offers a new revenue stream for regions with suitable geological conditions, diversifying their energy portfolios.
Utilizing geobaric energy can reduce reliance on imported oil, enhancing national and state energy security. It supports the domestic natural gas industry, contributing to economic growth and job creation.

Conclusion
In conclusion, coal mine methane and geobaric energy are two innovative ways to capture and utilize wasted feedstocks, which can then offer significant benefits when used as alternative fuels. They provide environmental advantages, economic opportunities, and enhance energy security for Pennsylvania. I thank the Committee for your time and attention and hope you consider policies that support the development and utilization of these resources. I am happy to answer any questions you may have.