DEPLOY DIALOGUES

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NATIONAL ENERGY TECHNOLOGY LABORATORY
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Regional Deploy Dialogue: **Appalachia Critical Materials**

> On July 17th, the U.S. Department of Energy (DOE) hosted a Deploy Dialogue focused on Critical Materials in the Appalachia Region at the National Energy Technology Laboratory (NETL) in Morgantown, West Virginia.

The Deploy Dialogues were first introduced at the Demonstrate, Deploy, Decarbonize 2023 (Deploy23) conference and provide an independent platform to further discussions around the Pathways to Commercial Liftoff reports and sectors. These invite-only, off-the-record workshops bring together senior leaders from both the private and public sectors to catalyze the deployment of clean energy and decarbonization technologies.

Over the past year, DOE built upon the momentum of Deploy23's Deploy Dialogues by bringing them to various conferences across the country. While the previous Deploy Dialogues have been focused on the growth of industry nationwide, this was the first one targeting a specific region and leverages the Appalachia Regional Report developed by DOE's Office of Fossil Energy and Carbon Management (FECM). The FECM Regional Reports curate relevant solutions to align with a region's unique energy and industry mix, local energy resources, and current initiatives and priorities.

This is a summary of the Critical Materials Deploy Dialogue at NETL Morgantown. It is not a verbatim transcript, but rather a summary of key themes and ideas discussed in each session. The session was off-the-record, and no attribution for statements is provided. The dialogue was not designed to and did not result in a consensus of opinions, but rather drew on individual insights from a diverse set of participants.

All Deploy Dialogues have the same overarching objective – to convene key decision makers and build the open dialogue and trust needed to accelerate our clean energy transition; however, each Dialogue is tailored to a specific sector in focus, resulting in slight differences in structure and outputs.

Critical Materials in Appalachia

Appalachia is well positioned to have a key role in developing a domestic source of critical minerals and materials. Critical minerals, including rare earth elements, are key to our national defense and to manufacturing clean energy technologies— such as solar panels, wind turbines, electric vehicles, and hydrogen fuel cells—that will help the United States achieve a net-zero emissions economy. They are also essential to the manufacture of technologies and products vital to our country's national security. Demand for critical minerals and materials is growing quickly in the United States and globally, and the United States currently imports greater than 80 percent of its rare earth elements, and 100 percent of several other critical minerals, from non-domestic suppliers.

There is significant opportunity in Appalachia to build a secure, sustainable domestic supply of critical minerals from a broad range of secondary and unconventional sources. Secondary and unconventional sources of critical minerals include mined coal, coal waste, coal ash, acid mine drainage, mine tailings, produced water from oil and gas production and other industrial waste streams. Initial estimates suggest that unconventional and secondary sources could provide significant amounts of the rare earth elements and other critical minerals and materials needed to reach the nation's clean energy goals. For example, wastes and byproducts from known fossil fuel reserves and other industries nation-wide currently contain more than 10 million tons of rare earth elements, which is equivalent to more than a 300-year supply at the current rate of U.S. consumption.[1] These opportunities make Appalachia a strong potential resource to underpin the development of domestic supply chains to help reduce America's dependence on other countries for these critical minerals, create good-paying jobs, remediate land and water, and support communities that historically have depended on mining and energy production.

[1] Division of Minerals Sustainability_July 2024.pdf (energy.gov)

The overarching discussion question for the Dialogue was

> "What is holding back the rich critical mineral resources from secondary and unconventional materials in Appalachia from being developed?".

The workshop was opened by Dr. Marianne Walck, Director of the National Energy Technology Laboratory, and Ryan Peay, Deputy Assistant Secretary for the Office of Resource Sustainability in DOE's Office of Fossil Energy and Carbon Management (FECM). The session included a brief presentation to provide Appalachian critical materials market context, followed by discussions and breakouts looking at the potential for critical materials in Appalachia, the barriers and challenges to development, and possible actions and solutions. The workshop highlighted a range of perspectives with participants from the region, including project developers, power producers, financial institutions, and infrastructure/EPC firms.

Themes from the Critical Materials Regional Deploy Dialogue

1. Characterization

Participants highlighted that there has been a lot of discussion of technologies to access critical materials resources, and not enough discussion of understanding the volume, value, and location of the secondary and unconventional resources in place. To scale the critical materials industry in Appalachia, developers and investors need to have confidence in the composition of the resource. Government can play an important role in helping industry and investors better understand the resource potential. Startups often try to build these capabilities in-house, but the national laboratories have capabilities in this area that could benefit the industry broadly. The industry would also benefit from more in-depth supply chain analysis, which government is well-positioned to support.

2. Workforce

From the beginning of the session, participants regularly raised the need for a properly skilled workforce as a major barrier to building a strong critical materials

industry in the region. Estimates were shared of the need for 500 new mining engineers per year to meet demand, in contrast with around 160 currently graduating each year after approximately five years of education, and a majority of those going to opportunities outside of the region. Appalachia is home to some of the strongest mining engineering programs in the world; however, "coal" and "mining" have a negative connotation in the minds of many people entering university and the workforce. Government can support organizations working to change this perception, as well as help with retraining, apprentice programs, and partnership with unions and universities to achieve this goal.

3. Policy

Permitting and community opposition have played a major role in slowing the development of the critical materials industry in Appalachia. To help facilitate easier permitting, industry should start by trying to choose an active or currently permitted site. If that is not feasible, they can look to modify current permits, and consult with people and experts/companies who can help in the permitting process. Government can help facilitate discussions and interagency work, as well as support work with communities to help them better understand the technology and alleviate potential concerns about safety and emission. A national policy to prioritize critical minerals and materials facilities and refineries would be ideal and would support national goals for domestic manufacturing and onshoring supply chains.

4. Access to Capital and Coproducts

To build a critical materials industry in Appalachia, developers and their investors will need to see the industry as a safer bet than they do today. One challenge is that the sheer scale (and therefore costs) of many projects is so high that it is a barrier to many potential funders. One way to address this would be through encouraging the consistent development of coproducts, effectively converting byproducts to coproducts and maximizing the potential for revenue. Also, by minimizing the total waste footprint, disposal costs would be reduced. This would require developing at-scale technologies that are flexible enough to support multiple products, and thereby mitigating some production and pricing risks. Additionally, scale will be a challenge, as off-takers will want to deal with larger volumes given the quality and certification requirements, so opportunities for small producers to join with large processors will need to be explored.

5. Market Risk and Demand-support

Given the potential for global suppliers to flood the market and drive down the price of critical minerals and materials and the challenges of price discovery on many rare earths, the initial producers of domestic unconventional critical materials need policies that support certainty in price and volume until the industry has sufficient scale and technology development. Supports could include strategic domestic reserve (would support domestic industry and insulate our economy from global uncertainty), government purchasing programs, and tax incentives for American-made, among others. Government can lead by actively engaging with the market, effectively absorbing the security premium as these markets develop, and creating domestic critical material content requirements.

6. Development approaches

The history and geology of the Appalachian region has resulted in a diverse, dense, and broad map of opportunities in terms of secondary resources, making the choice of approach complex. Whereas a 'hub and spoke' model that moves various volumes of material to a central processing site has been successfully applied in other sectors, concerns were raised that a 'build it and they will come' model had its own suite of risks. Other models were also explored, such as creating portable processing technology that can be relocated as needed or establishing point-source processing where there is a sufficient concentration of material at a single site.