Questions for the Record

Examining the Methodology and Structure of the U.S. Geological Survey's Critical Minerals List | Subcommittee on Energy and Mineral Resources, House Natural Resources Committee

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Thank you for the followup questions for the record, Member Grijalva, and thank you to the committee for your attention. I have reposted these four questions in bold below, with each followed by my answers.

1. Is recycling critical minerals a net energy loser or winner? In other words, does it take more energy to mine a critical material and turn it into a product or to recycle a critical material for the same product? Are there environmental benefits of using recycled materials, and can you share any examples?

Recycling metals to recover critical minerals is nearly always a net energy winner. It takes far less energy to recover metals from recycled electronic and electrical equipment waste than the energy required to liberate metals from ores and brines. Some metals that have very high rates of recycling because it is not only energy saving, but it is highly economic. This is because some waste materials have very high concentrations of metals, much higher than one can find in ores, brines, or other natural resources.

The exception to this rule is when metals are used dissipatively, in lower concentrations than found in ores. Steel for example uses very low quantities of tellurium and aluminum and recovering such low concentrations requires correspondingly more energy. This is what I emphasized in my original testimony innovations in materials science to replace materials used dissipatively which if substituted can be found can augment critical minerals supplies. Some screenings of critical metals have found that most have dissipative use rates over 50%, which is consistently much higher than other metals. But to the main question, there is extensive research documenting the high energy savings associated with recovering and recycling metals. Recycling and other waste recovery efforts help bring a life cycle approach to the critical minerals challenge.

Many end-of-life items that are recycled at high rates include automobiles, where steel where over 90% of steel is recovered and made into new steel. A report from McKinsey suggests that a battery made of recycled metals has four times fewer energy requirements than a battery made from virgin natural resources (McKinsey 2023). Another example is aluminum, which is also recycled at high rates because of relatively low energy requirements than recovery of bauxite. Recycling these metals can result in the avoidance of up to 90% of the energy used to produce

these material from natural resources. The reason these materials go uncollected is the lack of rules and regulations that require their recovery and collection. According to a 2022 GAO report, “DOE officials stated that most critical minerals, such as rare earth elements (REE), are not collected for recycling on a large scale, in part because of variations in recycling programs” (p 16, GAO 2022). “Moreover, according to an EPA report, U.S. recyclable collection infrastructure is outdated.” (p. 17, GAO, 2022).

2. Could you expand upon the social and economic benefits of developing circular economy approaches to critical minerals supply chain risks?

The social and economic benefits of developing a circular economy for critical minerals supplies are manyfold. Critical area that would benefit from expanded recycling and collection systems for materials include job creation, infrastructure investments, and workforce development. Developing a value chain for various critical metals here in the United States can help buffer supplies that might be vulnerable to disruption. Developing leadership in this space could result in valuable industry as the value of battery recycling alone is poised to be over $95 billion per year by 2040 (McKinsey 2023).

3. Please expand on the community and environmental benefits of reforming the 1872 mining law to build a sustainable domestic supply chain for critical minerals and materials?

The interagency working group report on Responsible Mining on Public Lands identified over sixty actions that can help create better predictability for environmental groups, Tribes, and mining companies. Reforming the 1872 mining law according the report and other experts suggest that community benefits from these reforms come in a variety of forms including more certainty, accountability, and stakeholder perspectives that result in better project outcomes.

4. Can you expand on how water supplies, endangered species, cultural heritage, and Tribal consultation should factor into mine permitting?

Water supplies particularly across the American West’s public lands system are critical to thriving communities and ecosystems. Given the extensive legacy contamination of water it is critical that new mine permitting processes take water concerns seriously and ensure that there are revenues set aside to clean up potential groundwater contamination during operations through mine closure and reclamation. Ongoing regional droughts across the west mean that its important to ensure that groundwater and surface waters are not over drafted for mining activities.

Tribal consultation is often described as failing Tribes. It is important that Tribes are consider more than merely stakeholders or members of the public but as sovereign nations with important expertise on cultural resources. We need to collectively do more to center Tribal voices in mining permitting decisions because often these perspectives are in strong alignment with sustainable land use stewardship and protecting cultural heritage and endangered species.

References

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