



To: House Committee on Natural Resources Republican Members
From: Michael S. Moats, Ph.D.
Date: May 18, 2021
Subject: Outline of Verbal Remarks Entitled “**Where Have the Smelters Gone? Reversing America’s Decline in Non-Ferrous and Critical Metal Production**” Presented at Republican Forum titled “Critical Minerals: Addressing Supply Chain Challenges and Rising Demand”

Dear Republican Members of the House Committee on Natural Resources:

Due to the short duration between my invitation and the forum, I am providing an outline summary of my verbal remarks. I will happy to provide the committee or a subset of the committee more details on any of the points raised in my remarks.

Sincerely,

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Outline of Verbal Remarks - “Where Have the Smelters Gone? Reversing America’s Decline in Non-Ferrous and Critical Metal Production”

- Decarbonizing our energy systems will increase the need for metal production by two to six times per kilowatt of energy production
 - These metals are not all critical minerals
 - Critical minerals are not only rare earth elements
 - Federal focus on one supply chain has led to an over concentration of resources to address only one group of elements
 - Many critical minerals/materials are by-products of the processing of larger tonnage metals (aluminum, copper, lead, zinc)
 - Control of the larger non-ferrous production leads to control of critical elements such as tellurium, gallium, indium, bismuth, and germanium
 - These five elements are highly critical for energy, electronics, and defense applications
 - Not all critical minerals are critical due to their need for the energy transition

- Smelters and refineries, not mines, produce metals necessary for solar and wind generation along with critical metal by-products
 - Many discussions have been focused on finding new deposits and developing new mines to produce critical elements domestically
 - Largely, mines produce mineral concentrates and not metals
 - Smelters and refineries produce metals
 - Over the past 25 years, the number of primary U.S. non-ferrous refineries has shrunk dramatically (all data from USGS Commodity Summaries)
 - U.S aluminum smelters decreased from 22 to seven
 - China increased production by twenty-fold
 - U.S copper refineries decreased from seven to two
 - China increased production by six-fold
 - U.S. zinc refineries decreased from three to one
 - China increased production by 50%
 - U.S. lead smelters decreased from three to zero
 - China increased production by twelve-fold
 - Europe and Japan have to generally maintain their production of refined metals
 - Why has the U.S. declined – perhaps location and policy?
 - Even if new mines open to produce mineral concentrates, the United States will still struggle to produce critical metals because it does not have enough capacity to produce refined metals for its needs
 - This includes nickel and cobalt production needed for lithium ion batteries
- Policymakers should consider how to encourage domestic non-ferrous metal and critical element by-product production using domestic and international mineral concentrates
 - A “Strategic Metals Act” should be considered similar to the “Orphan Drug Act” to provide incentives for domestic production of small tonnage critical elements such as tellurium, gallium, indium, bismuth, and germanium from domestic and imported feedstocks
 - Similar to government support of beryllium production
 - Provide financing for partial ownership of foreign mines with the requirement to on-shore concentrates to feed new smelters (similar to the practices of Japanese and Korean companies and government)
 - Facilitate off-take agreements between metal producers and “green energy” companies to provide capital for domestic production of non-ferrous and critical metal by-products

- Domestic workforce supply to produce non-ferrous and critical metals will be important sustain and grow domestic metal production
 - Due to lack of investment and low enrollments, many U.S. universities no longer offer degrees in mining and metallurgical engineering
 - 11 ABET accredited mining engineering programs
 - 8 ABET accredited metallurgical engineering programs
 - Central South University in China alone has 60 full professors in metallurgy and environment with more assoc. and asst. professors
 - Policymakers should signal to University presidents the criticality of these remaining programs through targeted research funding opportunities
 - The federal government could create a mining/metallurgy innovation center to foster research and enhance faculty and student interest in non-ferrous and critical metal production
 - Chinese universities dominate the published research in non-ferrous and critical metal production
 - One metallurgy institute at Central South University trains 30 PhD each year