Climate Change and Disruption Risk to Critical Material Supply Chains: A Neodymium Magnet Case Study

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Background/Objectives. As we move to address the climate crisis, advances in clean energy technologies are essential to mitigate future climate change. The transition to these technologies also offers peril as the world races to develop and deploy these emerging technologies. Countries will compete to control resources and dominate new technologies needed for the clean energy transition. The clean energy transition will require economic mobilization on a scale not seen since the industrial revolution and will strain the global production of critical materials, with rare earth elements (REE) playing an especially important role for clean energy technologies such electric motors and turbines. Climate change and extreme weather can also disrupt these important supply chains and the United States Government will seek to onshore these critical supply chains.

Neodymium is a critical material for many commercial products, including the magnets needed in electric vehicle motors and wind power turbines. As demand increases for these technologies, it is likely the United States Government will seek to onshore this or similar supply chains. This supply chain is water intensive, often located in arid regions, and there are risks to onshoring to meet future demand. A climate lens is necessary to understand potential for future supply disruption.

Approach/Activities. A supply chain model was developed to understand the United States' neodymium magnet supply chain that accounts for water scarcity in the mining, refining, and production stages of neodymium magnets. The model combines open source and proprietary data sources on materials flows, individual supply nodes, flows of resources and emissions, and geography of modeled elements. Increases in demand, anticipated climate changes to water availability, and the global nature of this supply chain were included.

Results/Lessons Learned. The team learned that planned locations for onshoring of this supply chain present the risk of unsustainable water consumption. In order to address, development of advanced manufacturing technology is needed, which implies increased cost to onshore. If a climate lens is not used to assess this developing supply chain, policy makers may underestimate the challenges associated with the United States producing this critical technology domestically. Also, the adaptable cradle-to-grave modeling process used in this case study can be adapted to other critical supply chains.

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