TESTIMONY BEFORE THE

SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES
COMMITTEE ON NATURAL RESOURCES
U.S. HOUSE OF REPRESENTATIVES

AMERICAN METALS AND MINERAL SECURITY: AN EXAMINATION OF THE DOMESTIC CRITICAL MINERALS SUPPLY AND DEMAND CHAIN

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Introduction

Chairman Lamborn, Ranking Member Holt, and members of the Subcommittee, it is a privilege to share with you some of General Electric's experiences in securing materials critical to our manufacturing operations, and our thoughts on ways the Federal government can help strengthen the entire supply chain of strategic and critical minerals to promote America's economic well-being, national security, and global economic competitiveness.

Background

GE is an advanced technology, services, and finance company taking on the world's toughest challenges. Operating in more than 100 countries with more than 300,000 employees, we are driving advanced technology and product solutions in key industries such as energy, water, transportation, aviation, and healthcare providing a cleaner, more sustainable future for our nation and the world.

At the core of every GE product are the materials that make up that product. To put GE's material usage in perspective, we spend $40 billion annually on materials. 10% of this is for the direct purchase of metals and alloys. GE products incorporate at least 75 of the first 83 elements listed in the Periodic Table of Elements. Rare earth elements, which have attracted attention in the news, can be found in GE products for energy efficient fluorescent lighting, permanent magnets for generators in our most advanced industrial motors, advanced medical imaging technologies, compressor motors for our Oil and Gas business, and in coatings for aircraft engines and power generation turbines.

Because materials are so fundamental to everything we do as a company, we are constantly watching, evaluating, and anticipating supply changes with respect to materials that are vital to GE's business interests. On the proactive side, we invest a great deal of time and resources to develop new materials and processes that help reduce our dependence on any given material and increase our flexibility in product design choices.

We have more than 45,000 scientists and engineers working for GE in the US and around the globe, with extensive expertise in materials development, system design, and manufacturing.

As a Senior Engineer in the Manufacturing and Materials Technology team at GE Global Research, one of my jobs is to understand the latest trends in materials and to help identify and support new R&D projects with our businesses to manage our materials needs in a sustainable way.

Without development of new supplies and more focused research in materials and manufacturing, such supply challenges could seriously undermine efforts to meet the nation's future needs in energy, healthcare, and transportation. We believe GE's experience in addressing its material needs can inform the Federal government's efforts to develop a clear and comprehensive national policy to assure domestic availability of minerals essential for national economic well-being, national security, and global economic competitiveness.

GE's Approach to Addressing Material Risks

GE uses a two-step process to identify and respond to material risks. The first step is an evaluation of our operations to determine which material supply chains have the highest risk of disruption. The process GE uses is a modification of an assessment tool introduced by the National Research Council in 2008. Our analysis considers elements used in GE operations. Each element is assigned scores in two categories: "Price and Supply Risk" and "Impact of a Restricted Supply on GE." Elements that score high in both categories are identified as materials needing further study and a detailed plan to mitigate supply risks.

In assigning a "Supply Risk" score, it is important to recognize a disruption can occur anywhere in the supply chain. This includes physical shortages due to inadequate mine supply, economic considerations such as co-production, geopolitical factors that could restrict the movement of material, bottlenecks in the processing of intermediate forms of the material, and changes in demand due to the introduction of new products. These factors are taken into account in our sourcing decisions, which helps illustrate why such decisions are so complex. At GE, we assign a composite score that takes into account each of these factors. An "Impact" score is assigned based on our volume of usage compared to the world supply, criticality to products, options for substitution, and revenue from products containing the element. It is important to note that the "Supply Risk" and "Impact" scores are based on data from a particular point in time. These scores can and do change in response to market dynamics, government policy, and technology development.

Once an element is identified as high risk, a comprehensive strategy is developed to reduce this risk. Such a strategy can include improvements in the supply chain, improvements in manufacturing efficiency, as well as research and development into new materials and recycling opportunities. In layman's terms, these options can be thought of as "looking for more material", "using what we have more effectively," and "developing alternatives." Often, a combination of several of these approaches, which may have different and complementary time horizons, may need to be implemented.

Improvements in the supply chain can involve the development of alternate sources, including the support of new mines. In this regard, efforts to streamline the process of opening new mines are an important step towards diversifying and securing supply. The development of domestic resources has the dual benefits of increasing supply, as well as improving the security of the

supply. Manufacturers can also develop long-term supply agreements that provide suppliers with a better understanding of our future needs.

Manufacturers also have the option of improving the efficiency of their operations. In cases where a manufacturing process was designed during a time when the availability of a raw material was not a concern, alternate processes can be developed and implemented that greatly improve its material utilization. An example of this is the development of near-net-shape manufacturing technologies that produce parts and products by maximizing material utilization. Another solution is the recycling of end-of-life products and optimizing product design to enable such recycling. This, along with the development of recycling technology for the re-use of manufacturing scrap can generate an important source of raw materials. Currently, commodity elements such as Aluminum and Copper are extensively recycled. Over the past few years, GE has taken steps to extend this to critical materials such as Rhenium, an element used in super alloys for high efficiency aircraft engines and electricity generating turbines.

In the long run, technology development can either greatly reduce the use of an at-risk element or eliminate the need for the element altogether. While there are cases where the properties imparted by the element are uniquely suitable to a particular application, I can think of multiple examples where GE has been able to invent alternate materials, use already existing alternatives to significantly reduce our risk, or develop new system designs that reduce or eliminate the need for a particular material.

Pursuing this path is not easy and presents significant challenges that need to be addressed. The materials development and certification process takes several years. For this reason, having nearer term sourcing and manufacturing solutions is critical in order to "buy time" for the longer-term solutions to come to fruition. In addition, such material development projects tend to be higher risk and require risk mitigation strategies and parallel paths. The Federal Government is already enabling public-private collaborations that provide both the materials understanding and the resources to attempt higher risk approaches through efforts such as the Department of Energy's Critical Materials Institute (CMI). GE participates as an industry partner in the CMI working with national labs, universities, and other companies to reduce the use of rare earth elements in permanent magnets and lighting, as part of a holistic strategy to address strategic and critical materials risk in domestic supply chains related to the energy sector.

Recommendations

Based on our past experience I would like to emphasize the following aspects that are important to consider when thinking about strengthening strategic and critical mineral supply chains:

1) Early identification of the issue – technical development of a complete solution can be hampered by not having the time required to develop some of the longer-term solutions, including the opening of new mines.
2) Vulnerabilities can exist at any part of the supply chain – while it is natural and appropriate to start with the supply or raw mineral ores, it is also important to pay attention to other links in the supply chain that could be vulnerable to disruption.
3) Each element is different and some problems are easier to solve than others – typically a unique solution will be needed for each element and each use of that element. While basic understanding provides a foundation from which solutions can be developed, it is

important that each solution be compatible with real life manufacturing and system design. A specific elemental restriction can be easier to solve if it involves few applications and has a greater flexibility of supply. Future raw materials issues will likely have increased complexity as they become based on global shortages of minerals that are more broadly used throughout society.

Given increasing challenges around the sustainability of materials, it will be critical for the Federal government to maintain continued vigilance towards all links in the supply chain of strategic and critical minerals. Based on the discussion above, we appreciate efforts made to date to identify and address bottlenecks in the process for developing domestic resources. We also applaud the government's support of collaborative efforts between academia, government laboratories, and industry to ensure that manufacturing compatible solutions are available in time to avert disruptions in US manufacturing.

Comments on H.R.761

Based on the above discussion, it is clear that increased options in the raw materials supply chain will be favored by manufacturers. GE believes legislation to promote the responsible removal of roadblocks to mineral exploration and development in the United States is an important step in this direction. While it is important to reduce delays in the mine permitting process, GE also believes that any changes made must not weaken existing environmental protections. Encouraging the development of domestic stocks of strategic and critical minerals is, along with parallel efforts that strengthen the entire supply chain, a necessary element of a coherent national policy to promote national economic well-being, national security, and global economic competitiveness.

Conclusion

In closing, we believe that the efforts to promote the development of domestic stocks of strategic and critical minerals are an important part of a comprehensive approach that will provide businesses with more flexibility and make us less vulnerable to material shortages. Chairman Lamborn and members of the subcommittee, thank you for your time and the opportunity to provide our comments and recommendations.

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