S. 1600, THE CRITICAL MINERALS POLICY ACT OF 2013

Statement of

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Before the

Committee on Energy and Natural Resources
U.S. Senate

January 28, 2014

Good morning, Mr. Chairman, members of the Committee, ladies and gentlemen. My name is Rod Eggert. I am a professor of economics and business at Colorado School of Mines, as well as deputy director of the Critical Materials Institute, an energy innovation hub of the U.S. Department of Energy. My area of expertise is the economics of mineral resources. In addition to my current activities related to critical minerals and materials, several years ago I participated in two review panels relevant for today's hearing. I chaired the committee of the U.S. National Research Council that prepared the 2008 report *Minerals, Critical Minerals, and the U.S. Economy*. I served as a member of the committee of the American Physical Society and the Materials Research Society that prepared the 2011 report *Energy Critical Elements: Securing Materials for Emerging Technologies*. I also testified previously on critical minerals and materials before a Subcommittee of this Committee (2010), a House Committee (2011), and a committee of the European Parliament (2011).

I organize my remarks into three sections. First, I describe the context for current concerns about critical minerals. Second, I present my views on appropriate roles for government in light of these concerns, which reflect my previous testimony and published papers. Third, I comment on S. 1600 itself.

<u>Context</u>

Mineral-based materials and products are becoming increasingly complex. Early cell phones in the 1980s consisted of materials that used approximately 30 elements from the periodic table; today's smart phones contain 60-70 mineral-derived elements. General

Electric uses more than 70 of the first 83 elements of the periodic table in its products or processes used to make these products. In contrast, as recently as three decades ago, a typical household owned products containing perhaps only 30 or so of these elements.

New technologies and engineered materials create the potential for rapid increases in demand for some elements used previously and even now in small quantities. The most prominent—although by no means only—examples are neodymium and dysprosium in permanent magnets for electronics and high-efficiency motors; europium, terbium and yttrium in advanced lighting systems; lithium in batteries; and gallium, indium, and tellurium in thin-film photovoltaic materials.

These technological developments raise two concerns. The first is that supply will not keep up with demand growth due to the time lags involved in bringing new production capacity online or more fundamentally the basic geologic scarcity of certain elements. The second concern is that supply is insecure or risky because of fragile supply chains. The causes of fragility are several and vary from case to case: industry concentration; reliance on imports from politically risky countries, some of which impose export restrictions on primary raw materials; and reliance on by-product production. In both cases, mineral availability—or more precisely, unavailability—is a potential constraint on the development and deployment of emerging and important technologies, especially in the energy, electronics, transportation and defense sectors.

Roles for Government[1]

As an economist, I believe in the power and effectiveness of markets. Markets provide strong incentives for private investments that re-invigorate supply and reduce supply risks. Markets encourage users of critical materials to obtain "insurance": for example, in the short term, users can maintain stockpiles, diversify sources of supply, develop joint-sharing arrangements with other users, or develop tighter relations with producers. Over the longer term, users can undertake research and development to develop alternative materials that use less of, or no, elements subject to significant supply risks. Scarcity and supply risk encourage investments in mineral exploration and mine development (potentially funded by users seeking secure supplies), improved manufacturing efficiency, and recycling of manufacturing wastes and end-of-life products.

But markets are not panaceas. Government plays essential roles in facilitating market activities. For mineral resources, government can play four important roles that facilitate well-functioning markets and help ensure reliability of material supplies in the short term and availability of mineral resources in the long term:

1. *Encourage undistorted international trade*. The governments of raw-material-importing nations should fight policies of exporting countries that restrict raw-material exports to the detriment of users of these materials. The U.S., European,

[1] See Eggert (2010) and Eggert (2011), as well as two expert-panel reports in which I participated (APS/MRS 2011, NRC 2008). My testimony today overlaps considerably with views I expressed in previous testimony before (a) the Subcommittee on Energy, Committee on Energy and Natural Resources, September 30, 2010, (b) the Committee on Industry, Research, and Energy of the European Parliament, January 26, 2011, and (c) the Subcommittee on Energy and Mineral Resources, Committee on Natural Resources, U.S. House of Representatives, May 24, 2011.

and Japanese filings with the World Trade Organization against China and its restrictions on rare-earth, molybdenum, and tungsten exports are examples.

2. *Improve regulatory-approval processes for domestic resource development*. Foreign sources of supply are not necessarily more risky than domestic sources. But when foreign sources are risky, domestic production can help offset the risks associated with unreliable foreign supplies. Developing a new mine in the United States appropriately requires an approval process that allows for public participation and consideration of the potential environmental and social effects of proposed mining. This process is costly and time consuming—arguably excessively so, not just for mines but for developments in all sectors of the economy. I do not suggest that mines receive preferential treatment, rather that attention be focused on developing better ways to assess and make decisions about the various commercial, environmental, and social considerations of project development.
3. *Facilitate provision of information and analysis*. I support enhancing the types of data and information the federal government collects, disseminates and analyzes. Sound decision-making requires good information. Government plays an important role in ensuring that sufficient information exists. The Department of Commerce and Department of Labor collect and publish information on the state of the national economy that informs public and private decision making, as does the Energy Information Administration in the realm of energy. With respect to mineral resources and material supply chains, I recommend (a) enhanced focus on those parts of the mineral and material life cycle that are under-represented at

present including reserves and subeconomic resources, by-product and co-product primary production, stocks and flows of materials available for recycling, in-use stocks, material flows, and materials embedded in internationally traded goods and (b) periodic analysis of mineral criticality over a range of minerals. At present, the markets for most critical minerals are less-than-completely transparent, in large part because the markets are small and often involve a relatively small number of producers and users, many of which find it to their competitive advantage to keep information confidential.

4. *Facilitate research and education*. I recommend that the federal government develop and fund pre-commercial activities that are likely to be underfunded by the private sector acting alone because the benefits of these activities are diffuse, difficult to capture (easy to copy), risky, and far in the future. Over the longer term, science and technology are keys to responding to concerns about the adequacy and reliability of mineral resources and mineral-based materials, to improving our ability to recycle essential yet scarce elements, and to developing alternatives to these elements.

   Education and research go hand in hand. Educational programs, especially those at the graduate level, educate and train the next generation of scientists and engineers, who in the future will respond to concerns about newly emerging critical minerals. Education and research in the geosciences, mining, mineral processing and extractive metallurgy, environmental science and engineering, manufacturing, and recycling can mitigate supply risks and increase material availability. Improvements in materials design—fostered by education and research in materials science and engineering—can ease the pressures imposed by those elements and materials subject to supply risks or limited availability. Government, in addition to simply funding education and research, can play an important role in facilitating collaborations among universities, government research laboratories, and industry.

These views on appropriate roles for government are not mine alone. A common conclusion of essentially all recent studies on critical minerals and materials is to urge governments to improve and expand activities related to information and analysis, education, and research (for example, APS/MRS 2011, European Commission 2010, NRC 2008).

<u>S. 1600, The Critical Minerals Policy Act of 2013</u>

My views above form the conceptual lens through which I consider S. 1600, the Critical Minerals Policy Act of 2013. My specific comments:

1. <u>Overall</u>: S. 1600 covers three of the four areas I discuss above. The fourth area, promoting undistorted international trade in mineral resources and materials, is outside this Committee's purview.
2. <u>Section 101 Designations</u>: This section is consistent with my third role for government. I support efforts to identify minerals that are most critical in the sense that they are both (a) subject to potential supply restrictions and (b) important in use. NRC (2008) recommends this sort of evaluation and periodic

re-evaluation. Japan and the European Union already carry out this type of evaluation from the perspective of the Japanese and European economies (see European Commission 2010). Periodic re-evaluation is essential, as what is "critical" changes over time as materials, products, and market conditions evolve and change.

3. <u>Section 102 Policy</u>: The amendments to the National Materials and Minerals Policy, Research and Development Act of 1980 are appropriate and consistent with my views on the role of government.
4. <u>Section 103 Resource Assessment, Section 108 Analysis and Forecasting</u>: These sections represent actions that are important parts of information and analysis, my third role for government.
5. <u>Section 104 Study, Section 105 Agency Review and Reports</u>: The actions these sections require would be an important start to improving the efficiency of the process of regulatory approval for domestic mineral development (my second area of government action).
6. <u>Section 106 Recycling, Efficiency and Supply, Section 107 Alternatives</u>: These sections are consistent with my fourth role of government. They would require the Secretary of Energy to conduct programs of research and development. The Department of Energy already funds programs in the areas identified in Section 106 and 107. Passage of S. 1600 would provide greater justification for, and allow for possible expansion of, these activities.
7. <u>Section 109 Education and Workforce</u>: This section is consistent with my fourth role of government in the area of critical minerals. Over the last several decades,

the Unites States has lost a significant amount of its intellectual infrastructure in the area of mineral resources.

8. Section 110 International Cooperation: Although international cooperation is not part of my conceptual framework for government involvement in critical minerals, I support it. The United States is not the only nation facing supply-chain risks for mineral resources and downstream materials. No nation can expect to be, nor should strive to be, self-sufficient. Japan, the European Union, and several individual European countries, in particular, have ongoing activities in this area. There is much to learn from their efforts, and we have a responsibility to work together with our allies on mutually beneficial activities that help ensure supply chains of critical raw materials.

Thank you for the opportunity to testify today. I would be happy to address any questions the Committee members have.

References

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