Green Technology Depends on Metals with Weird Names

A supply of clean, affordable energy depends on little-known substances

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Image: *Ross MacDonald*

There's one problem with the silicon age: its magic depends on elements that are far scarcer than beach sand. Some aren't merely in limited supply: many people have never even heard of them. And yet those elements have become essential to the green economy. Alien-sounding elements such as yttrium, neodymium, europium, terbium and dysprosium are key components of energy-saving lights, powerful permanent magnets and other technologies. And then there are gallium, indium and tellurium, which create the thin-film photovoltaics needed in solar panels. The U.S. Department of Energy now counts those first five elements as “critical materials” crucial to new technology but whose supply is at risk of disruption. The department's experts are closely monitoring global production of the last three and likewise the lithium that provides batteries for pocket flashlights and hybrid cars.

Earlier this year the DoE took a major step by launching the Critical Materials Institute, a $120-million program to avert a supply shortage. Led by the Ames Laboratory in Iowa, with backing from 17 other government laboratories, universities and industry partners, the institute represents a welcome investment in new research. Unfortunately—like the

original Manhattan Project—the program is driven more by the threat of international conflict than by ideals of scientific cooperation. The appropriation made it through Congress almost certainly because of legislators' fear of China's dominance in many critical elements and Bolivia's ambition to become “the Saudi Arabia of lithium.”

The worries are probably inevitable. China—historically a prickly partner at best to the U.S.—effectively has much of the world's critical-materials market at its mercy. Take the rare earth elements neodymium, europium, terbium and dysprosium. Despite their name, rare earths are many times more common than gold or platinum and can be found in deposits around the world. In recent years, however, cheap labor and lax environmental regulation have enabled China to corner the global market, mining and refining well over 90 percent of rare earths.

At the same time, China has consistently fallen short of its own production quotas. In 2012 the U.S., the European Union and Japan, suspecting China was manipulating the market, filed a formal complaint with the World Trade Organization (WTO). China argues that production cutbacks were necessary for environmental cleanup. At press time, a preliminary ruling in October 2013 against China will likely be appealed. Meanwhile Japan has announced discovery of vast undersea deposits of rare earths, and the Americans, among others, are working to restart their own disused facilities. The shortages won't last.

Bolivia's lithium is a different story. The impoverished, landlocked country needs no artificial shortages to boost the market. As the lightest metal, lithium has unmatched ability to form compounds that can store electricity in a minimal weight and volume. At least half the world's known reserves are located in a relatively small stretch of the Andes Mountains, where Bolivia and Argentina share a border with Chile.

There's more at stake here than fancy gadgets for the rich. The point of critical materials is to use energy more efficiently. One fifth of the world still lives without access to clean, affordable electricity, a problem that unimpeded supplies of rare earths and lithium could eventually remedy. The hard part will be to prevent old international feuds from getting in the way of that goal. The U.S. can help by embracing the spirit of international development and cooperation. A start could be with the U.S. National Science Foundation, which already maintains an active office in Beijing. We need more such

channels to encourage collaborative research on rare earths. Similarly, the strained relations between Washington and La Paz could benefit from signs of sincere U.S. willingness to assist Bolivia in developing the Uyuni salt flats, where a pilot processing plant began operating early in 2013.

Similar modest gestures could bring the world closer to a full-scale treaty on global mineral-supply security. A foundation of sorts has already been laid by efforts such as the Minamata Convention on Mercury, the recently adopted international pact to reduce emissions and use of the toxic metal. Humanity's health and prosperity depend on the wise harnessing of natural resources. Narrow national interests and rivalries can only obstruct that process, ultimately leaving us all just that much poorer. The need for critical materials should catalyze international cooperation. After all, those materials can enlighten the world—literally.

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