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# **Energy-Critical Elements: The Market is Working**

**Testimony before  
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**Derek Scissors, Ph.D.  
Research Fellow, Asian Studies Center  
The Heritage Foundation**

My name is Derek Scissors. I am Asia economics research fellow at The Heritage Foundation. The views I express in this testimony are my own, and should not be construed as representing any official position of The Heritage Foundation.

## **Energy-Critical Elements: The Market Is Working**

Derek Scissors, Ph.D.

It may have seemed as if the prices of rare earth elements could only rise, but they have recently dropped quite a bit. The drop—and what is behind it—is an excellent reminder of why governments should not use price fluctuations as a reason to intervene in energy markets.

High prices should not be used as a reason to endorse certain materials or existing firms through subsidies. Nor should the government skew technological development by favoring particular research paths. These actions are self-defeating and will lead to an uncompetitive industry, where market forces are already creating more competition and technological dynamism.

In rare earths, and in the wider category of energy-critical elements, the first role of government is to provide vital information that private actors cannot gather. Second, opening more federal land to evaluation, and possibly exploration, should be considered. Third, basic research, only, should be conducted under certain conditions.

## **Price Declines**

Rare earth elements (REEs) are a group of 17 elements currently valuable in energy and military equipment. Energy-critical elements (ECEs) are a larger group, classified on the basis of their present uses, that include rare earths but also other elements.<sup>1</sup> REEs receive more attention but, where possible, it is more informative to assess ECEs.

REEs gained global attention when prices began to rise in 2009, a trend that continued into 2011. During this two-year period, a debate began between those calling for the U.S. government to ensure supply and those arguing that both market supply and market demand should be allowed to work unimpeded.<sup>2</sup>

Recent evidence favors those who prefer market forces, as old and new players have responded and driven prices down. Contemporary adjustment has been driven primarily by changes in demand. Higher prices led to demand destruction, as always. Some of this demand weakness is due to conservation, in particular new recycling processes from Hitachi's narrow focus on magnets to Umicore's broad-spectrum efforts. Another effect of higher prices is to cause substitution of other elements (for example, in powering batteries).<sup>3</sup>

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<sup>1</sup> American Physical Society Panel on Public Affairs and The Materials Research Society, "Energy Critical Elements: Securing Materials for Emerging Technologies," February 2011, at <http://www.aps.org/policy/reports/popa-reports/upload/elementsreport.pdf> (December 2, 2011).

<sup>2</sup> Derek Scissors, "Rare Earths: Cause for Worry, not Panic," Heritage Foundation *The Foundry*, October 6, 2010, at <http://blog.heritage.org/2010/10/06/rare-earths-cause-for-worry-not-panic/> (December 2, 2011).

<sup>3</sup> David Fickling, "Lynas Shares Rise as Price Fall Brings Surety to Customers," Dow Jones Newswires, November 30, 2011, at <http://www.theaustralian.com.au/business/mining-energy/lynas-shares-rise-as-price-fall-brings-surety-to-customers/story-e6frg9df-1226209983105> (December 2, 2011) and Frik Els, "Price of Abundant Rare Earths

On the supply side, higher prices have encouraged new producers to enter the market and existing suppliers to expand. In the U.S. and elsewhere, new firms have been created, existing ECE firms have mushroomed in size, and new deposits have been discovered, as one would expect with the greater incentive to explore.<sup>4</sup> The market response has progressed to the point where transnational alliances have been struck between established consumers and nascent producers, as in Molycorp's agreement in late November with Japan's Daido Steel and Mitsubishi.<sup>5</sup>

It is not that a great deal of new physical supply has become available; that process has only started. In the same way, inadequate supply actually caused only some of the prior price explosion. Prices have been moving in large part in response to anticipation of future shortages, previously skyrocketing in anticipation of durable future shortage but correcting as the shortfall now seems less acute.

Falling prices are the inevitable result of the demand destruction and new incentives in supply. By August, the prices of all REEs had begun to drop,<sup>6</sup> a decline that has persisted through the end of November and brought costs down about one-third from their peak. This should have been no surprise: If permitted, markets naturally correct.

Beyond the general downward trend, snapshots of the market are not very informative. Not only have REE prices been changing rapidly, but trading in some elements is not sufficiently developed to generate reliable estimates. Among those that are more heavily traded, Cerium has dropped over 40 percent in the past three months, while the decline for Samarium started later and has been smaller through the end of November.<sup>7</sup> This variation is natural due to differing supply (some REEs are not actually rare) and differing demand, especially between heavy and light elements.

The trend of broadly declining prices will continue until further supply expansion, recycling, conservation, and substitution are no longer commercially appealing. When that happens is less

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Could Halve as Hybrid Makers Find Alternatives," Mining.com, September 29, 2011, at <http://www.mining.com/2011/09/29/price-of-abundant-rare-earths-could-halve-as-hybrid-makers-find-alternatives/> (December 2, 2011).

<sup>4</sup> "Lynas Raises 170m in Capital Raising," Associated Press, October 28, 2009, at <http://metalsplace.com/news/articles/30854/lynas-raises-170m-in-capital-raising/> (October 31, 2011); Press release, "USMMA Welcomes New Member Companies Texas Rare Earth Resources and Stans Energy," Business Wire, July 19, 2001, at <http://www.businesswire.com/news/home/20110719006647/en/USMMA-Welcomes-Member-Companies-Texas-Rare-Earth> (October 31, 2011); and Daniel Grushkin, "Alaska's Billion Dollar Mountain," *Bloomberg Businessweek*, October 27, 2011, at <http://www.businessweek.com/magazine/alaskas-billion-dollar-mountain-10272011.html> (October 31, 2011).

<sup>5</sup> Dorothy Kosich, "Molycorp, Daido, Mitsubishi Form Next Generation Rare Earth Magnets JV," Mineweb, November 29, 2011, at <http://www.mineweb.com/mineweb/view/mineweb/en/page72102?oid=140588&sn=Detail&pid=102055> (December 2, 2011).

<sup>6</sup> Yu Xi, "Prices of Rare-earth Metals Drop in July," *Global Times*, July 7, 2011, at <http://www.globaltimes.cn/NEWS/tabid/99/ID/665156/Prices-of-rare-earth-metals-drop-in-July.aspx> (October 31, 2011).

<sup>7</sup> "Cerium Metal Prices, News, and Information," Metal-Pages, December 1, 2011, at <http://www.metal-pages.com/metals/cerium/metal-prices-news-information/> (December 2, 2011).

important than the fact that it ultimately *should* happen: ECE prices *should* rise when market forces drive them in that direction. Without scarcity and high prices, responsive research and innovation will not occur and technological stagnation will ensue, perpetuating the very conditions that prompted concerns over ECEs.

### **Are ECEs Different?**

In this way, government intervention is typically self-defeating. It prevents the market from clearing away problems used to justify intervention in the first place (for example, the temporary lack of substitutes for scarce REEs). There are, of course, those who believe the government should act whenever prices are high or low—in natural resources, houses, farm goods, health care, stocks, and so on. The outcome is always that the vast majority end up subsidizing a very small group.

In addition, there are more sophisticated claims that market principles should not apply to ECEs, as they are thought to be exceptional. These claims do not stand up well to scrutiny.

Certain ECEs are important to the U.S. military, but most are not. Further, within the group that is important, some materials have long life cycles and no supply shortage is anticipated.<sup>8</sup> It is misleading to insist that an assured supply of ECEs is vital for national security without demonstrating shortfalls that rely both on known resources and on specific forecasts of military demand. Otherwise, the potential national security importance of a small subset of ECEs will be used to justify much broader, harmful government interference.

The other feature of ECEs, and REEs in particular, often cited to support government action is Chinese supply dominance. This dominance is not important in American trade figures. Raw and refined REEs do not fit seamlessly into existing trade categories, but the U.S. spent at most \$1.4 billion on their import in 2010 (fish imports from China were almost \$2 billion).<sup>9</sup> At that level, the cost of imported REEs cannot be important either in the defense budget or in commercial energy.

In terms of production, China is said to account for more than 90 percent of REEs, though this figure may now be declining. The reason for a possible decline is also a reason for worry: The Chinese government and its state-owned enterprises have consistently behaved in predatory fashion with respect to REEs. The first phase of this behavior was actually sharp reductions in prices that drove competitors out of business.<sup>10</sup> This occurred for most of the past decade and gave China its leading position.

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<sup>8</sup> B. R. Arvidson, “The Many Uses of Rare-Earth Magnetic Separators for Heavy Mineral Sands Processing,” International Heavy Minerals Conference, June 2001, at <http://www.outokumputechnology.com/files/Technology/Documents/Physical%20Separation/Technical%20Papers/ManyusesofREBA.pdf> (October 31, 2011), and Jack Lifton, “Heavy Rare Earths In America, Crystal Balls & Brass Balls,” Technology Metals Research, August 4, 2011, at <http://www.techmetalsresearch.com/2011/08/heavy-rare-earth-in-america-crystal-balls-brass-balls/> (October 31, 2011).

<sup>9</sup> U.S. Census Bureau, “U.S. International Trade Statistics,” at [http://censtats.census.gov/naic3\\_6/naics3\\_6.shtml](http://censtats.census.gov/naic3_6/naics3_6.shtml) (December 2, 2011).

<sup>10</sup> Jack Dini, “China’s Monopoly on Rare Earth Metals,” Canada Free Press, October 30, 2011, at <http://www.canadafreepress.com/index.php/article/41856> (December 2, 2011).

When Beijing stopped undercutting the market, prices rose sharply and the global hunt for alternatives began, which is now bringing prices down. China's response to the ongoing price decline has been to cut supply further.<sup>11</sup> This has reintroduced some fear of shortage but is also a further spur to global market development. Indeed, the PRC has been cutting supply to no avail throughout the period during which prices have been dropping. Chinese production dominance in REEs is unfortunate, but it is also unstable.

The PRC's share of reserves is also unstable. While the viability of deposits varies with market prices, the U.S. Geological Survey claims that China has over one-third of known REE reserves. The share falls when all ECEs are considered and, even for REEs, will fall as exploration continues.<sup>12</sup> As with all other mineral resources when prices rise, there are likely vast sources of ECEs yet to be discovered. If prices remain high, and with them the incentive to explore, the size and distribution of known reserves will change considerably.<sup>13</sup>

An aspect of the functioning of markets that is often omitted in discussing ECEs, therefore, is that Chinese dominance can last only as long as Beijing is willing to sell REEs at below-market prices. Because alternative suppliers can freely enter when prices are high, the market can adjust to any Chinese predation.

Further, REEs will not always be as important as they are seen to be now. The uses of REEs are not timeless; they arose in the 1970s from a private-sector response to unreliable supply of strategic minerals from southern Africa.<sup>14</sup> Nor was the prominence of REEs anticipated: Some environmentalists who opposed Molycorp's mine a decade ago now call for REE subsidies for environmental equipment. China's price cuts actually spurred mass use of REEs and many assume REEs will grow further in importance. But if conditions are reversed so that prices are high and it is REE supply that is unreliable, other ECEs will again arise as substitutes.

## What To Do...

In light of these facts, the House must first decide the extent of any true national interest that might justify government intervention. Examining market developments and the nature of ECEs show no broad national-interest justification right now (although there may be a national interest

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<sup>11</sup> Shivom Seth, "More Rare Earth Companies in China Suspending Production as Prices Slide," Mineweb.com, October 27, 2011, at

<http://www.mineweb.com/mineweb/view/mineweb/en/page72102?oid=138362&sn=Detail&pid=102055> (November 30, 2011), and "Baotou Rare Earth Shares Plunge After Decision to Halt Production," Xinhuanet, October 19, 2011, at [http://news.xinhuanet.com/english2010/china/2011-10/19/c\\_131200285.htm](http://news.xinhuanet.com/english2010/china/2011-10/19/c_131200285.htm) (November 30, 2011).

<sup>12</sup> U.S. Geological Survey, "Mineral Commodity Summaries," January 2011, at

[http://minerals.usgs.gov/minerals/pubs/commodity/rare\\_earth/mcs-2011-rare.pdf](http://minerals.usgs.gov/minerals/pubs/commodity/rare_earth/mcs-2011-rare.pdf) (October 31, 2011).

<sup>13</sup> Geology.com, "REE: Rare Earth Elements and Their Uses," at <http://geology.com/articles/rare-earth-elements/> (March 18, 2011); Abhishek Shah, "Toshiba Leads Japanese Search for Rare Earth in Mongolia, Kazakhstan and Uranium Processing," GreenWorldInvestor.com, November 29, 2010, at <http://greenworldinvestor.com/2010/11/29/toshiba-leads-japanese-search-for-rare-earth-in-mongoliakazakhstan-and-uranium-processing/> (December 2, 2011).

<sup>14</sup> Aaron Sichel, "The Story of Neodymium: Motors, Materials, and the Search for Supply Security," Chorus Motors, Autumn 2008, at [http://www.choruscars.com/Chorus\\_NEO\\_WhitePaper.pdf](http://www.choruscars.com/Chorus_NEO_WhitePaper.pdf) (December 2, 2011).

concerning a small subset of ECEs used by the military). The ensuing question is whether future government intervention might be justified.

In seeking to address this question, the House has multiple options, ranging from research to recycling to retread industrial policy. When the market is working properly, as it is now, the most helpful government policy is to extend the size of the market through deregulation. An obvious way to inhibit Chinese or any other monopoly position in ECEs is for the U.S. to make more of its own resources available. To this end, modifications of federal restrictions on land use should be studied.

A second core government role is information provision. Pursuant to the committee's instruction to testify regarding H.R. 2090, The Energy Critical Advancement Act of 2011, the resolution correctly acts to fulfill this role. One clear government responsibility is to ensure that U.S. military equipment demand is not affected by surprise ECE market shifts, and information relevant to these specific requirements should be compiled on a regular basis.

In energy, the dynamic exploration and production processes in REEs in particular are altering the distribution of American and global production and reserves. This information is very difficult for a private actor to compile and update, making it a government responsibility to do so, one rightly taken up in H.R. 2090. A number of other proposals also do this, offering different mechanisms and different priorities.

Beyond information provision, government can be involved in basic research, as H.R. 2090 indicates. Basic research should be focused on areas of clear government responsibility, and all opportunities to shift work to the private sector should be examined.

### **...And What Not To Do**

In contrast, active interference in a functioning market is self-defeating. Some proposals and actions concerning ECEs pick out seemingly important materials for what is unavoidably long-term action on the basis of short-term conditions. Supporting ECEs in light of current use risks warping research incentives and generating inferior technology. Supporting individual companies risks elevating the inefficient over superior present or future competitors. A combination of weak firms and inflexible technology kills any industry. Picking winners, including technological winners, in a rapidly developing market increases the odds of a losing industry in the future.

A brief description of certain Department of Energy programs that utilize ECEs provides examples of market-distorting practices with no national-interest justification.

- The Advanced Research Projects Agency–Energy (ARPA–E) intends to “bridge the gap between basic energy research and development/industrial innovation.” This is a bridge between work that might help the private sector and work which binds needed private-sector innovation to government initiative. ARPA–E tops its goals with “To bring a

freshness, excitement, and sense of mission to energy research,” straining the notion of national interest.<sup>15</sup>

- The Vehicle Technology Program is “strongly committed to partnerships to help ensure the eventual market acceptance of the technologies being developed.” Ensuring market acceptance of technology is exactly what the government should not do; it pushes private actors toward the government’s preferred path, limiting flexibility and assuring lower capability and higher cost.
- The Advanced Manufacturing Office is similarly looking to deploy technologies rather than just initiate research.
- The Wind Program’s goals lead with job creation and rural economic development, far removed from a national interest in energy.<sup>16</sup>

The government should generally not participate in applied research, as this biases the technology path. While the line between basic and applied research is often blurry, one difference is that research focused on exploiting current technology is applied and not a proper activity for government. Also, government research should not be done in cooperation with only one commercial entity or focused on technology utilized by only one commercial entity. These are essentially subsidies supporting inefficient production and should be avoided entirely.

Recipients of subsidies often claim the mantle of representing the national interest. These claims are incompatible with all legislation seeking the correct goal of a competitive ECE market. It is competition that ensures superior firms and the best technology will emerge over time. In a competitive market, no single firm or technology is important enough to merit government support. Government interference to support a particular firm or technology inherently bars formation of a competitive ECE market and assures higher costs and slower development.

In this vein, it should be recognized that the heavier cost of subsidies is not financial, but rather their distorting effect on markets. Loan guarantees are thus only a minor improvement over grants. The direct cost to the taxpayer is lower, but they still work at odds with the creation of competitive markets, emergence of superior firms, and dynamic technological development.

The defense of loan guarantees and other subsidies is that they are necessary to ensure ECE supply. However, the market is already doing an excellent job of ensuring ECE supply, and prices are falling as a result. Government action to ensure supply might mean lower prices, but this has little value given that REE imports in particular cost so little. Far more important is that below-market prices discourage conservation, substitution, and innovation.

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<sup>15</sup> U.S. Department of Energy, Advanced Research Projects Agency, “About,” at <http://arpa-e.energy.gov/About/About.aspx> (December 2, 2011).

<sup>16</sup> U.S. Department of Energy, Vehicle Technologies Program, “Financial Opportunities,” September 29, 2011, at <http://www1.eere.energy.gov/vehiclesandfuels/financial/index.html> (December 2, 2011), U.S. Department of Energy, Advanced Manufacturing Office, “About,” November 30, 2011, at <http://www1.eere.energy.gov/industry/about/index.html> (December 2, 2011) and U.S. Department of Energy, Wind Program, “About the Program,” September 22, 2011, at <http://www1.eere.energy.gov/wind/about.html> (December 2, 2011).

The various proposals for action are also subject to simple arithmetic. A single guaranteed loan, outright subsidy, or applied research program is probably a bad idea, but it is a limited one. Many such programs or subsidies make it certain the government will make multiple incorrect choices, picking elements, companies, and especially technologies that ruin market development. Finally, any proposals that mandate both multiple subsidies and many other activities immediately fail even to identify and prioritize a critical task that justifies government attention.

## Conclusion

In sum:

1. The House should consider opening more land to ECE-related assessment and exploration.
2. The House should strongly consider immediately devoting more resources to gathering information on ECEs on a regular basis.
3. The House absolutely should not subsidize ECE mining, production, or refinement, including with loan guarantees. This will reverse progress being made by the market.
4. The House should consider supporting basic research on ECE's. Applied research is often tantamount to subsidy, carries the same risks, and should be strictly limited.

Because prices may go up as well as down, the U.S. government should gather information on possible market shifts. For the same reason, demands for further government intervention in ECEs are being made on the basis of conditions that would no longer apply when the intervention became effective. In contrast, global market adjustment has been rapid and thorough. Let the market continue to work.

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