TESTIMONY
of
Dr. Robert Jaffe
for
The House Natural Resources Committee

May 24th, 2011

Mr. Chairman and members of the committee, thank you for the opportunity to testify today.

I am a Professor of Theoretical Physics at MIT but I'm not here to deliver a lecture on quarks. I'm here to discuss a study on *Energy Critical Elements* that I chaired on behalf of two leading scientific organizations: the American Physical Society and the Materials Research Society.

Our study focused intensely on elements critical to new technologies that have the capacity to transform the way we transport, store, or use energy. Please note that we did not consider defense-related issues. I enclosed a full copy of the report for the record, but this morning I'll simply highlight a few key recommendations.

First, let me first reassure you --- the sky is not falling. The world is not going to run out of any of these elements anytime soon. However: the problem of critical elements is serious and very real. While rare earths are the "flavor of the month", a host of other elements are poised to present problems in the future.

If appropriate steps are not taken, we face possible disruptive short-term constraints on supply of some elements that are not presently mined, refined, or traded in large quantities, but are critical to the deployment of potentially game-changing energy technologies. Casualties might include things ranging from important petroleum refinery catalysts to state-of-the-art wind turbines or market competitive solar panels. In our report we refer to these elements as ECEs: Energy-Critical Elements.

Constraints on availability of these elements would limit the competitiveness of both U.S. industries and the domestic scientific enterprise.

It is our view that with careful stewardship by the government, coupled with the imagination of fundamental research and the initiative of U.S. industry, the problem of ECE availability can be managed for the foreseeable future.

To accomplish that, we recommend a three component approach: information, research, and recycling.

But first, let me say a few words about what we don't recommend.

The U.S. can't mine its way to ECE independence. Yes, we should certainly pursue domestic mining when economically appropriate – but not with the expectation that mining alone will solve the problem. Many ECEs are simply not found here in economically viable deposits, and others are produced more efficiently – for a variety of reasons – by other countries. Free international trade with a diverse set of suppliers works to everyone's advantage.

We can't rely on stockpiling either. We found that stockpiling is a disincentive to innovation because it anchors us to the status quo. Stockpiles have proved a poor way for governments to try to moderate price fluctuations and stabilize markets, often with unintended negative consequences. Note, however, that we did not consider defense stockpiles, which may be motivated by other considerations.

In developing our recommendations for the most effective way to address this issue, we took a lesson from industry.

> **CASE STUDY**: General Electric has for many years tracked the market for an exceptionally rare metal, rhenium, which is critical to its advanced turbines used both in jet engines and modern natural-gas fired power plants. In 2006, General Electric projected that demand for rhenium would outpace worldwide supply within a few years. Instead of stockpiling, GE reduced its immediate need for new rhenium by a wide-ranging recycling program, and began an intensive, multiyear research program to develop an alternative alloy. By 2010 they had found, tested, and certified several new alloys that use less rhenium. Meanwhile the price of rhenium had risen 20-fold to over $10,000/kg.
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> **LESSON**: GE succeeded, but many smaller U.S. companies and university & national labs: 1) do not have the information gathering network needed to recognize an impending supply disruption; 2) can't afford to carry out substitutional research; and, 3) can't engage in extensive recycling.

Consequently, in general, we recommend the following:

1) The government should closely monitor worldwide resources and make that information accessible to U.S. industries and labs. Accurate information about availability will allow the scientific enterprise to see beyond the price spikes and plan for the future. This can be achieved by, among other things, elevating the federal information gathering entity to a "Principal Statistical Agency" similar to the Bureau of Labor Statistics and the Energy Information Administration.

2) The government should also promote fundamental research aimed at the twin goals of increasing supplies and decreasing our dependence on ECEs. It is especially important to support fundamental research on earth-abundant substitutes for ECEs. The goal should be a broad understanding of the advantages and disadvantage of technologies based on alternative materials, in order to enable U.S. manufacturers or lab researchers to more smoothly shift to a substitute in advance of supply disruptions.

3) Cell phones and iPods end up discarded in the back of sock drawers, yet they all contain ECEs in concentrations that exceed the richest ores. Those dispersed products could be gathered into a resource – an urban mine – so the ECEs can be extracted for reuse. There are various paths to achieve this: government could help increase recycling by enabling greater consumer awareness and industry could stimulate it by providing consumer incentives.

We believe that this triad of information gathering, research, and recycling will provide the U.S. with the best safeguard against disruptions.

I believe that these steps can be implemented with a budget-neutral approach that respects the distinction between activities that belong in the private sector and those that fall to government. As a result, I've been able to team with a Research Fellow at the Heritage Foundation and a Resident Scholar at the American Enterprise Institute to draw attention to this approach. Although this might not be the typical collaboration for an MIT professor, it indicates that our recommendations identify an appropriate role for government and are fiscally responsible.

Several House bills have been introduced to address the minerals availability issue. The Johnson-Markey bill rightly emphasizes the importance of information gathering. The Coffman bill addresses rare earth elements and primarily addresses near-term issues. The Miller bill emphasizes some of the research and information gathering efforts recommended in the APS/MRS report. The recently introduced Hultgren bill has provisions on our full triad: information, research, and recycling, and is closely aligned with the point of view I have described here. Together these bills present the full range of options from which an effective policy regarding critical elements can be crafted.

Thank you for the opportunity to testify.