REMARKS PREPARED FOR DELIVERY

TECHNOLOGY AND RARE EARTH METALS CONFERENCE 2010

KEYNOTE ADDRESS

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1. INTRODUCTION

Thank you for the invitation to speak at this important conference.

At energy conferences today, no topic is hotter than shale gas. The story is striking: recoverable reserves of shale gas have increased six-fold in the past few years, thanks to new drilling technologies. This increase has been transformational, with U.S. natural gas imports now predicted to drop steadily in the next decade and beyond, whereas just a few years ago imports were projected to climb for the foreseeable future. Large shale gas reserves are believed to exist in other places around the world, including China and Eastern Europe, with potentially dramatic implications for patterns of energy use in those regions as well.

What does this have to do with rare earth metals?

Before answering that question, let me tell you about a much less well-known resource: rhenium.

Rhenium is the chemical element with atomic number 75. In part due to its very high melting point, rhenium is a critical component in nickel-based “superalloys,” which are capable of functioning under very high stress. These superalloys are used in the jet engines of military aircraft and some of the world’s most energy-efficient gas turbines.

However, rhenium is very rare. It is a byproduct from copper ores, but on average 120 tons of copper are needed to produce 30 grams of rhenium. In recent years, as rhenium's use in turbine blades and other applications has grown, its price has increased sharply.

So metallurgists at General Electric have worked to develop alternative superalloys that use less rhenium. GE has also partnered with the U.S. Navy and leading airlines to recycle turbine blades that contain rhenium. These steps have helped mitigate the risk of future rhenium supply disruptions or price spikes.

What do these two stories tell us?

That supply constraints aren't static. Strategies for addressing shortages of strategic resources are available, if we act wisely. We can invest in additional sources of supply. We can develop substitutes. We can re-use materials and find ways to use them more efficiently. We can consider use of stockpiles and strategic reserves. Not every one of these strategies will work every time. But taken together, they offer a set of approaches we should pursue as appropriate whenever potential shortages of natural resources loom on the horizon.

2. RARE EARTH METALS

That brings us to rare earth metals. As participants at this conference know, "rare earths" are typically defined to include the 15 elements in the periodic table with atomic numbers 57 through 71, along with several other elements. They include elements unfamiliar to most people, such as lanthanum, cerium, neodymium and europium.

Ironically, rare earth elements are not actually rare. Their misleading name probably comes from early mining of these elements in Europe, which focused on extraction from minerals that were quite uncommon. In fact, most rare earth elements are widely distributed in the Earth's crust. Indeed the abundance of rare earths in the Earth's crust is higher than that of some major industrial metals. Even the least abundant rare earths are found in greater quantities than, for example, bismuth and cadmium.

Rare earth elements have many desirable properties, including the ability to form unusually strong, lightweight magnetic materials when alloyed with other metals. They also have distinctive and valuable optical properties including fluorescence and emission of coherent light – important for lasers. Many of these properties result from the presence of an unfilled inner electron shell in their atomic structure.

These properties and others have made rare earth metals especially valuable in a number of applications, including for clean energy technologies. Lanthanum (atomic number 57) is used in batteries. Neodymium (atomic number 60) is used in magnets for electric motors. Europium (atomic number 63) is used in colored phosphors and lasers. Rare earth metals are also used in manufacturing energy-efficient windows and in capacitors, sensors and scintillators used in electricity transmission.

Although rare earth metals are found in many places on Earth, including the United States, Canada, Australia, Brazil and South Africa, they are difficult to extract in profitable quantities without substantial time and cost. This has led to geographically concentrated production.

Geographic concentration in the production of rare earth metals is not new. Prior to 1948, most of the world's rare earth production came from placer sand deposits in Brazil and India. In the following decades, production shifted to monazite deposits in South Africa and elsewhere. In the 1970s and 1980s, global production was dominated by the output from the Mountain Pass mine in California. Today, although production of rare earths still occurs in a number of countries, more than 95 percent of global supply is produced in China.

It goes without saying that diversified sources of supply are important for any strategic material. So too are substitutes and strategies for re-use and recycling. If rare earth metals are going to play an increasing role in our economy, we need to pursue those strategies. And there's every reason to believe that rare earth metals could play an increasing role in the global economy as the world transitions to clean energy.

3. CLEAN ENERGY ECONOMY

This transition is already well underway. The world is on the cusp of a clean energy revolution. Here in the United States, the Obama Administration is making historic investments in clean energy.

The American Recovery and Reinvestment Act was the largest one-time investment in clean energy in our nation's history – more than $80 billion. At the Department of Energy, we're investing our $37 billion in Recovery funds in electric vehicles; batteries and advanced energy storage; a smarter and more reliable electric grid; and wind and solar technologies, among many other areas. Through this investment, we'll at least double our renewable energy generation and manufacturing capacities by 2012. We'll also deploy hundreds of thousands of electric vehicles and charging infrastructure to power them; weatherize at least half a million homes; and expand our grid.

Other countries are also seizing this opportunity. Indeed, the market for clean energy technologies is growing rapidly all over the world.

Today, the Chinese government is launching programs to deploy electric cars in 13 major cities. It's connecting urban centers with high-speed rail. It's building huge wind farms, ultra-supercritical advanced coal plants and ultra-high-voltage long-distance transmission lines with low line loss.

India has launched an ambitious National Solar Mission, with the goal of reaching 20 gigawatts of installed solar capacity by 2020.

In Europe, strong public policies are driving sustained investments in clean energy. Denmark is the world's leading producer of wind turbines, earning more than $4 billion each year in that industry. Germany and Spain are the world's top installers of solar photovoltaic panels, accounting for nearly three-quarters of a global market worth $37 billion last year.
Around the world, investments in clean energy technologies are growing, helping create jobs, promote economic growth and fight climate change. These technologies will be a key part of the transition to a clean energy future.

However today, many of these technologies rely on the special properties of rare-earth metals. There's no reason to panic, but there's every reason to be smart and serious as we plan for growing global demand for products that contain rare earth metals and other strategic materials.

4. STRATEGIES TO MANAGE POTENTIAL RISKS

For the clean energy economy to reach its full potential, we must work together to ensure stable supplies of the materials required. That means working together to diversify global supply chains, as well as investing in manufacturing and processing. It means research and development into substitutes. It means finding ways to recycle and re-use scarce materials. U.S. talent and innovative capacity in materials science can be harnessed to create the next generation of rare earth applications and competing technologies.

To proactively address the availability of rare earths and other strategic materials required for the clean energy economy, we must take a three-part approach:

The first strategy is to **globalize supply chains for strategic materials**. To paraphrase what Churchill once said about oil: Security rests above all in diversity of supply. To manage supply risk, we need multiple, distributed sources of strategic materials in the years ahead. This means taking steps to encourage extraction, refining and manufacturing here in the United States, as well as encouraging our trading partners to expedite the environmentally-sound creation of alternative supplies.

The United States will explore investments at all stages of the supply chain, from environmentally-sound material extraction, to purification and processing, to the manufacture of chemicals and components, and finally to end uses. These investments will help the United States strengthen our manufacturing base over the long term. And we will examine issues related to strategic stockpiling of critical materials, especially those with dual-use potential, i.e., in both civilian and military applications.

Second, we must **develop substitutes.** Doing so will improve our flexibility as we address the materials demands of the clean energy economy. This means investing in RD&D to develop transformational magnet, battery terminal and other technologies that reduce our dependence on rare earths. DOE's Vehicle Technologies Program, the ARPA-E program, and our national labs are all currently conducting research along these tracks. The ARPA-E program recently funded a consortium of universities, laboratories and private companies to conduct research into high-energy permanent magnets that will use domestically-available materials while more than doubling magnetic energy density over current state-of-the-art technologies.

Third, we must promote **recycling, re-use and more efficient use** of strategic materials, to get more economic value out of each ton of ore extracted and refined. As in the case of GE's turbine blade recycling program, re-use can help mitigate potential supply constraints. Widespread recycling and re-use could significantly lower world demand for rare earths and other strategic materials. And, importantly, recycling and re-use could also reduce the lifecycle environmental footprint of these materials.

As a society, we have dealt with these types of issues before, mainly through smart policy and R&D investments that reinforced efficient market mechanisms. We can and will do so again.

To help address these concerns, I am today announcing that the Department of Energy will develop its first-ever strategic plan for addressing the role of rare earth and other strategic materials in clean energy technologies. The plan will apply the approaches described above and draw on the strengths of the Department in technology innovation. We will build on work on these topics already underway, including in DOE's national labs, and work closely with colleagues from other agencies throughout the U.S. government. We will solicit broad public input, including from the stakeholders and experts here in this room.

5. <u>CONCLUSION</u>

So in conclusion, as I said earlier: there's no reason to panic, but every reason to be smart and serious as we plan for growing global demand for products that contain rare earth metals.

The United States intends to be a world leader in clean energy technologies. Toward that end, we are shaping the policies and approaches to help prevent disruptions in supply of the materials needed for those technologies. This will involve careful and collaborative policy development. The United States will develop and implement systematic approaches to building a stable, geographically diverse supply chain; encourage technical innovations to identify substitutes as well as minimize the requirements for these key materials; and encourage recycling and re-use wherever possible. We will rely on the creative genius and entrepreneurial ingenuity of the business community to meet an emerging market demand in a competitive fashion. Working together, we can meet these challenges.