Testimony of Mark Caffarey
Executive Vice President of Umicore USA Inc.
before the
Subcommittee on Energy
of the Senate Committee on Energy & Natural Resources
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Madam Chairman, Mr. Ranking Member, and Members of the Committee, my name is Mark Caffarey, and I am an Executive Vice President at Umicore USA. Thank you for the opportunity to testify before you today.

Umicore is a global materials technology company, with annual sales of some $15 billion. We focus on areas where we can best use our expertise in materials science, chemistry, metallurgy, and recycling. We produce metals-based materials for: rechargeable batteries for laptops, mobile phones and electric cars; emission control catalysts for passenger cars; photovoltaic systems; and fuel cells. We are also the world's leading recycler of precious metals.

The three bills before the Committee today – S. 383. S. 421, and S. 1113 – all call upon the Department of Energy to launch programs in the recycling of critical materials. I am testifying today to offer Umicore's support for those programs, because we at Umicore believe the recycling of products containing critical materials is a central strategy to securing access to critical materials for the United States.

Our belief is not based on theory, but rather on practice – our own business experience. Umicore is more than 200 years old, with a history in mining and metals smelting. In the last fifteen years we have transformed our operations by developing a closed loop business model, allowing us to secure from our recycling more than 50% of the metals we transform into materials. Among those are three highlighted by DOE as critical for clean energy technologies (indium, gallium, tellurium from US DOE's Critical Materials Strategy, 2010) as well as Platinum Group Metals added to the list of critical materials in other parts of the world. In 2010 Umicore recovered approximately $6.5 billion in metals value from discarded end-of-life products and industrial by-products. Because Umicore knows that, in principle, metals can be infinitely recycled without losing any of their properties, a key component of our business strategy is to increase even further the range of materials we derive from recycling.

As you consider the legislation before you, we urge to contemplate the benefits of recycling in achieving the common objectives of these three bills. First and most importantly, these bills all seek to ensure that the United States has secure, ready, domestic access to critical materials required for defense and civilian high-technology products. If the United States committed itself to meeting its critical

materials needs in large part through recycling, there is no nation on earth that could match American resources. The United States has the largest "above-ground" mines of critical materials in the world, in the sense that this country's supply of industrial scrap and end-of-life automobiles, electronics, and electronic appliances – whether they are in wreckers' yards, land-fills, or Americans' basements and attics – can't be matched by any other nation. In essence, these "above-ground mines" make the United States the Saudi Arabia of critical materials. A well-developed recycling system could tap these mines for U.S. critical materials security without limit.

Second, recovering metals from production scrap and waste and from end-of-life products is much more efficient and needs much less energy than production from primary resources. In terms of productivity, consider that for every ton of gold-containing ore taken from the ground through mining, approximately 5 grams of gold can be recovered. Likewise for ore containing platinum group metals that is mined, approximately 5 grams of PGM's can be recovered. (Platinum Group Metals = Platinum, Palladium, Rhodium, Ruthenium, Osmium, and Iridium) On the other hand, for every ton of mobile phones recycled, we can harvest 300-350 grams of gold, or more than 70 times the yield from mining. And for every ton of automobile catalysts recycled, we can harvest 2,000 grams of PGMs – more than 400 times the yield from mining. Each year in Maxton, North Carolina, Umicore Autocatalyst Recycling (UAR) reclaims over 2 million grams of PGMs from approximately 1 million recycled automobiles. The spent automotive catalyst is de-canned and sampled in the North Carolina facility.

In terms of energy savings, take the production of aluminum, for example. Recycling uses only 5-10% of the energy that would be required for virgin aluminum production, representing a 90-95% energy savings. For the precious metals (i.e. gold, silver and the the platinum group metals) and for metals such as cobalt, indium or tellurium, the energy savings achieved by state-of-the-art recycling are also significant. An exact calculation of energy efficiency per metal is difficult to achieve due to the heterogeneous nature of our feed and the numerous metals extracted from the Umicore flowsheet. Our initial work indicates that the annual production of metals from our recycling/refining facility creates in total about 1/5th the CO2 emissions compared to producing those same 17 metals via the primary route. Recycling is by far the more energy efficient way to produce critical materials – as long as the appropriate process chains are used.

Take an example of these energy efficiency savings from our own organization. Umicore Battery Recycling has evaluated its recycling process for rechargeable battery materials versus primary production of these materials. Umicore's process avoids the mining of virgin materials (at high energy cost), requires no additional energy-consuming processing to achieve quality in the materials because of the high purity of the materials in the used batteries, and finishes with a highly energy-efficient recycling (smelter) technology. Umicore estimates that

the energy savings achieved by its battery recycling process amounts to 50-70% compared to production from ores (depending on the battery composition). Umicore's rechargeable battery recycling plant will soon have a capacity for 7,000 tons of rechargeable batteries (equivalent to 150,000 automobiles or 250 million mobile devices).

Likewise, Umicore's recycling process for precious metals containing industrial byproducts and End of Life materials avoids the mining of virgin materials (at high energy cost) and allows the recovery of 17 metals in all – two of them from the critical list published by DOE: indium and tellurium. The rare earth elements present in the automotive catalysts would be extremely difficult to recover due to the chemical nature of those catalysts.

Third, and finally, the economic growth benefits of a domestic commitment to the recycling of critical materials could be enormous. Umicore itself employs 14,400 people world-wide, with 1500 highly-skilled, highly paid employees at our largest plant, the precious metals and battery recycling plant. The employment potential of a robust U.S. critical materials recycling industry is significant, involving not only many, many jobs but also jobs of varying skill levels at each of four stages of the recycling process: (1) the collection of discarded end-of-life products and scrap; (2) the dismantling and sorting of products and the separation of components; (3) the pre-treatment of the separated components; and (4) the refining of the pre-treated materials into the final critical material products, which is what we do at our recycling plants. Finally, there is all the indirect employment that can be associated with the recycling industry – IT, engineering, transportation, sales, administration, as well as research at universities and research centers. The economic growth potential is enormous, because the recycling of critical materials is an entire industry, and the United States has not begun yet to build one domestically.

The three bills before you call upon the Secretary of Energy to develop a research and development program that includes recycling. Again, Umicore's own experience offers testimony to the wisdom of those provisions, having gone from a company obtaining metals from mining to one obtaining metals mainly from industrial by-products and end-of-life products using highly energy efficient, clean recycling technologies. This strategic business decision has resulted in high levels of innovation within the company and has stimulated research and innovation via collaboration with many university partners and in-house R&D centers. So Umicore believes that government support for fundamental, pre-competitive research and development for critical materials – as contemplated in the three bills before you today -- is appropriate and necessary.

The focus on research and development in the three bills will be especially important in the subset of critical materials known as the "rare earths." Umicore is now performing research on the possibility of recycling rare earths from various

sources of end-of-life materials and is evaluating the possibility of stepping into funded projects where this can be further addressed.

But we also note that there are existing, proven technologies to recycle many critical materials beyond the rare earth subset. So with respect to these critical materials, we can focus now on how the nation should support the development of a critical-materials recycling industry built upon those existing, proven technologies like Umicore's..

To that end, I note that Umicore has provided comments (attached) to the Secretary of Energy on the proposed strategic plan for the department to the effect that there should be a department-wide effort to determine how DoE programs can support the development of such a critical materials recycling industry.

But perhaps this Committee should also consider including in any bill it forwards to the floor provisions that require the Secretary to study and make recommendations to the Congress on how the development of such an industry could be catalyzed by demonstration, deployment, and financing programs in the Department of Energy or other federal agencies. As noted above, the recycling process includes four critical stages: collection, dismantling, pre-treatment, and then refining. Such a study would contemplate how federal policies could support the development of private-sector infrastructure for each of these stages so that the American system for recycling critical materials is as robust as it should be. Such a study could be a vital first step to achieving the significant national security, energy-efficiency, and economic growth benefits described above.

Thank you for the opportunity to testify before you today, and I stand ready to answer any questions you may have.