



Sustainable Product Development

Critical for Resource Conservation and Product Innovation

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What do LED lights, cell phones, fiber optic cables, household paints, and industrial pipelines have in common? Each contains rare earth elements (REE). Rare earth elements are a set of 17 chemical elements in the periodic table, and many will be completely harvested in our lifetime.

The vast adaptation of these elements has caused immense demand from manufacturers across numerous industries, and reliance on REE is placing these manufacturers at risk. Rare earth elements are in limited supply and can be difficult to locate in heavy concentration. Control of the raw elements is also a significant factor. For instance, Europium, Terbium and Yttrium, the elements that give color to LEDs and to television and smart phone screens, are primarily located in mines in China. This creates a monopolization of the resources and poses another risk to dependent manufacturers.

Element	Use	Risk
Tantalum	Electronic components, military and aerospace	Part of supply comes from conflict zones.
Germanium	Fiber optics and infrared night vision systems	Germanium is mainly a by-product of zinc ore processing. Zinc proven reserves: 20 years of consumption.
Indium	Touch screens and high-efficiency thin film solar panels	Reserves estimated to 17 years - Demand has increased 10x over the past decade.
Niobium	High resistant alloys for pipelines	Roughly 95% of reserves located in Brazil.
Europium, Terbium and Yttrium	LEDs and electronic screens	Heavily monopolized extraction in China.
Rhenium	Turbines for commercial airliner and fighter jets	One of the rarest elements on Earth, reserves estimated at 50 years.
Antimony	Fire retardants in paint and textiles, lead-acid batteries	Estimated 11 years of global reserves.

USGS Mineral Commodity Summary 2012

Source:

<http://minerals.usgs.gov/minerals/pubs/mcs/2012/mcs2012.pdf>



Demand for these resources has skyrocketed over the past decade, increasing the possibility of shortages, which could cripple production of thousands of products. In order to stay competitive in markets where natural resources critical to production are dwindling, companies must find innovative solutions. Resource conservation and development of closed loop recycling of products is becoming essential in manufacturing operations that rely on REE. As supplies diminish and prices increase, manufacturers must be proactive in pioneering new products and processes to thrive long-term.

According to The Economist, "if wind turbines and electrical vehicles are going to fulfill the role that environmental planners have assigned them in reducing carbon-dioxide emissions, current technologies would require an increase in the supply of neodymium and dysprosium of more than 700% and 2,600% respectively during the next 25 years."

From a sustainability perspective, this creates opportunity for innovation and advancement through Sustainable Product Development (SPD). SPD programs are designed to identify opportunities for improvement and generate more sustainable products. SPD teams use life cycle thinking techniques and tools to consider alternative materials, processes and sourcing that result in decreased environmental impacts throughout the product's life. Combining innovative design techniques with life cycle data allows manufacturers to evaluate future products before going to market, thus increasing environmental performance, enhancing market appeal and maximizing ROI.

Example:

Ford Motor Company develops new Lithium-ion battery to reduce the use of REE. These new batteries are lighter and more efficient, delivering reduced cost and improved performance. Expected reductions of REE are 500,000 pounds per year.

Source:

http://media.ford.com/article_display.cfm?article_id=37087



An alternative (or supplement) to reducing REE use is REE reclamation and recycling. These elements can be salvaged and incorporated into new products. Designing future products for easy REE reclamation is essential to the sustainability of several industries. The SPD process looks at the entire life cycle of a product, including the end-of-life and disposal impacts. Designing products for easy disassembly and recycling allows companies to utilize a closed loop system that minimizes dependency on virgin materials and generates financial savings.

The need for radical resource changes is imperative – not only for many manufacturers and industries, but for sustaining our economic system. As technology progresses and more REE is required, the risk for shortage and production standstill increases. Sustainable Product Development addresses this need, and is the key to designing innovative products and processes to create future value and ensure environmental and economic continuity.

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