Rare Earths are Becoming Rare! *By* Walt Benecki

Rare Earth magnet producers and users have experienced sticker shock over the past few years as rare earth alloys and NdFeB magnet prices have skyrocketed. This trend is in sharp contrast to the period of steadily decreasing prices that everyone in the magnet industry had come to enjoy and expect for a number of years. That ballgame is now over.

China has dominated the world production for more than a decade, producing over 90% of all Rare Earth Oxides (REO) since the early 1990's. Unfortunately, China is facing a combination of issues that seem to have modified the overall rare earth landscape.

The Chinese rare earth industry has been dealing with environmental and weather issues as well as a recently publicized fire that have all impacted REO production. In addition, government restrictions have seriously reduced exports. Tariffs have been increased and rogue exporters are being identified and, in many cases, shut down. At the same time, domestic demand from China's booming economy (China currently consumes over 50% of all REO production) and a strengthening Yuan do little to encourage exports.

As a result of all these dynamics, Japanese, North American and European magnet suppliers are experiencing a serious margin squeeze that forces them to pass on higher prices to their customers. In some cases, the increases have been dramatic – stories of 50-100% increases abound.

Before anyone pushes the panic button, it is important to put the recent price increases in a longer term perspective. In spite of the recent price hikes, price levels for most REO and related alloy products (and magnets!) are actually lower than they were 10-12 years ago. The fact is that, in their zeal to promote their rare earth industry and solidify their position as the dominant world producer, the Chinese probably lowered REO prices more than was appropriate. Now, looking forward, the issue is much more related to future market demand.

Two major drivers are expected to influence the future demand-supply balance for REO – rare earth magnet demand and metal hydride batteries. The end application that requires both these products in significant quantities is the hybrid car. As a result, by 2010 NdFeB magnets and NiMH batteries are expected to account for approximately 38% of total rare earth demand (Table 1). Overall REO demand is expected to grow 10% per year, but magnet REO demand will increase 13% per year and NiMH battery requirements by an astounding 30% per year. Current REO production in China is estimated at approximately 100,000 metric tons.

Table 1 Rare Earth Oxide Demand by Application (Metric Tons)
Source: BCC Research (2006)

Application	2005	2010	% AAG
Rare Earth Magnets	17,150	31,100	12.6%
NiMH Batteries	7,200	27,300	30.5
Catalysts	21,230	25,960	3.8
Polishing Compounds	15,150	23,500	9.2
Glass Additives	13,590	13,990	0.6
Phosphors	4,007	7,512	13.0
All Other	16,935	24,950	8.0
Total	**95,262**	**154,312**	**10.1%**

An additional issue that exacerbates the REO demand-supply equation is the fact that there will be significant imbalance between the various rare earth elements. Demand for Neodymium and Praseodymium will be strong (12-16% per year) while demand for Cerium is expected to grow at 7% per year. Since the separation process cannot selectively produce rare earths, the supply of Neodymium and Praseodymium will be short while Cerium will likely experience an excessive supply. This imbalance issue is expected to be a significant driver pushing up prices for those rare earths that are "more rare" to provide balance for those rare earths that will be more abundant. Neo Material Technologies reported at a Shanghai conference late last year that a total of 350,000 metric tons of REO will need to be mined by 2010 to meet the demand of the NdFeB magnet industry.

Some longer range projections of market demand are ominous. Earlier this year, Research Connect predicted that 2 million metric tons of REO will be required to meet the forecasted 2025 requirements of hybrid, electric and hydrogen vehicles.

One obvious answer is for new rare earth producers, preferably outside of China, to enter the market and that is one trend currently underway. Three companies have announced intentions to startup rare earth production within the next few years (Table 2).

Table 2 Additional REO Production Capacity

Company	Country	Site	Estimated Capacity	Start of Production
Molycorp	USA	Mountain Pass	25,500	2008
Lynas .	Australia	Mt. Weld	10,500	2008
Great Western	Canada	Hoidas Lake	4,000	2010

Unfortunately, bringing new mining and separation capacity on line is expensive and often involves a lengthy startup process. The Molycorp announcement in May of this year was expected and welcomed by the magnet industry. Molycorp indicates they expect to start shipping product in early 2008, primarily to customers in Japan. If Molycorp and Lynas startup on schedule, they will represent a short term relief valve that may limit price increases during the 2008-9 time period. However, market demand will continue to accelerate and it is unlikely that we will see supply exceeding demand for a long time.

Great Western Minerals has announced a novel approach that they call "Mine to Market". Great Western plans to provide a complete value chain from the mine through the production of specialty alloys and powders. Although Great Western is a number of years away from fully implementing this business model, they are currently producing alloys and powders for customers on a contract basis.

There are actions that the magnet industry can take to address rising REO prices. First, the classic Chinese production process of producing blocks of NdFeB and then cutting to the desired shape is wasting tons of Nd and Pr each year. The Chinese need to transition to "press to shape" manufacturing, the process that has been common in Japan and the West for decades. The Chinese need to reduce the waste of precious rare earth material inherent with their traditional "slicing and dicing" process.

Secondly, the magnet industry needs to develop the capability to recycle rare earth materials from scrap magnets and grinding swarf. Very few companies have seized this initiative. In the past, recycling has been deemed too expensive and the magnet industry has generally ignored the value existing in scrap and swarf. This attitude needs to shift as material costs continue to climb.

Third, the rare earth magnet industry needs to focus their research and development efforts toward the reduction of Neodymium and Praseodymium content, hopefully without sacrificing magnet performance. This does represent a certain technological challenge, but those creative enough to achieve success will likely prosper.

Magnet sellers and users also have contingency actions available to deal with escalated NdFeB magnet prices. Sellers need to consider Nd/Pr surcharges to fairly pass on legitimate raw material price increases to their customers. Magnet users always have the option to reconsider the application of hard ferrite magnets, a product with less attractive magnetic properties, but much lower prices, as compared to NdFeB. Unfortunately, those applications where either size or weight is critical will find this transition very difficult.

Where sintered NdFeB continues to be the magnet of choice, buyers need to insist that their magnet suppliers are pressing to shape wherever possible rather that slicing and dicing. The press to shape requirement will increase upfront tooling costs, but the initial tooling expense should prove to be a sound investment.

Bonded magnet users need to pressure their suppliers for powders that contain less Neodymium, Praseodymium and Cobalt, all relatively expensive materials now utilized in rare earth powders. The bonded magnet community has also been addicted to steady price reductions for the past 15 years. Those days are now apparently over. Fortunately, bonded magnets often are the obvious magnet of choice and magnet cost is often a relatively low percentage of total product cost. In these cases, most bonded magnet customers will accept the higher magnet prices and continue to leverage the many advantages of injection molded and compression bonded NdFeB.

Another danger is that some Chinese suppliers of sintered NdFeB magnets and assemblies may overreact to the pressure from their customers to limit price increases. In some cases, Chinese suppliers may attempt to reduce their costs by sourcing certain products (including magnets) from marginal local producers. The result can sometimes be delivery delays, quality problems and potential patent infringement vulnerability. Western buyers need to be diligent to avoid these problems.

In summary, most knowledgeable organizations are forecasting increased rare earth prices as demand for hybrid vehicles continues to accelerate. It does not appear that the Chinese government is currently disposed to relaxing restrictions on production and exports of rare earth oxides and alloys.

The recent Molycorp announcement seems to represent a short term relief valve, however it is unlikely that Molycorp made the decision to invest in the costly start-up with the expectation that price levels will decline. In any case, Molycorp's incremental supply will be welcomed by industry.

Magnet buyers need to be proactive. They should demand more efficient processes. They need to encourage creative magnet development and aggressive recycling. If the NdFeB magnet industry does not respond, the result may be higher magnet prices and some reversal of product substitution in favor of hard ferrite magnets.

Walter Benecki is president of Walter T. Benecki LLC, a consultancy serving the worldwide magnetics industry. Walt currently serves on the boards of the Electric Motor Education and Research Foundation, the Bunting Magnetics Company and Great Western Minerals Group Ltd. For additional information, visit his website: www.waltbenecki.com.

Magnetics Business & Technology
November 2007