

## Hardware vs. Software

In recent issues of Magnetics Magazine, my fellow contributors have lamented the current situation for rare earths and magnets outside of China, in particular the threatened reduction of rare earth exports from China. There is a reason why people are so confused on this subject. A general lack of understanding of how this market works, leads to the naïve assumption that the rare earth market should work like any other market. It usually does not. So it is no surprise to see a wide variety of reactions: from a shrug to panic, and everything in between. Who is right?

While it is true today that over 95% of the world's rare earth supply comes out of China, it does not mean that China is the only place in the world where rare earths are found. In fact, the rare earth business developed without any Chinese resources whatsoever. In the early days, the business was based primarily on the deposit at Mountain Pass, CA owned by Molycorp(1) and several other deposits around the world, including the monazite sands in western Australia. This market was developed from scratch over a roughly 40 year period from 1950 through 1990. When the Chinese entered the market in a serious way circa 1990, production shifted to China, albeit slowly. The driver was cheap prices and not the quality or quantity of resources outside China. Soon after, production of products that use rare earths, like magnets, followed rare earths to China, too. So when the Chinese say they might limit exports of rare earths, they mean the raw materials and not the products that contain them, a statement that should reduce the panic. The clear and consistent emphasis of the Chinese business model is on value added products, not on exporting raw materials.

Here is the hardware part of the story. There are many deposits identified around the world. We see no shortage of deposits, just a lack of mining activity in these deposits. We also see two organizations in the US trying to reinvigorate industrial activity: REITA(2) for rare earths and USMMA(3) for magnets. Their focus, I would say, is on the deposits, factories and businesses. Either they want to develop new business or preserve existing businesses. There is also the US Geological Survey(4) which keeps tabs on rare earth deposits, imports and exports. So it is really not accurate to say the US Government should become involved in this situation, when it has been monitoring and documenting it for a very long time. However, it is very fair to ask the government to become more involved as financing is needed for several rare earth projects.

Since I mentioned the USGS, I should note that Jim Hedrick, who monitored rare earths for many years, retired at the end of 2009. His replacement is Dan Cordier.

But there is a software part of the story, too, which is almost always overlooked. Try to find someone who knows something about the commercial applications of rare earths or their quirky market dynamics outside of China. You will come up with an extremely short list. One thing you may notice about the people on this list is that nearly everyone is well over 50 years of age, which means this expertise will be available for perhaps a decade or two. Compared to the age of the world's rare earth deposits and their time to depletion, you realize that the software is far more volatile than the hardware by many orders of magnitude.

That's why I see software as the bigger problem because of the question of lifetime. If we are going to be successful in returning order to a chaotic rare earth market in an efficient way, it will come in part from experts mapping and guiding the way forward. It won't come from finding more deposits. We don't need to panic, but we do need to be concerned enough to act, both wisely and without further delay. Our window of opportunity is relatively short because of the age of our experts. I hope that we have the wisdom to take advantage of this opportunity; otherwise, we will just have continued chaos when we try to reinvent the wheel later on.

These are the things I would push for:

1. Clearly identify products that contain rare earths. Intel and AMD do a marvelous job in this area making sure we all know which chip is inside our computers with a small sticker. Otherwise, we might not know it. We need to raise the consciousness of people on the subject of products that contain rare earths. Most people do not realize that neodymium and dysprosium make our laptops possible. Without Nd and Dy, laptops would be like the old Compaq's, a luggable computer. One that you could drag home to work on a project over the weekend, but not the travel-friendly kind we have today.
2. Restart the Rare Earth Information Center.[5] I would make it both an academic resource, which is what it was previously, and a commercial resource, too. We need to promote more uses of rare earths to improve the balance and diversity of applications and to identify *every viable commercial use*. The work here is not finished. So far, no one has really stepped up to take on this task.
3. Develop a separate business devoted to recovering and recycling used rare earths from existing waste streams. This is an untapped resource in itself, a more environmentally friendly way to operate and reduce demand on current ore sources.
4. Interview retirees from any business involved with rare earths and publish the findings. There is a great deal of information that needs to be captured while we can still do it. This would aid in reducing the time needed to bring some new projects on stream, provide some ideas for future business and reduce the risk that we may need to rediscover what was already known.

The truth is that we need both hardware and software in the rare earth business to be successful, just like computers. This is a battle along several fronts, which means there is no single answer; many helpful ideas taken together will form a good solution.

1. [www.molycorp.com](http://www.molycorp.com)
2. [www.reitusa.org](http://www.reitusa.org)
3. [www.usmagnetmaterials.org](http://www.usmagnetmaterials.org)
4. [http://minerals.usgs.gov/minerals/pubs/commodity/rare\\_earths/](http://minerals.usgs.gov/minerals/pubs/commodity/rare_earths/)
5. [www.spontaneoumaterials.com/Papers/Summer2006.pdf](http://www.spontaneoumaterials.com/Papers/Summer2006.pdf)

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