

Rare earth metals are to the 21st Century what oil was to the 20th Century. In the 20th Century, countries that had access to oil were able to embrace the best technology available: tractor trailers, cars, diesel trains, airplanes and jets, plastics, and petrochemicals. Say what you will about the effects of oil on the environment, its effect on economies is profound, nearly immediate, and lasting.

But today we live in a world that has intense competition for oil, and oil's geopolitical issues are merging with its environmental issues to create a real force for alternative sources of energy. Nobody should be so naive as to believe that the age of oil is over, it isn't and it's not going to be anytime soon - but technology has changed economies just as oil did in the last century. And while oil did not eliminate the previously preferred source, coal, it supplanted it in numerous technologies.

Today, countries need superfast computers, exceptional telecommunications, advanced electronics, high-speed cell phones, and high-tech defense systems to survive in the 21st Century economy and political world. Increasingly, countries are using renewable energy technology from solar panels to wind turbines to the batteries in hybrid and electric cars to reduce their exposure to foreign-sourced oil.

All of those things rely on rare earth metals or "rare earths".

The rare earths are a group of 17 metals on the periodic table, some are "heavy" and some are "light" - the atomic weight of each distinguishes its class. The heavy rare earths are more rare and more costly.

**Rare Earth Elements**

<b>La</b> 57	<b>Ce</b> 58	<b>Pr</b> 59	<b>Nd</b> 60	<b>Pm</b> 61	<b>Sm</b> 62	<b>Eu</b> 63	<b>Gd</b> 64	<b>Tb</b> 65	<b>Dy</b> 66	<b>Ho</b> 67	<b>Er</b> 68	<b>Tm</b> 69	<b>Yb</b> 70	<b>Lu</b> 71
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Lanthanides

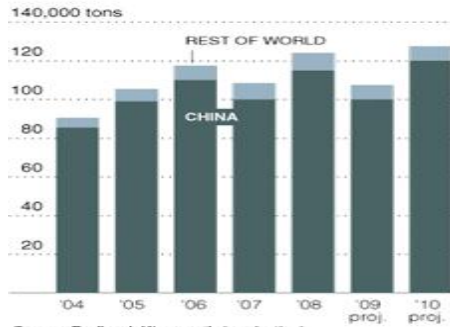
H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	<b>Y</b>	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	<b>Lu</b>	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac	Lr														

Unfortunately for the United States, China controls between 93 and 97 percent of all rare earth production (depending on whose assessment you believe, whether the U.S. Energy Information Administration, the International Energy Agency, or industry estimates.)

## Rare Wealth

China accounts for the vast majority of the world's production of rare earths — 17 elements — which are used in a wide array of products.

### RARE EARTH MINERAL PRODUCTION



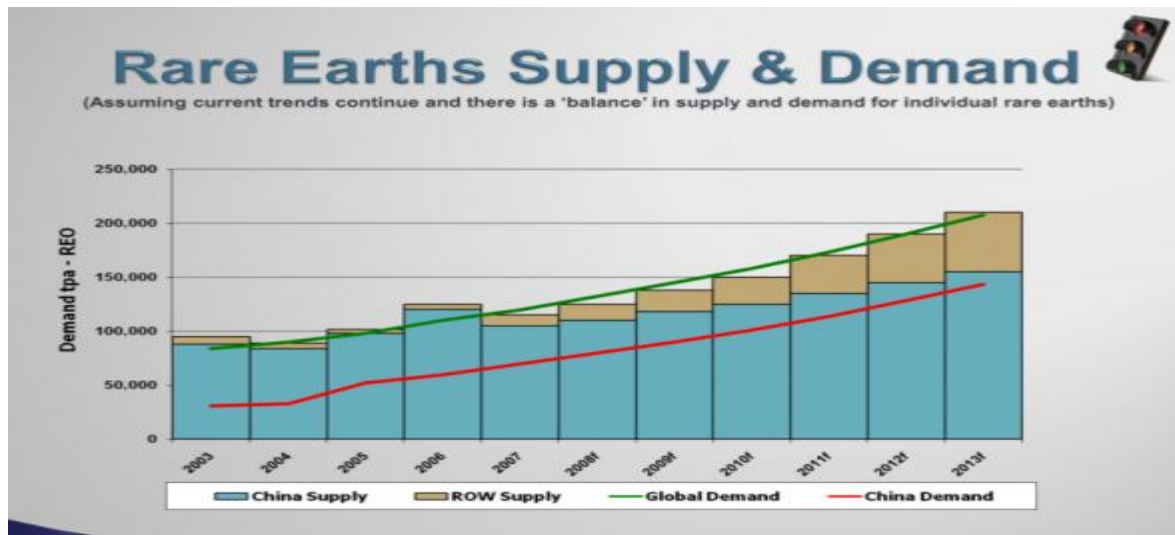
Source: Dudley J. Kingsnorth (production)

### RARE EARTHS

RARE EARTHS	ATOMIC NO.	COMMERICAL USE
Scandium	21	Stadium lights
Yttrium	39	Lasers
Lanthanum	57	Electric car batteries
Cerium	58	Lens polishes
Praseodymium	59	Searchlights, aircraft parts
Neodymium	60	High-strength magnets
Promethium	61	Portable X-ray units
Samarium	62	Glass
Europium	63	Compact fluorescent bulbs
Gadolinium	64	Neutron radiography
Terbium	65	High-strength magnets
Dysprosium	66	High-strength magnets
Holmium	67	Glass tint
Erbium	68	Metal alloys
Thulium	69	Lasers
Ytterbium	70	Stainless steel
Lutetium	71	None

THE NEW YORK TIMES

According to Bloomberg BusinessWeek, "in the past five years, China has cut export quotas [for rare earths] by nearly half, while imposing a tariff of 25 percent on the most expensive rare earths [Yttrium, Neodymium, Dysprosium, Terbium, and Europium] and a 15 percent tariff on the rest." James Arredy explained the effect in a Wall Street Journal article, "Rare-earth prices remain far above where they were just two years ago. lanthanum hovers 18 times above its 2009 price, while prices for cerium are nearly 25 times higher."



In response, a group of U.S.-based solar panel manufacturers filed a complaint at the World Trade Organization alleging that the Chinese were engaging in unfair trade practices aimed at harming U.S. companies.

China currently exports about 40,000 metric tons of rare earths per year - the U.S. Geological Survey estimates that China has about half of the world's 110 million metric tons of rare earth deposits.

Unfortunately for the world, China's resources are among the easiest to access [much of the

world's rare earths lie in ocean beds two miles deep and inaccessible with current technology]. In short, China controls the minerals that are essential to 21st Century technology. A major, and growing concern is that through China's monopoly on rare earths it is gaining both military and economic power over the other developed countries.

In fact, this fall the U.S. Pentagon provided a report to Congress that found Chinese domination of the rare earths market has led to a military risk to the United States.

It's important to remember that in 1859, at Titusville, Pennsylvania, the U.S. became the first nation to develop oil as an energy source. That created an extraordinary competitive advantage for America, and it was a large part of the reason for U.S. domination in the 20th Century.

Today, China holds the resource of the future; and it has proven through its use of quotas and tariffs that it understands that power... Interestingly, the renewable energy standards of the U.S., Germany, and Spain have increased that power by sending hundreds of billions of dollars to China to buy solar panels and wind turbines.

Without rare earths, solar power and wind turbines wouldn't perform at anything like the levels they do today (and while their capacity factors are low relative to other fuels, they are high enough to lead countries to support massive subsidies and tax credits for their emplacement.

China's control over rare earths, and their apparent willingness to use export pricing to reduce competition led Credit Suisse to predict that China will have production capacity equal to two-thirds of the total global solar panel market in 2012 - and it will be turning out panels at a lower cost than current cost leader First Solar, an American firm.

This massive flow of dollars is enabling China to increase its exploration and production of rare earths for civilian and military purposes and leads to uncomfortable questions about the economic effects of renewable energy. Increasingly, it has also led to concerns about the environmental impacts of renewable energy because of Chinese mining and manufacturing processes.

France's Environment Minister Nathalie Kosciusko-Morizet told the French Parliament that most solar panels "were made in China with a highly questionable carbon footprint." That reality led France to cut its feed-in tariffs to reduce the solar subsidies it provided.

Insight believes that U.S. states, particularly Republican-leaning states, will take a very serious second look at their renewable energy programs and solar panels will come under serious scrutiny.