Upcycling: The influence of de-globalization on the supply of technology metals and materials

The principal driver for change that I see in the overall supply picture for technology metals and materials as a result of the end of, and the slow reversal of, globalization is the realization by intelligent people of the need for capitalization of the security of their supply by individual nations. This I believe will re-start many projects that were deemed uneconomical without the added value of security of supply, **and it will make the conservation by recycling of critical materials not only nice but necessary**. The capital may well come from subsidies, both governmental and through apparent "premium" pricing used to enforce industrial policies such as already is in operation in China, Japan, and Korea; and even in the USA as governmental grants officially said to support **innovation** or the **environment**, since direct subsidies for critical materials would go against Washington's neoliberal narrative (also in its death throes along with globalization-its baby). You can chose your own prime mover for this: It can be the political need to create domestic manufacturing jobs or the geo-political need for resource security either to insure those jobs or to become independent of the influence of other nations on your own nation's economy and military preparedness.

The bitter competition among Asia's largest economies, which collectively are nearly twice as large as that of the USA, for natural resources is now the principal driver of demand for all natural resources.

As for the infrastructure metals, so aptly named by my

colleague, Christopher Ecclestone, the USA and Canada are uniquely insulated from global iron, aluminum, copper, zinc, and lead prices, to name the most useful, by not only the domestic presence of existing producing mines, reserve formerly producing mines, currently on care and maintenance, and known mineable deposits, but also by the world's most well developed recycling industry. Europe has far less domestic "mining" resources of these types (Thus the creation of the mercantile empires of the just now historical past), but it, Europe, has a large and well developed recycling industry across not just infrastructure metals but also technology metals and materials. Asia's main industrialized nations until this century were on the periphery of the continent and poorly endowed with natural resources, so they (Japan and Korea) became not only importers but from the very beginning recyclers of all metals, infrastructure and technology. One of the "causes" of Japan's expansion of its Asian war of conquest to include American colonies in World War II, celebrated by economic historians, was certainly the decision by President Roosevelt in 1940 to cut off Japan from exports of American iron, steel, coal, and oil leaving Japan's Imperial Navy with just a six-month supply of fuel, for example.

The advent of the Chinese raw material eating economy of the early 21st century was sudden and dramatic as well as immense. Just as with the American Revolution the world (of resource supply and demand) was literally turned upside down in just a few years. Financial engineers with no regard for future planning or long term outlook wasted enormous amounts of capital "looking for resources" from small investors to milk for "junior mining" schemes while real producing global miners and refiners foolishly overspent their unexpected gifts of capital on the supply of infrastructure metals while allowing scarce technology metals and materials supply as well as demand to move out of their control. The big three of Asian economies, now China as well as Japan and Korea, immediately added recycling to purchasing and domestic mining (China) of

technology metals and materials. This was and is intended for security of supply. All of these nations have explicit or implicit industrial policies of conserving and recycling scarce natural resources necessary to maintain technological parity with each other.

It is time for North America to play catch up on technology metals and materials conservation and recycling. North America has the most diverse supply of natural resources of any continent except Africa. North America also recycles a higher percentage of its infrastructure, transportation, and household “white” metal scrap than any other region on the planet. But as to technology metals and materials North American conservation and recycling has been woefully deficient in recycling even though the region long ago gave up the primary production (often as companion metals) of technology metals and materials. The short sighted financial engineers and politicians of North America have turned a blind eye towards the necessity of self-sufficiency in technology metals and materials.

The recent attempt, so-called, to “revive” rare earth mining in North America was a great success for financial promoters but achieved not one dollar of growth of North American wealth but rather a redistribution of existing assets to promoter fat cats. It is not at all surprising therefore that there also was no downstream supply chain development in the rare earth space in North America during the rare earth “boom.” Why develop processing assets if there is nothing to process and no reason to do so anyway.

But now as globalization reverts (or perhaps “re-sets”) once again (the third time in 125 years) to its primary driver, economic national self-sufficiency, it is time to take a fresh look at the North American technology metals and materials spaces. This time though we needn’t just pretend as the promoters desire us to that exploration has any more than nominal value. The key metrics now have to do with downstream

supply chain development. And this will be measured by the costs and efficiencies of demonstration plants not drill holes, metallurgies, and laboratory results.

First let’s look at the (technology metal) alloying elements used to make modern lightweight corrosion resistant steels: There are plenty of known but mostly undeveloped chromium resources in North America in Quebec and in California/Oregon; there are producing mines for niobium in Quebec today and at least three new ones in development, two in Canada and one in the USA; vanadium is produced as a byproduct of uranium both in the USA and Canada; one of the world’s best developed nickel resources is in Sudbury, Ontario and geographically nearby is North America’s newest nickel mine in Michigan’s Upper Peninsula. Cobalt is produced as a companion metal at the Sudbury nickel complex, and there are primary cobalt deposits both in the USA and Canada. Molybdenum is mined in the USA both as a primary and as a companion (to copper) metal in such volumes that the USA is a net exporter of Molybdenum. Finally tungsten is present in known large deposits in North America and is currently mined in Canada in significant volume. All of these alloying elements are recycled today in the USA for re-use in making new steel alloys.

I am not going to discuss the platinum group metals, since I think they are already in sufficient supply, maintained by a very effective recycling industry in the USA and Europe, so that there will be no platinum group metals shortage so long as the electrification of vehicles by storage battery continues to grow apace. The most well organized scrap industries in the world are the West’s iron and steel, aluminum, copper, lead , nickel, zinc and platinum group metals ones. Just to give an example of efficiency: Lead recycling in the USA accounts for 85% of annual demand for lead; somewhat less of the steel demand is met by recycling, and even the least demand replacement, that for the platinum group metals is already nearly 40% from recycling!

Where the North American manufacturing industry has not done the conservation and recycling job is with technology metals for electronics. This has been principally due to outsourcing and dissemination. Out of sight, out of mind is a good analysis of why seemingly intelligent American sourcing managers have ignored recycling. As recently as last year I was told of a meeting of a rare-earth junior with the PhD (physics) sourcing director of a California electric vehicle manufacturer who confidently told the visitor that his company did not use or buy rare earths. This person was apparently unaware of the rare earth enabled motors, generators, and sensors used in every motor vehicle no matter what the fuel for the power train might be. Yet someone at the same company directs the end of life and scrap lithium ion battery packs from that company's vehicles to a contracted disassembler and the separated cathodes (lithium and cobalt) and anodes (graphite and copper) thus produced to overseas reclaiming operations where the technology metals and materials are extracted, re-purified, and reformed into raw materials for new battery cell manufacturing. One of, if not, the world's largest vehicle manufacturers uses the same disassembler to not only recover the valuable critical technology metals from its lithium ion battery scrap but also from its nickel metal (rare earth) hydride battery scrap. All such prepared scrap is sent either to Japan or Vietnam for "recycling." Waste not want not, seems to be the Asian mantra.

Financial engineers still try to trick us and to squeeze money out of politicians through the fantasy of "urban mining." This is my personal favorite con game. On a regular basis some new venture will announce that it has a "technology" allowing it to recover critical (technology) metals from undifferentiated consumer electronics. Overlooked purposely by promoters of this type of "venture" is the fact that the bulk of these materials are submerged in undifferentiated household garbage intended for landfill. Also overlooked is that the overwhelming revenue from giant garbage (waste) collectors is

in “tipping fees.” The money that they are paid to pick up and take the garbage to “landfills” formerly known as city-dumps. A client of mine recently found out just how basic such collection is when they asked the largest American garbage collector for a price per kilogram of prepared (separated) rare earth permanent magnet scrap. They got the number $35/kg, which wasn’t unreasonable considering the dissemination of such material in household scrap. I had explained to them repeatedly how to get such prepared scrap much much cheaper from within the automotive and white metal scrap supply chains but they wanted to “outsource” the supply rather than develop it. When I go into the market to source such scrap I, of course, find that my competitors are Chinese or Japanese.

The technology metals and materials that could be collected and economically concentrated in the USA from our industrial and consumer scrap are:

- Rare earth battery and magnet component metals,
- Lithium,
- Cobalt, and
- Engineered (anode) graphite

A nascent industry for all of the above already exists in the USA-I am not aware of any domestically owned Canadian ventures at this time.

As the attraction of potential holes-in-the-ground to be filled with money (junior mining projects) subsides we may see “recycling projects” born to fill actual needs and on-shoring of manufacturing picks up again. Be very careful of “urban mining” and “disruptive technologies” put forward as differentiators of projects. Existing technologies are to be replaced **only** when it makes economic sense. The issue in recycling is the difference between the **total** costs and the **total** value of all of the components and materials that make up the devices or components to be recycled. Recycling projects are most often rejected by financiers because the

selling price of one of the recovered metals is less than the cost of it when obtained as the only product from the recycling project. This is an incorrect analysis.

Here’s a new word for small investors and even institutional investors to add to their vocabulary:

Upcycling, also known as creative reuse, is the process of transforming by-products, waste materials, useless, or unwanted products into new materials or products of better quality or for better environmental value. **Upcycling** is the opposite of downcycling, which is the other half of the recycling process.