The decay of American education and the impact on our critical materials supply chain

The off-shoring of America's manufacturing industries that has precipitated the supply chain crisis dominating today's news cycle has had one very ominous and overlooked consequence. **America has lost its lead in people with the experience and skills to re-build and operate critical supply chains across an increasing number of industries**.

Not only has basic research and development in the refining and fabricating of critical metals and materials' products been severely reduced and eroded in North America, but also legacy skills are vanishing due to the simple facts of an aging industrial engineering and science population combined with little interest in the specialized education needed to replace them.

The small remaining critical materials R&D community is concentrated in the academic world where pie-in-the-sky ideas and number of publications, not sales of goods and services, or the good of the country, are the metrics for success. Industrial R&D and legacy manufacturing engineering skills are in short supply with no replenishment system being even contemplated. Government policies are set by academics with no industrial experience. Politicians do not seem to understand how ominous this is, because their information is filtered only through the academic and bureaucratic world.

The vast sums spent on social justice related education at all levels of our society and the emphasis placed on this by government and, increasingly by industry, has replaced the

emphasis on science and engineering that once dominated government and industry's educational focus and has depleted the funding for what remains of that prior focus. T**he current attack on math and science in American K12 education is an ominous portent of national failure to even try to compete globally.**

There can be no "revival" of America's dominance in the production and use of critical materials for our age of technology without a massive reset of educational priorities.

America's "leaders" are set on satisfying the lowest common denominator, through a social media approach to solving problems. Whatever is easy and popular at the moment is the government's answer on everything.

Children have to be motivated from the very beginning of their education to understand the value to themselves and to society of education of the most capable of them in the sciences, engineering, and medicine. This process cannot be interrupted by ideologues without severe long-term consequences. The Chinese realized the importance of science and engineering more than 25 years ago, and they reformed their society's educational goals to ruthless selectivity among their children for the skills required. They have been enormously successful.

After World War II America had a similar awakening. Within 25 years of that ending Americans walked on the moon and science and engineering were celebrated. World War II's industrial R&D was controlled by the government. Afterwards private industry took over and gave the world modern solid state electronics, and a cornucopia of miniaturized electronics followed and changed the world and society forever. That American tsunami of new technologies that forever changed the world has now receded.

Its time either to refocus American education or lose forever our rapidly diminishing lead in technologies.

Biden, the Chinese raw material hunt and the ‘massive’ monazite results of Appia Rare Earths & Uranium

While the Biden Administration fixates on solving the port problem in the United States, China continues to dominate the Western world’s supplies of, when it comes to the bigger picture, critical metals and materials. Literally, at the same time the US government is trying to focus on the issues right in front of it that may disrupt Christmas (*heaven forbid*), Chinese companies continue to seek out and lock up more of the raw materials that will drive the future. In just the last few days, Zijin Mining Group Co., Ltd. launched a C$960 million takeover bid for Canadian domiciled Neo Lithium Corp. (TSXV: NLC | OTCQX: NTTHF), while Contemporary Amperex Technology Co. Limited (CATL), the world’s largest battery supplier and ironically already part owner of Neo Lithium, signed a battery supply deal with U.S. commercial EV maker, Electric Last Mile Solutions Inc. (NASDAQ: ELMS). Three weeks ago CATL made a C$377 million takeover bid for Canada’s Millennial Lithium Corp. (TSXV: ML). Zijin is no stranger to taking out Canadian mining companies having previously acquired Nevsun Resources (C$1.86 billion), Guyana Goldfields (C$323 million), and Continental Gold (C$1.4 billion), and those were just some of its Canadian targets.

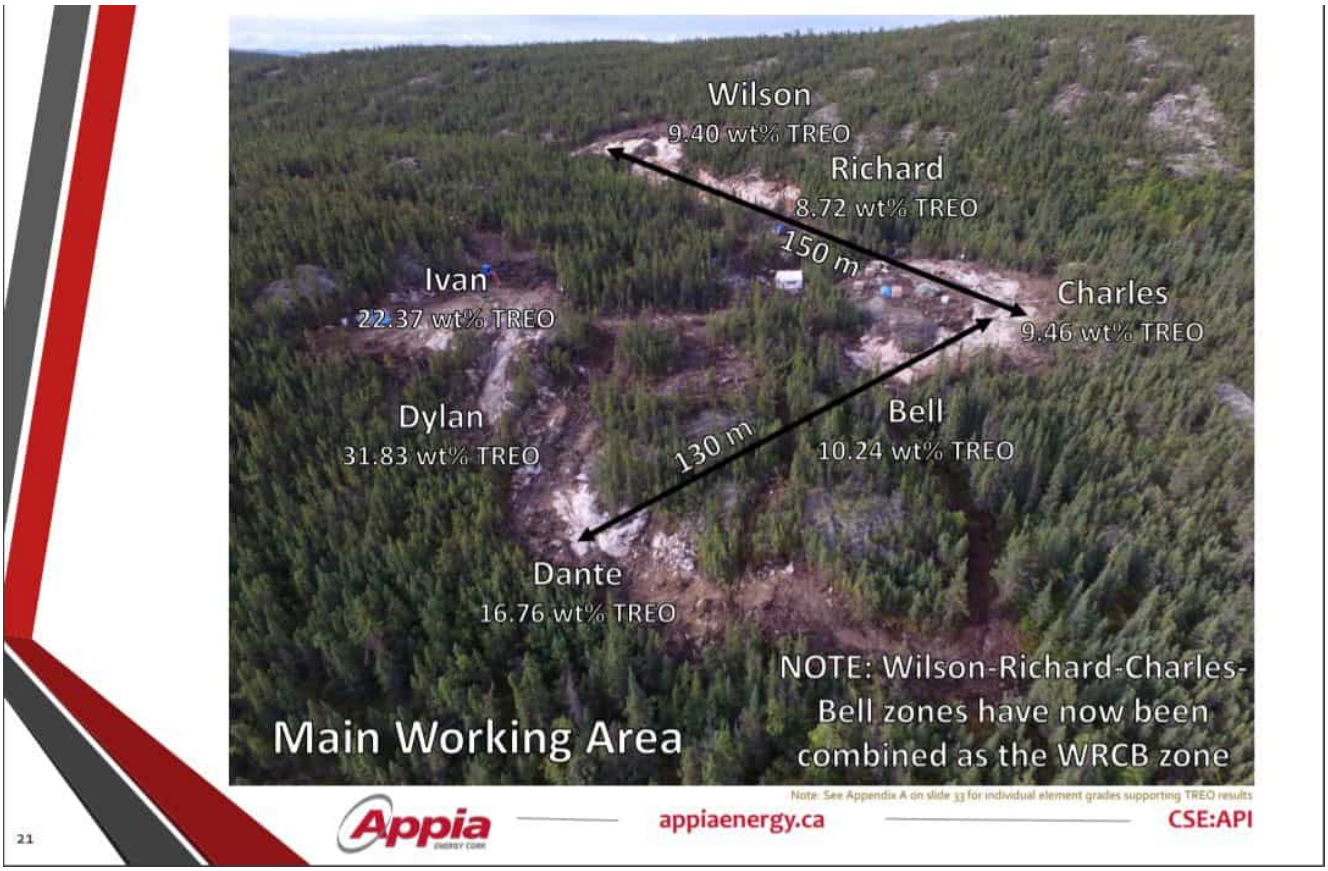
From an investor’s perspective, I guess this takeover activity can be viewed as a good thing given that these Chinese entities are paying full value for their acquisitions. So you get your liquidity event and hopefully have made money to go

off and find the next possible target. But it is disappointing to see the West talk the talk about our greener future but not walk the walk as our leaders appear to be completely oblivious as to how we'll get there if we let China control all the raw materials. I will save that rant for another day. In the meantime let's have a look at a company that could tick the boxes for a potential acquisition by the Chinese.

Of late it seems the flavour of the day is lithium but that isn't the only critical material out there. The Chinese have long since cornered the market for rare earths but if no one is willing to stop them, or even slow them down, then why wouldn't they continue to acquire everything the world will let them. One Canadian junior mining company that could fit the bill is Appia Rare Earths & Uranium Corp. (CSE: API | OTCQB: APAAF), or perhaps you know it by its former name Appia Energy Corp. but that was so yesterday (today is literally the first day trading under its new name). Appia is a Canadian publicly-listed company in the uranium and rare earth element sectors and is currently in its largest exploration and diamond drilling program in the Company's history, focusing on delineating high grade critical rare earth elements, gallium, and uranium on its 100% owned Alces Lake property, as well as exploring for high-grade uranium, in the prolific Athabasca Basin, on its Loranger, North Wollaston, and Eastside properties. Appia has found some of the highest grade samples of neodymium rich monazite on its properties in Saskatchewan.

The Alces Lake discovery of an accessible extensive hard rock deposit of monazite is very important to the world's demand for magnet rare earths. This is because Appia's monazite is neodymium rich, which is the most desirable for the production of rare earth permanent magnets. Not only is it rich in neodymium (Nd) and praseodymium (Pr), but also contains 1% of xenotime, the best heavy rare earth bearing hard rock mineral. The good news is that yesterday the Company announced it has discovered new and previously unknown occurrences of massive

and semi-massive monazite in the Wilson North area of Alces Lake. A total of 27 drill holes (2,460 m) have been completed at the Wilson-Richard-Charles-Bell zones (WRCB), with at least 27 holes (2,360 m) remaining. In total the Company has completed 61 drill holes (4,575 m) including drilling at Biotite Lake (13 holes – 685 m), Danny (7 holes – 430 m) and Sweet Chili Heat (14 holes – 995 m) with monazite occurrences identified in each area. One drill continues to test the continuity and depth extent of the WRCB zones, while the other moves across the property, exploring new drill targets, named Diablo and Oldman River.



Source

With assays pending for all 61 holes drilled to date in the 2021 program, it’s certainly exciting times for Appia. The Wilson North 21-WRC-015 drill hole showed monazite mineralization over 8.85 m from 15.74 m – 24.59 m. As noted above, three other locations also saw monazite occurrences. If the grades in this season’s drill holes match the world class

grades previously announced things could get very interesting very quickly. The Company is well funded to complete this season's drilling with plans to prepare an NI 43-101 report following the conclusion of the current exploration program later this year. With 107.6 million shares outstanding, the current market cap for Appia stands at roughly $82 million. That's chump change given what some of these Chinese companies are throwing around for quality assets.

Keep in mind that for the last few years China has been buying monazite concentrates, thrown off as residues from heavy mineral sands' mining, from all over the world including, until recently, from the USA! China bought 30,000 tonnes last year from Rio Tinto in Southern Africa; and up to another 20,000 tons from Indonesia, Brazil. It is logical to assume that China would have a great interest in a higher grade neodymium rich monazite deposit than Lynas' Mt Weld especially since the Appia material has 1 percent xenotime, which is a higher grade of heavy rare earth rich, xenotime, than Lynas' deposits at Mt Weld.

Appia may be on the cusp of an exciting future.

JC Potvin on Murchison's high-grade Brabant-McKenzie Zinc-Copper-Silver deposit

In a recent InvestorIntel interview, Chris Thompson spoke with Jean-Charles ("JC") Potvin, President, CEO, and Chairman of Murchison Minerals Ltd. (TSXV: MUR) about the positive metallurgical results from Murchison's high-grade Brabant-McKenzie Zinc-Copper-Silver deposit and gave an update on

their HPM battery metals project.

In this InvestorIntel interview, which may also be viewed on YouTube (click here to subscribe to the InvestorIntel Channel), JC said that the Brabant-McKenzie deposit is located close to excellent infrastructure and that the preliminary metallurgical testing on the deposit resulted in a high-grade and clean concentrate with over 90% recovery for zinc and copper using a very simple process. JC also provided an update on Murchison's HPM Project where they recently confirmed multiple prospective nickel-copper-cobalt targets.

To watch the full interview, click here.

About Murchison Minerals Ltd.

Murchison is a Canadian-based exploration company focused on the exploration and development of its HPM nickel-copper-cobalt project in Quebec and its 100%-owned Brabant Lake zinc-copper-silver project in north-central Saskatchewan. The Company holds an option to earn a 100%-interest in the Barraute VMS exploration project also located in Quebec, north of Val d'Or. Murchison currently has 108.9 million shares issued and outstanding.

To learn more about Murchison Minerals Ltd., click here.

Disclaimer: Murchison Minerals Ltd. is an advertorial member of InvestorIntel Corp.

This interview, which was produced by InvestorIntel Corp. (IIC) does not contain, nor does it purport to contain, a summary of all the material information concerning the "Company" being interviewed. IIC offers no representations or warranties that any of the information contained in this interview is accurate or complete.

This presentation may contain"forward-looking statements" within the meaning of applicable Canadian securities

legislation. Forward-looking statements are based on the opinions and assumptions of management of the Company as of the date made. They are inherently susceptible to uncertainty and other factors that could cause actual events/results to differ materially from these forward-looking statements. Additional risks and uncertainties, including those that the Company does not know about now or that it currently deems immaterial, may also adversely affect the Company's business or any investment therein.

Any projections given are principally intended for use as objectives and are not intended, and should not be taken, as assurances that the projected results will be obtained by the Company. The assumptions used may not prove to be accurate and a potential decline in the Company's financial condition or results of operations may negatively impact the value of its securities. Prospective investors are urged to review the Company's profile on Sedar.com and to carry out independent investigations in order to determine their interest in investing in the Company.

If you have any questions surrounding the content of this interview, please email info@investorintel.com.

Scandium International's IX Process offers an extraction technology of critical materials from existing mine

operations

When it comes to producing much needed and valuable critical minerals there are two ways to do this. The traditional way consists of developing a proven deposit into a mine by spending hundreds of millions of dollars, on average, and up to 16.5 years to reach production. However, a far quicker way is to develop and prove a new extraction technology that can selectively recover, as byproducts, critical materials from existing mines. Today's company, Scandium International Mining Corp. (TSX: SCY), has been working on both ways at once, with both their own advanced stage scandium project and also with the creation of a joint venture to use a recent milestone achieved in their, in-house developed, critical materials recovery technology. They are, in addition, working on developing a high purity alumina ("HPA") production technology business.

Scandium International owns 100% of the Nyngan Scandium Project, located in New South Wales, Australia. The Project is at an advanced stage with a DFS completed, all required governmental approvals in place, and is now seeking financing. The Company also owns a 100% interest in the Honeybugle Scandium Property, an exploration property adjacent to the Nyngan Scandium Project.

Scandium International has developed and is ready to deploy an ion exchange ("IX") technology to recover scandium, cobalt, and other critical metals. The Company has also developed a process to manufacture an aluminum-scandium master alloy (Al-Sc2%) from scandium oxide and has a High Purity Alumina ("HPA") manufacturing process. All of these processes are likely to have free-standing value in the critical metals' marketplaces on their own.

Critical metals recovery mining strategy using ion exchange (IX) technology

As a result of Scandium International's IX recovery technology process success, the Company recently announced that it had signed a Letter of Intent ("LOI") with Nevada Gold Mines to pursue critical metals recovery at Nevada Gold Mines' Phoenix Mine, in Nevada, USA. As reported: "The program is anticipated to require 15 months to complete. With program completion, the partners intend to take an investment decision on the construction and operation of a plant facility to recover critical metals from mine solutions. The LOI also outlines key parameters of a partnership, including formation of a joint venture to hold the plant facility, and a 50:50 ownership in the recovery circuit asset."

The net result of the above news is that Scandium International will now get a chance to prove their IX selective recovery technology at scale, and when it is successful, to be able to create a new revenue stream from the 50:50 JV. As stated: "This (critical metals recovery) CMR project, and other similar projects in development, **have the potential to produce material quantities of strategically important metals,** tailored to today's tech-driven products, and can do so from a distributed global copper production base. The environmental impact from this production process is minimal – **no new mines are required**."

Phoenix Mine critical metals recovery Scoping Stage INDICATIVE ONLY economics (not yet reliable)

Source: Scandium International company presentation

I would expect that this could lead to many other similar projects globally to recover added value byproducts from existing mines wanting to capture more critical metals from their mining process. It seems the market remains cautious as the stock price has not reacted yet. Of course, this is not unusual, as it usually takes actual results and dollars to flow before the market wakes up – but therein is the potential opportunity for early investors.

Scandium International stock price has not yet reacted to the potential value-add of their ion exchange (IX) technology to extract critical materials from existing mine operations.

Source: Yahoo Finance

Scandium International states:

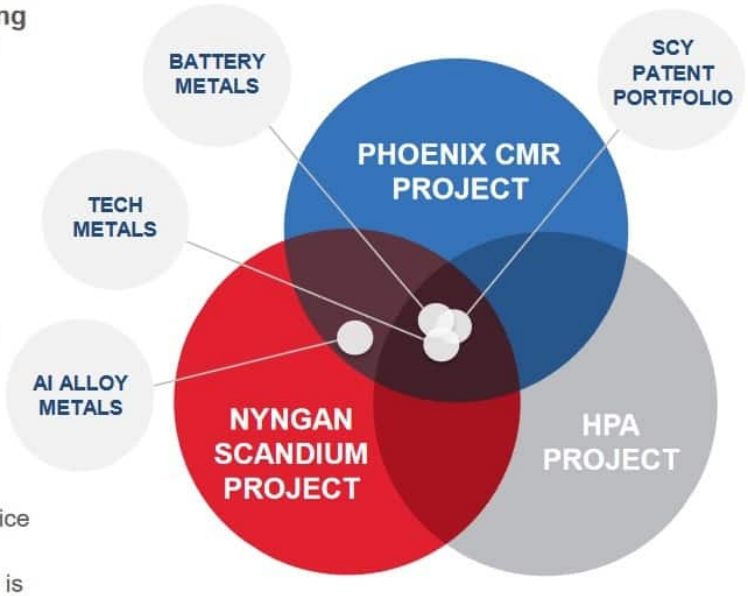
“The Company is also currently pursuing CMR opportunities with various copper industry groups, where SCY proposes to employ ion exchange technology to extract unrecovered critical metals from existing mine process streams. This program represents a fast-track concept to make battery-grade nickel and cobalt products, scandium master alloy product, and other critical metals, from North American sources.”

High purity alumina opportunity

On May 27 Scandium International announced the filing for patent protection on their High Purity Alumina (“HPA”) manufacturing process. Scandium International intends to pursue a business in producing high purity alumina, and to employ the designs and methods contained in the patent application to manufacture HPA, for use in both the LED lighting industry and the lithium-ion battery industry. More details here.

Scandium International has broadened their strategy now with 3 key areas of focus

- **SCY's development focus centers on producing critical minerals needed for next-gen product components.**
  - Everything in the SCY development portfolio has a product offer for batteries.
  - SCY wants to be a materials supplier, not a components manufacturer.
- **Phoenix CMR Project is our focus now.**
  - CMR is a multi-mineral producer concept.
  - The Phoenix project product suite is supported by established metals markets.
- **The two new projects are fast to market, and also environmentally friendly.**
  - Much faster to develop than mine alternatives.
  - Both have low environmental impacts and service ESG-positive applications.
  - Both have initiating potential in the USA, which is our intent.



Source: Scandium International company presentation

Closing remarks

It is still early days for Scandium International in regards to commercializing their ion exchange critical metals recovery technology. However recent news gives significant impetus to the idea that one day the process will become a significant regular commercial success with wide application in commercial mining.

Scandium International is concurrently developing their high grade Nyngan Scandium Project in Australia and multiple high-purity alumina and aluminum-scandium master alloy opportunities.

Trading on a market cap of just C$52 million there is a lot to like about the potential of Scandium International Mining Corp. Stay tuned for more developments.

Disclosure: The author is long Scandium International Mining Corp. (TSX: SCY)

China Is Consolidating its Industrial Economy – The Case of the “Medium and Heavy Rare Earths’ Industry”

Perhaps the most significant announcement in the commodity space last week, one that was almost completely overlooked by the mainstream press, although it was picked up by some of the the “wire” services, and the New York Times, was the announcement that the Chinese “medium [samarium, europium, and gadolinium] and heavy {mainly terbium, dysprosium, and yttrium] rare earth producers and processors” were consolidating their operations. Those of you who follow the Chinese rare earth industry know that in the mid-teens [around 2015] China’s mandarins reformed the Chinese rare earth industry by consolidating all of its operations under the umbrella of just 6 companies, which each became responsible for the rare earth companies in their geographic areas meeting and not exceeding their government specified quotas for production and processing. The ostensible purpose of this initial consolidation was twofold. It was intended to corral illegal rare earth mining and to address the rampant pollution from all domestic Chinese rare earth mining.

Most of my “in-the-know” colleagues scoffed at both stated purposes. They said that no one could or wanted to control Chinese illegal mining and no one in China really cared about pollution. They were all wrong; they did not understand that these goals were set by China’s president, Xi Jinping, and that it would be very unhealthy for any Chinese businessman to scoff at these goals or to impede them.

For most of the last two years the production of heavy rare earths from China's ionic clays has been completely curtailed due to pollution, and China today is importing more than a third of its rare earth bearing ore concentrates including most of its needs for heavy rare earths. This is a result not only of the crackdown on pollution but to continue the ban on working Chinese ionic clays, both to reduce pollution and to conserve a scarce and diminishing resource.

Last week the Chinese government announced the implementation of a second phase of consolidation in its domestic rare earths' industry. Two or three of the six rare earths' production managing companies will merge their medium and heavy rare earths' operations to form just one Chinese manager of all of China's medium and heavy rare earth production centered on the city of Ganzhou, which is the center of the Chinese medium and heavy rare earth industry.

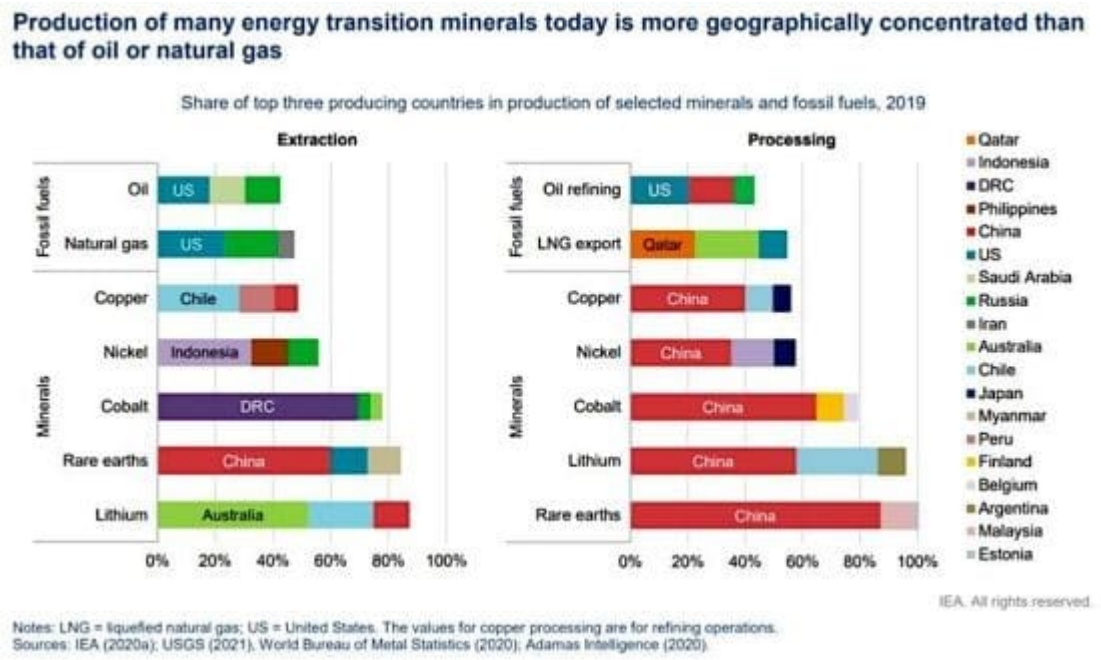
My guess is that before 2025 a third phase, the consolidation of all Chinese rare earths' production and processing, light, medium, and heavy, will be announced and implemented so that there will be then just one Chinese Rare Earths producer and processor. If that happens then there will be no possibility of any non-Chinese company controlling the prices, or supply, of rare earths.

I doubt that any nation or region that has not secured a sufficient supply of rare earths for its critical needs by 2025 will never after that be able to do so. China today has not only a near monopoly on all rare earths production and processing but also has a monopsony of demand for rare earth permanent magnets. The numerical size of the Chinese domestic market is twice that of the USA and Europe combined, and the Chinese Communist Party's plan, also known as Xi Jinping "thought," is for every Chinese to have the world's highest standard of living by 2049. That's going to require a billion EVs, billions of home appliances, and thousands of passenger aircraft, just to name a few large-scale users of rare earth

permanent magnets.

Its becoming harder and harder for Western companies to pretend that their fiercest competitor is not China, Inc. Its also harder and harder to believe that Xi's "dual circulation" [in which domestic consumption grows to be greater than export volumes] reformation of the approach to China's economy is not already dominant.

To achieve its goal of being the world's richest nation by 2049 China has already implemented its plan to become the world center of critical metals processing. Its progress is apparent from the graph below.



In reality, all Chinese businesses are SOEs, state-owned-companies, because they all take their direction from Beijing.

The centralization of China's critical metals industries is well underway. Rare Earth production and processing is just the beginning.

Avoiding A Critical Technology Metals (Lithium, Cobalt and Nickel) Disaster in the Real World

Mineral economists advising the U.S. government make mathematical models to predict real world outcomes even though they do not know if they have failed to include an important, even critical factor, or if they have the right data, until the model, as it always does, fails to reproduce real world measured results. Even then they do not know what is missing, because if they did, they would have included it in the first place. Because Cancel Culture now dominates the increasingly authoritarian and intolerant (of "different" ideas) world view of academic administrators, even physical scientists have succumbed to the nonsense of calling out, as biased, and refuting, various data, and its interpretation, which in the past was regularly included in models, thus distancing the models' results even further from reality.

The mistakes this incomplete or even just false modeling makes in the social sciences are bad enough, but in the case of mineral economics it could be fatal to the continuation of American global military hegemony.

Earlier this week, a publication called the "Rare Earth Observer" put it quite well. The author said that "… the Green New Deal utopians have no idea of the cost and difficulties of creating an entire new infrastructure. Nor do they understand that a new infrastructure would generate enormous carbon emissions by itself. ***Nor do they understand that the minerals and materials that go into electric power and batteries and new electricity grids and so forth are simply not available to the United States at the present time….***"

American Federal bureaucrats are almost uniformly drawn from the academic or governmental staffs' worlds. Hands on experience is rare although STEM degrees are not.

The models used by the United States' Geological Survey, once the mineral world's gold standard, today describe known, developed, mineral deposits (aka, mines) by calling them "resources." But a resource is on a ticking countdown clock. The "life" of a mine is the length of time it is projected to deliver a mineral, profitably. This means in practice how long the mine's ore grade will be high enough to make recovery and extraction profitable with known technologies. The minerals that might be able, someday, to be recovered ***economically*** are called "reserves."

A mineral not in parts of the earth that is currently accessible physically or technologically or both is known as a reserve, a very fluid term. The ocean or an asteroid can be styled as a deposit and then the economically unobtainable minerals become "reserves."

The only minerals that matter are those that can be extracted economically with proven technology.

Here is the reasoning of an American bureaucrat, or, sadly, a procurement officer at an American OEM car maker: To produce 50% of our product line as BEVs, battery powered electrics, will require enough lithium, cobalt, and nickel to make 10,000,000 100 kWh lithium ion batteries per year. This will require 160,000 tons of lithium annually. **That is twice as much lithium in total as was produced in 2019.** But the learned mineral economists at several New York and London based banks have written that lithium production by 2030 will be 14 times today's level, so using this wisdom plus my reading of the global lithium "reserves" at millions of tons in government (drum roll) official publications, such as the Federal Reserve's "Dick and Jane Can Produce Anything You Can Dream Up at No Added Cost," I, the bureaucrat or sourcing executive,

conclude that I can make as many BEVs as my President directs, so there. By the way, as the production of lithium increases and is increasingly expensive the cost will go down due to “economy of scale.”

In summary, to make the world green simply suspend rational thinking, real world data, learned expertise, and, last, but not least, common sense.

If this nonsense persists all critical technology metals are going to be very very expensive as resources are used up.

Lifton challenges the Green Elite Environmentalists to provide real evidence of an industrial park powered solely on alternative energy

Following the Engineering as well as the Science: Misrepresenting the Type of Energy Production Needs for the Supply of and the Demand for Basic as well as Critical Materials

Our civilization, the age of steel, cannot continue without fossil-fueled or nuclear-fueled baseload electricity generation. So when some ask why are the Chinese building a new fossil fuel fired baseload electrical generation plant on

a biweekly basis, and why are they building dozens of nuclear plants for the same purpose? It's because they know that for maintaining their heavy industrial raw material and manufacturing industries unreliable, intermittent power plants cannot be used and battery storage cannot be engineered to supply the needed continuous heavy industrial loads.

The popularization of science gives cover to many journalists, who simply don't know what they're talking about, to rely on a recent neologism known as "settled science," which is an oxymoronic contradiction in terms. It would be more realistic to speak of "settled engineering," but that would require quite a bit of physics, chemistry, metallurgy, and mathematics to comprehend. Be aware that once an engineering design is completed, erected, and operational a great deal of time and money has been expended and any changes can only be made at the margin without having to scrap the operation. This is why so-called "disruptive technologies" don't matter to existing basic and critical metals operations nearly as much as getting settled engineering to work efficiently. This, in fact, was one of the reasons that Molycorp failed financially. The engineering of chemistry, for example, that allows the mass production of iron, steel, aluminum and copper has been essentially the same for nearly a century and a half. The engineering of the production of the raw materials to manufacture rare earth permanent magnets was "settled" a half-century ago when the magnets and the demand for them became large enough to require commercialization.

I do not consider someone to be dumb because they don't know or even know of the second law of thermodynamics. I don't consider them dumb if they know of the law but don't understand its applications to the mining, ore beneficiation, extraction, separation, purification, transformation into metals and alloys, and the fabrication from those metals and alloys of forms suitable for the manufacturing of consumer and military goods; I do, however, consider those who ignore the

needs for and types of energy production required for each and every one of the aforementioned steps in the supply chain just detailed here, but pontificate upon green energy anyway, as if the need for fossil/nuclear fueled baseload wasn't a consideration, as dumb.

Every step in the production of a metal from its ores is an application that produces negative entropy. This means that the forms in which we find every natural resource on the earth, both fuel and nonfuel minerals is, when found, already in its natural, highest energy, state for its environment. In order to change that state into one in which we can use the materials requires that we temporarily alter the natural state of the resource by chemically and electrochemically rearranging its energy status and therefore making it metastable in our environment but useful in human terms.

Let's look at the production of steel, the most produced metal (annually) on the planet for the past 150 years, which is, in fact, an alloy of iron.

In its natural state on and near the surface of the earth iron occurs as fully oxidized chemical compounds, the highest energy form of iron that the earth's crust, oceans, and atmosphere allow to be stable at STP (standard temperature and pressure).

For each chemical element, there is only one total energy path that can be taken to put it temporarily into its lowest energy form as a pure chemical element at STP. To achieve that path chemical, metallurgical, and mechanical engineers must cooperate and always compromise with nature's rules.

For the use of iron, and every other chemical element, that path begins with economic considerations: How much iron, proportionately, and measured as metal, at STP, is in the mineral chosen for its entry into the steel supply chain? The higher the iron content (grade) the less overall energy will

be required to convert it to a metallic form. Simultaneously it must be determined how much tonnage of iron bearing mineral of this grade is in the deposit (This is known as the "resource" in mining jargon).

Miners then determine by a Techno Economic Analysis (TEA) (An academic acronym for figuring out if something can be done economically with known technologies) whether developing the deposit into a mine is feasible (I.e., is a profitable venture) in the (mining) near term.

To do a TEA miners must consider not just the amount of iron that can be produced annually but also the projected "life of the mine," which is a measure of the total amount of iron that can be economically recovered from the project over time. This is measured as how long the mine can produce sufficient output annually to be profitable.

Whether an iron ore deposit can be economically turned into a mine depends not only upon the grade and total tonnage but upon its accessibility and amenability to the machines needed to dig out the ore, the chemical engineering necessary to beneficiate (concentrate) the ore to as high an iron content as possible, and the chemical engineering necessary to process the ore concentrate into crude metallic iron.

With the last step (there are many more) mentioned above comes a dilemma for the Green Elite Environmentalists (GEEs). The conversion of iron ore to pig iron requires a large amount of continuous heat energy. For a blast furnace, the type typically used to reduce iron ore to crude metallic iron, this heat can be supplied by the combustion of coal or natural gas or by electricity. In all cases, the heating must be constant (uninterrupted). The idea of using wind or solar for this is ridiculous. It gets even more ridiculous when the next stage, the conversion of iron into steel is examined. In the USA today 70% of steel is produced by Electric Arc Furnaces using scrap. The arc in those furnaces is maintained at 10,000 to

20,000 amperes, for sometimes more than a day. What solar, wind, or battery field, or any combination of them can supply this without massive costly (and pointless, economically, if alternatives are available) engineering

Thermodynamics requires that to produce a ton of steel requires 440 kwh of energy. Today in the United States that costs around $50.00.

As soon as the switch to alternate energy impacts the cost of baseload fuels and the price of electricity so much that even politicians can understand it the great unthinking public may realize that baseload electricity for air conditioning and water pumping is a small price to pay to adapt to any small increase in temperature, if it ever occurs. I doubt that any culture will allow a return to the thirteenth century BC, when steel was more valuable than gold.