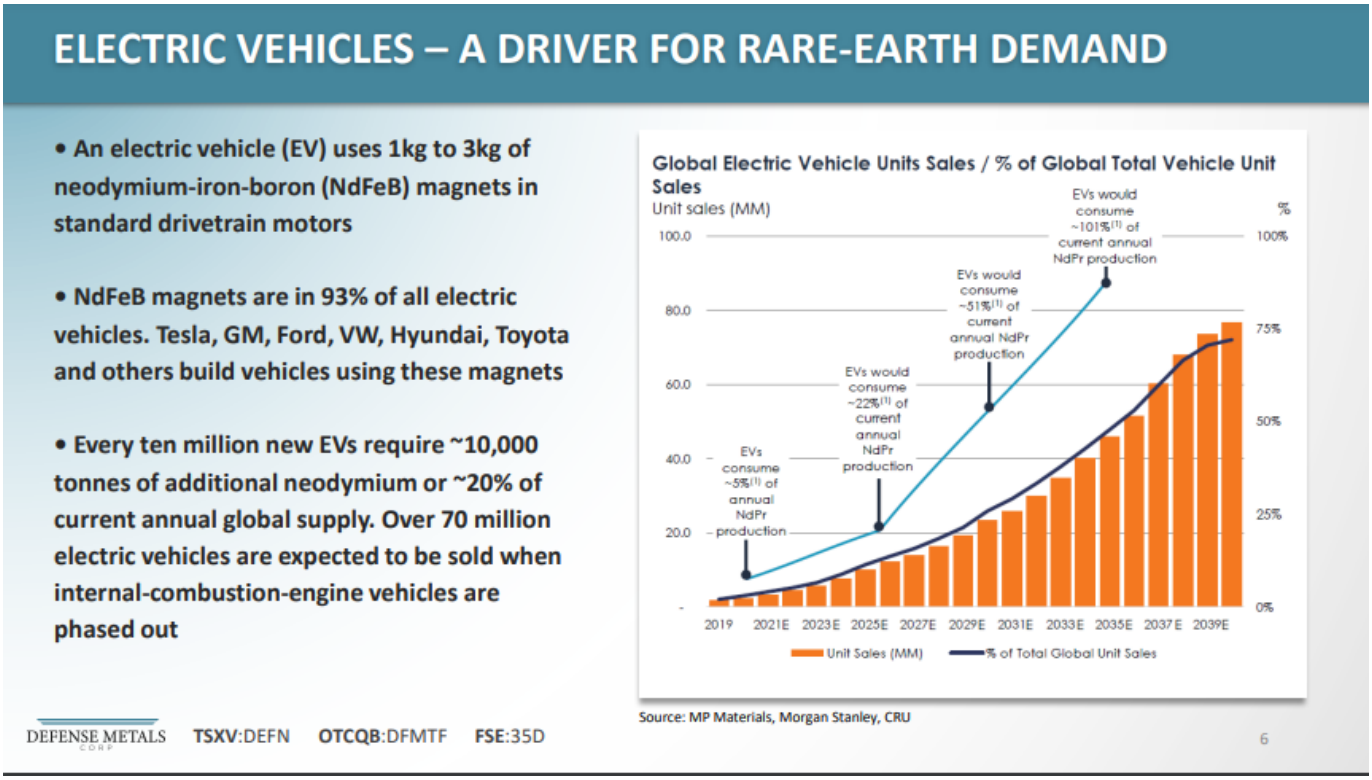
With plans to become a significant producer of the magnet rare earths, Defense Metals deserves a deeper dive

written by Tracy Weslosky | October 13, 2022

The Wicheeda Project plans to produce 25,000tpa of REO which represents ~10% of the current global production

Magnet rare earths demand is forecast to surge this decade. This is because an electric vehicle ("EV") uses 1kg to 3kg of neodymium–iron–boron ("NdFeB") magnets in standard drivetrain electric motors. NdFeB magnets are in 93% of all EVs. Global demand for EVs is expected to grow from 6.75 million in 2021 to over 70 million by (or before) 2040. This will require huge amounts of neodymium.

Every ten million new EVs require ~10,000 tonnes of additional neodymium or ~20% of the current annual global supply



Source: [Company presentation]

The key problem for the EV industry is where will the new magnet rare earths supply come from and can the West become independent from Chinese supply. Today's company is working towards a solution.

[Defense Metals Corp.] (TSXV: DEFN | OTCQB: DFMTF | Frankfurt: 35D) ('Defense Metals') plans to become a significant producer of the magnet rare earths neodymium and praseodymium from their 100% owned Wicheeda Rare Earth Element Project spread over 4,244 hectares and located 80 km northeast of Prince George, British Columbia, Canada.

Brought to my attention a few dozen times over the last 2-years, I am fond of Dr William Bird, Director – who is deemed a leader in understanding rare earths in our sector; and likewise, President & Director Luisa Moreno who has at least 10,000 professional hours in this sector by now I suspect. With a PhD in Materials Science and Mechanics, this is the theme we are stressing at the [Critical Minerals Summit] on Wednesday, November

9th and that is the scarcity of talented professionals with both the experience and education to tackle the formidable task of creating a decarbonized economy.

The Project has an Indicated Mineral Resource of 5 million tonnes averaging 2.95% LREO ("Light Rare Earth Oxide"), and an Inferred Mineral Resource of 29.5 million tonnes averaging 1.83% LREO. Key rare earths contained include neodymium (Nd) and praseodymium (Pd), as well as cerium (Ce) and lanthanum (La). The Resource is amenable to an open pit project and contains a mix of monazite and bastnaesite ore.

Some of the best drill results to date at the Wicheeda Rare Earth Element Project include:

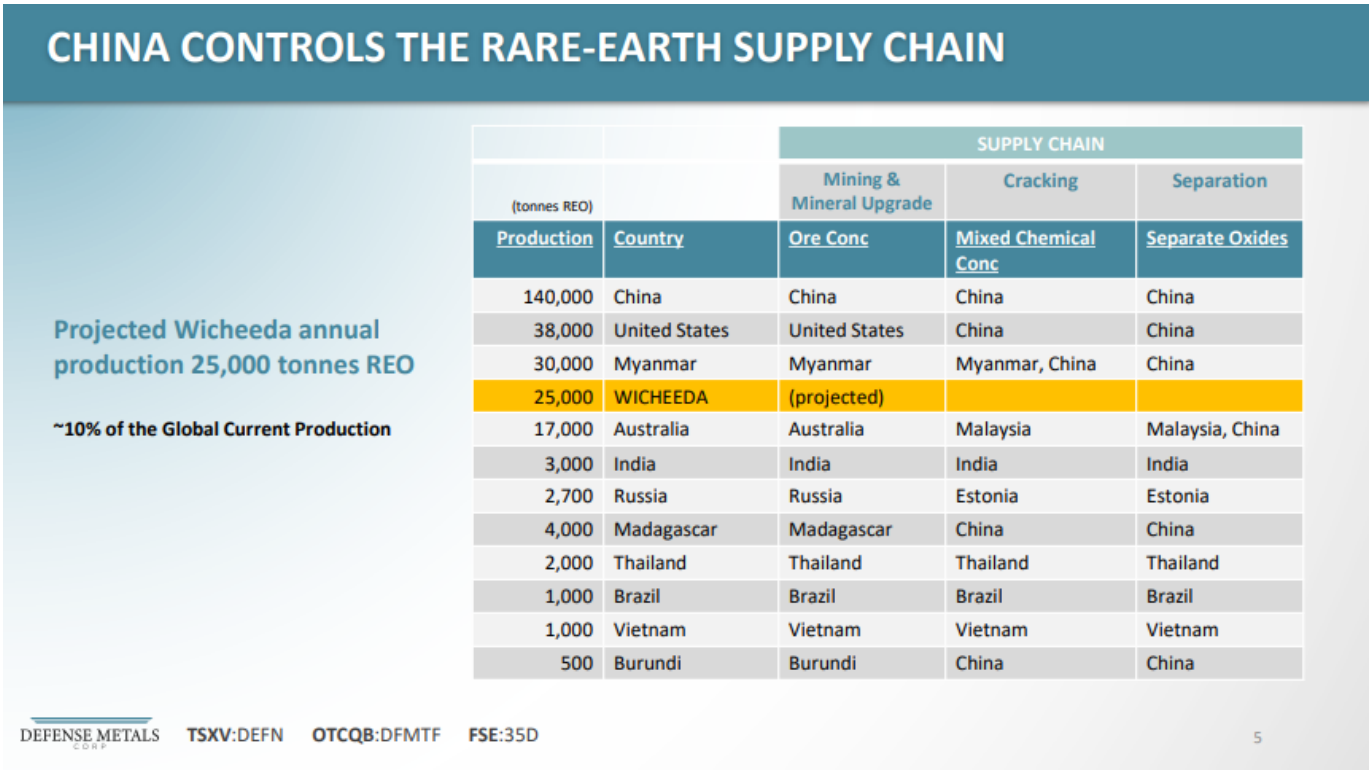
- WI21-49 – 3.79% Total Rare Earth Oxide ("TREO") over 150 Metres
- WI21-54 – 3.81% TREO over 117 metres.
- I21-58 – 3.09% TREO over 251 metres.
- WI21-59 – 2.76% TREO over 212 metres.

Strong PEA result with a NPV8% of C$517 million

The Wicheeda Project PEA (Jan. 2022) resulted in a post–tax NPV8% of C$517 million and a post-tax IRR of 18%, using a price assumption of US$100/kg NdPr. Initial CapEx is estimated at C$440 million.

Once in production Defense Metals targets to produce 25,423tpa of REO over a 16 year mine life, which would make the company a globally significant rare earths producer with ~10% of the current global production.

The Wicheeda Project plans to produce ~25,000tpa of REO which represents ~10% of the current global production

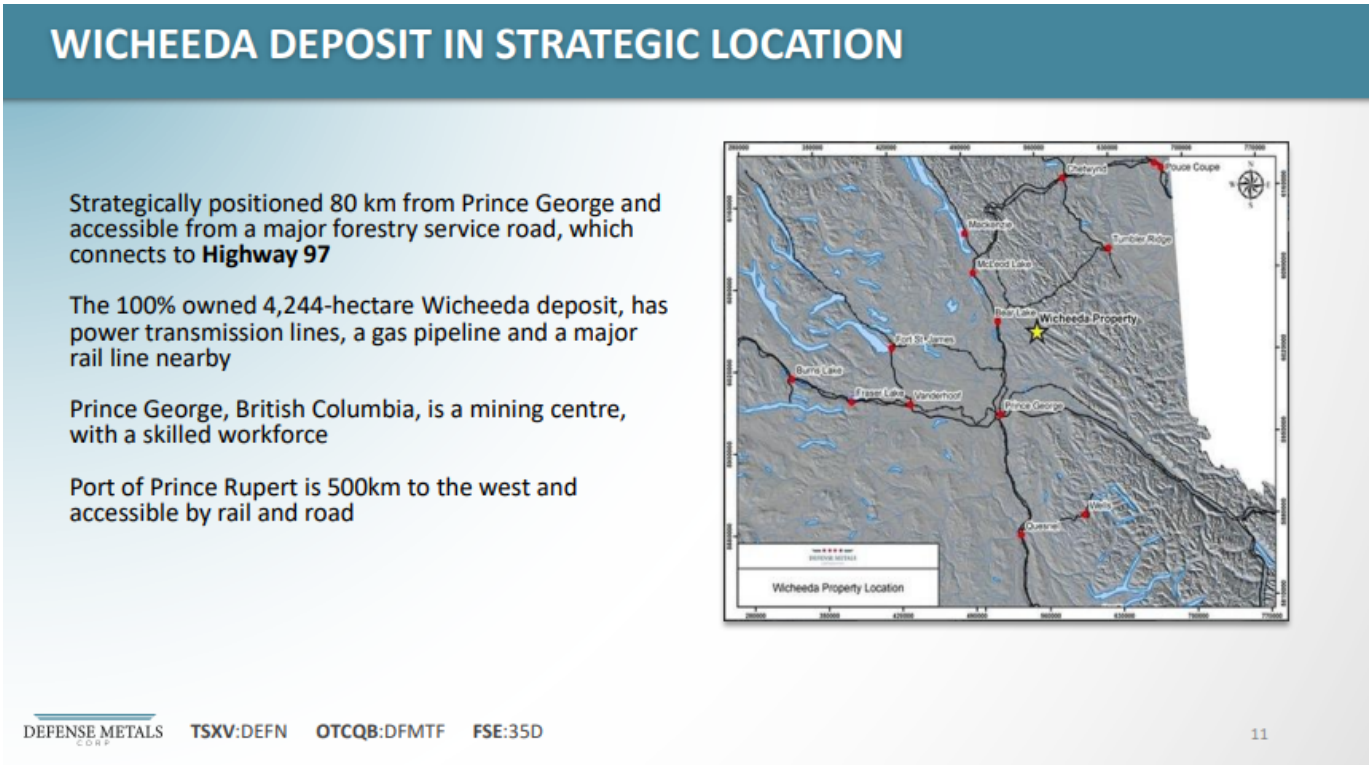


Source: [Company presentation]

The Wicheeda Project is accessible by a major forestry road that connects to a highway, with the town of Prince George 80kms away. Power lines and a gas pipeline are <40kms away and a major rail line is nearby.

Next steps for Defense Metals include a PFS to be completed in H1 2023, a pilot plant in 2024, and a FS completed in 2025.

The Wicheeda Project location map and key points showing adequate road access and reasonable local infrastructure including access to power and gas <40kms away



Source: [Company presentation]

Given the size and quality of the resource, safe location in Canada (with forestry road access, power & gas not too far away) and strong fundamentals supporting key magnet rare earths demand this decade; most investors would agree Defense Metals is worthy of a deeper look. Defense Metals current market cap is [C$44 million.]

Rare earths giant MP Materials invests heavily to rebuild a U.S. magnetics supply chain

written by InvestorNews | October 13, 2022

Taking private companies public through alternative investment

vehicles, such as special-purpose acquisition companies (SPAC), was a popular trend in 2020 and 2021. SPAC and other deals, such as Fortress Value Acquisition Corp (FVAC), have come under scrutiny by some parties as a cash grab. However, there are multiple success stories that have been able to secure investor trust.

One company who did not fall victim to this hype is MP Materials Corp. (NYSE: MP). In fact, MP Materials has continued to impress investors since the company went public through a FVAC in December 2020. Operating the only rare earth mining and processing facility in the United States, MP Materials is poised to continue to deliver rare earths (RE) to US customers whose appetite for these materials is nearly endless.

MP Materials primarily provides lanthanum, cerium, and neodymium-praseodymium oxide. Interestingly, MP Materials has both support from the commercial and military sectors. We reported back in December that General Motors (GM) struck a deal with MP Materials to supply U.S.-sourced and manufactured rare earth materials, alloy, and finished magnets for GM's electric vehicle programs. MP Materials plans to ramp up production to support this effort in 2023, but it remains to be seen if they can meet that aggressive timeline.

The Department of Defense will help contribute to the continued operation of the Mountain Pass facility. MP Materials was awarded a $35 million contract through the Industrial Base Analysis and Sustainment Program to support heavy rare earth elements (HREE) mining. These materials are critical to the development of permanent magnets that are key components in various products, from wind turbines to missile systems.

The Mountain Pass facility already has the capability to mine and process light rare earth elements (LREEs). The added

capability to mine HREE will enable MP Materials to mine all rare earths for high-performance magnet production. The company will also be able to recycle all recoverable rare earths from end-of-life magnets and magnet production scrap.

The company is currently building a 200,000 sq. ft. greenfield metal, alloy, and neodymium-iron-boron (NdFeB) magnet manufacturing facility in Fort Worth, Texas. This facility will also serve as the business and engineering headquarters for MP Magnetics. Materials mined at Mountain Pass will be processed and transformed into products at the Texas-based facility. Construction of this facility began in April 2022.

These exciting new developments and other macroeconomic forces have led to a positive outlook for MP Materials. The company had a promising first quarter of 2022 and beat market expectations. MP Materials posted revenues of $166 million—surpassing the $132 million expected—and boasted earnings per share of $0.50 (as opposed to the $0.38 expected).

Revenue increased 177% year-over-year from increases in the realized price of rare earth oxide from higher demand for rare earths. The increase in revenue was also in part due to the amount of rare earth oxide sold, which occurred due to higher production volumes and shipment timings.

MP Materials also had a significant amount of free cash flow in quarter one, but that will likely change throughout the rest of 2022. The company plans to continue to heavily invest in its assets this year. These investments could result in a negative free cash flow in 2022.

It remains to be seen whether MP Materials can meet the bold promises that management is aiming for. Improving rare-earth supply chains in the United States is a massive challenge, but currently, MP Materials has a chance to get there.

Get Ready, Get Set, Go – EV Demand Raises the Boron Bull Flag.

written by InvestorNews | October 13, 2022

NASDAQ listed 5E Advanced Materials is building a vertically integrated boron products operation in California to supply growing EV and decarbonization demands

Today we take a look at the chemical element boron and at a NASDAQ-listed boron company with a globally significant boron resource in California. 'Boron' is element number 5 in the periodic table and its demand is growing as we move towards a green energy and electric vehicle (EV) future. That is because boron is lightweight, very hard (boron carbide), and has strong heat and corrosion resistance. It is also quite rare, making up just 0.001% by weight of the Earth's crust.

About 2.5–3.0% of an EVs weight is boron, or put another way there is about 46–50 kg of boron in the form of alloys in a passenger EV. Examples of boron use in EVs include high-strength boron–infused steel and boron containing magnets used in drivetrains. Boron alloys and compounds are also used in solar panels and wind turbines, in micronutrients and super fertilisers, in nuclear reactors, and in military applications such as boron-infused tank armor plating.

Boron demand is increasing especially in the areas of green energy (decarbonization applications). Boron demand is forecast to grow 10x by 2050, with a supply gap (deficit) forecast to widen from the end of 2022. ~60% of global boron supply comes from Turkey and its state-owned assets and 85% of global supply comes from just two companies (Eti Maden & Rio Tinto).

Note: When you hear about electric motors being made with NdFeB permanent magnets, the 'B' refers to boron.

Boron uses

Source: 5E Advanced Materials company presentation

Boron supply gap forecast from end 2022 as demand increases and the new pipleine of projects supply is small

Source: 5E Advanced Materials website – Boron 101

5E Advanced Materials Inc.

5E Advanced Materials Inc. (NASDAQ: FEAM | ASX: 5EA) (5E) core business is founded on its low cost, light environmental touch, boron resource in Southern California, USA. According to 5E: "The Resource is designated Critical Infrastructure by the U.S. government and is the largest known conventional boron deposit globally."

5E is building a BORON^{+} Advanced Materials business that operates across the value chain from resource extraction, to refinement, to distribution. The business is backward integrated from customer product offering into processing and extraction methods. In other words, 5E finds the customer first and then

works backwards from there.

The 100% owned Fort Cady Project in Southern California has a Total Resource of ~327 million tons at 8.22% boric acid content and 323ppm lithium. The Total JORC Code Compliant Mineral Resource Estimate is 120.44 million tons at 6.51% B2O3, 11.57% H3BO3 and 344ppm lithium. Either way, it is a very large resource with a high boron content and some lithium by-product.

5E has already achieved an eDFS for Fort Cady and has all substantive permits in place. Next steps in 2022 will include a BFS, a small scale boron facility, and advancing off-take and potential partnerships. Beyond that production is targeted to begin by 2024+, subject to the above steps being completed.

5E's management and board have a wealth of relevant experience including CEO Henri Tausch having worked for Honeywell and COO Tyson Hall having worked for lithium giant Albemarle.

There are very few near term new boron projects, especially now that the Serbia government has blocked Jadar

Source: 5E Advanced Materials company presentation

Closing remarks

It is quite interesting that an EV has about the same amount of boron as lithium. As a critical technology material boron's use in rare earth permanent magnets is, indeed, critical. As an essential structural material boron's use in the many alloys and glass in an EV is necessary for light-weighting of the vehicle. While there are 100's of junior lithium miners scrambling to meet future lithium demand, there are very few companies focused on boron. Therein lies the opportunity. Even more important is the fact that 5E has a USA based project. It should not be

overlooked, either, that 5E's boron deposit is the largest one known in the world.

5E has recently listed on the NASDAQ under the ticker "FEAM" so this should start to raise more awareness about the company and the 'under the radar' demand boom for boron potentially ahead as the green revolution takes off.

5E Advanced Materials Inc. trades on a market cap of US$801 million.

General Motors engages with MP and Germany's Vakuumschmelze for Rare Earth Permanent Magnets

written by Jack Lifton | October 13, 2022

General Motors (NYSE: GM), has announced supplier agreements with both U.S. Based, MP Materials Corp. (NYSE: MP), and with Germany's Vacuumschmelze (VAC). This is very significant news, I think, because it means that GM will engage to support (financially, most likely,) Germany's Vacuumschmelze to enter the U.S. market and to expand its existing sintered rare earth permanent magnet (REPM) production by adding (unspecified) capacity in the USA. It's unlikely that VAC will drop any German (EU) customers, so to supply GM, it will add U.S. capacity. VAC says that it will add that capacity and begin U.S. production of REPMs for GM by 2024. America's MP Materials is also to be

engaged by GM as a REPM supplier, and I suspect, as a future supplier to VAC of NdPr metal as raw material for VAC domestic American REPM production for GM. The UK's Less Common Metals (LCM) is the only non-Chinese (perhaps also non-Japanese) supplier to VAC of rare earth metals now, but LCM can only produce 120 tpa of Nd metal at this time, and thus can support only 400 tpa of domestically produced (in the UK or EU) REPMs of the sintered Neodymium-iron-boron (NdFeB) type. LCM's customer is VAC, whose customer for REPMs is most likely Daimler, for its (Daimler's) in house electric motor production (in Germany now but to be expanded to the UK).

I think it very likely that Daimler is supporting VAC to also expand its capacity, in Europe, for its needs for sintered REPMs of the NdFeB type. Daimler and VAC also need to find additional Nd metal supplies for VAC in Europe. I won't be surprised if LCM is bought by Daimler or financed by Daimler to expand its rare earth metals production capacity.

No OEM car maker wants to single-source a critical production part, so that this announcement doesn't mean that GM is going to rely on just VAC or MP Materials for REPMs. It's not unusual that GM will support MP Materials also at the same time as VAC to ensure that it has a principal supplier and at least one second source. This has long been the automotive industry's standard sourcing procedure. In this case, the experienced and existing VAC is to be the principal supplier, and MP Materials will be a second source.

I suspect additional future suppliers of REPMs chosen by GM are undergoing due diligence right now.

VAC is really the Western World's (outside of Japan) largest, perhaps only, OEM of REPMs for automotive production use. It is thus the only choice currently for a non-Chinese Western OEM

automaker who wants “domestic” REPMs. But its capacity, currently only in Europe, is probably sold out to EU-based OEMs. This is the reason that to expand into the domestic American market it needs to add capacity, and this is the reason that GM is “supporting” VAC in building an REPM plant in the USA dedicated to the supply of GM. Magnet makers can only make magnets if they have secure supplies of raw materials, at competitive prices, and dedicated customers who will pay for finished goods by an indexed (to raw material costs) price. This is NOT the traditional pricing agenda in the OEM automotive industry. Fixed prices over the life of the contract are standard, and, in fact, the wild ride of neodymium prices in the last year has made REPM manufacturing for the OEM automotive parts industry a nightmare for those with the traditional fixed-price-for-the-life-of-the-contracts with OEM automotive. It’s very unlikely that VAC would commit to building a (just-in-time[?]) U.S. plant for a customer without financial assistance and guarantees and an indexed price. I hope that both GM and VAC will let us know if GM has “broken” protocol. This will have a lot to do with achieving any government subsidies for domestic REPM manufacturing.

Now for the bad news. A typical GM EV using the Ultium(TM) platform power train (a lithium-ion battery and an electric motor), if it uses a REPM based motor (REPMM) will need between 2.5 and 5 kg of NdFeB magnets. A 1000 tpa REPM facility can thus supply the needs for REPMMs of between 200,000 and 400,000 new cars. GM has consistently been making about 3,000,000 cars and trucks per year in the USA (forget 2020. It’s an outlier). So, to convert its domestic production to EVs entirely GM would need a maximum of 10,000 tpa of sintered NdFeB, REPMs. There is today no domestic REPM production capacity in North America. It will take a long time, if it even ever can be done, to achieve such a REPM capacity in the USA. But even if it is possible, it would

only be possible with guaranteed pricing for the feedstock raw materials (separated rare earths, rare earth metals, and magnet alloys), and a guaranteed competitive REPM price for a break-even capacity.) This is not just a monumental supply chain cost management problem; it is a complete break with legacy OEM Automotive sourcing cost structure management, because it makes REPM and REPMM costs unpredictable!

In my opinion, GM is not solving the domestic REPM supply chain problem; it is addressing it, rather than just talking about it as politicians are wont to do. GM is putting its money where its mouth is.

But, GM is not the only OEM car maker that produces or sells products into North America's nearly 20 million unit per year market. Total conversion of that market to EVs that use REPMMs would need 60,000+ tpa of REPMs annually. Europe's car market is larger than North America's, and China's domestic market is larger than Europe's. Today, China alone has the existing capacity in REPMs, REPMMs, and Lithium to transform its domestic car market production entirely to EVs, and it has announced that it will reach 20% of that goal by 2025 and 40% by 2030.

Projections of near-term EV production proportions for the American and European markets are wildly unrealistic, just based on the necessary critical raw materials and components capacity needed to achieve those goals. The build-out of the non-Chinese EV industry is just beginning in the West, and I think a long steep, very expensive, learning curve is ahead of us. I'm going to begin to address the critical raw material dilemma for EVs next week.