Weathering the rare earth prices storm, all eyes are on Neo Performance

written by InvestorNews | June 5, 2023

“Neo Performance Materials’ organization today is the closest that North America has yet come to a totally vertically integrated rare earth permanent magnet supplier. Now, the company has acquired and is moving to bring a significant rare earth deposit in Greenland into production. When that occurs, it will be the first company outside of China, ever, to be a totally vertically integrated manufacturer of rare earth permanent magnets. We should all be watching Neo Performance as if our (self-sufficient and secure) independent economic lives depend on it.” – Jack Lifton, Co-Chairman, Critical Minerals Institute

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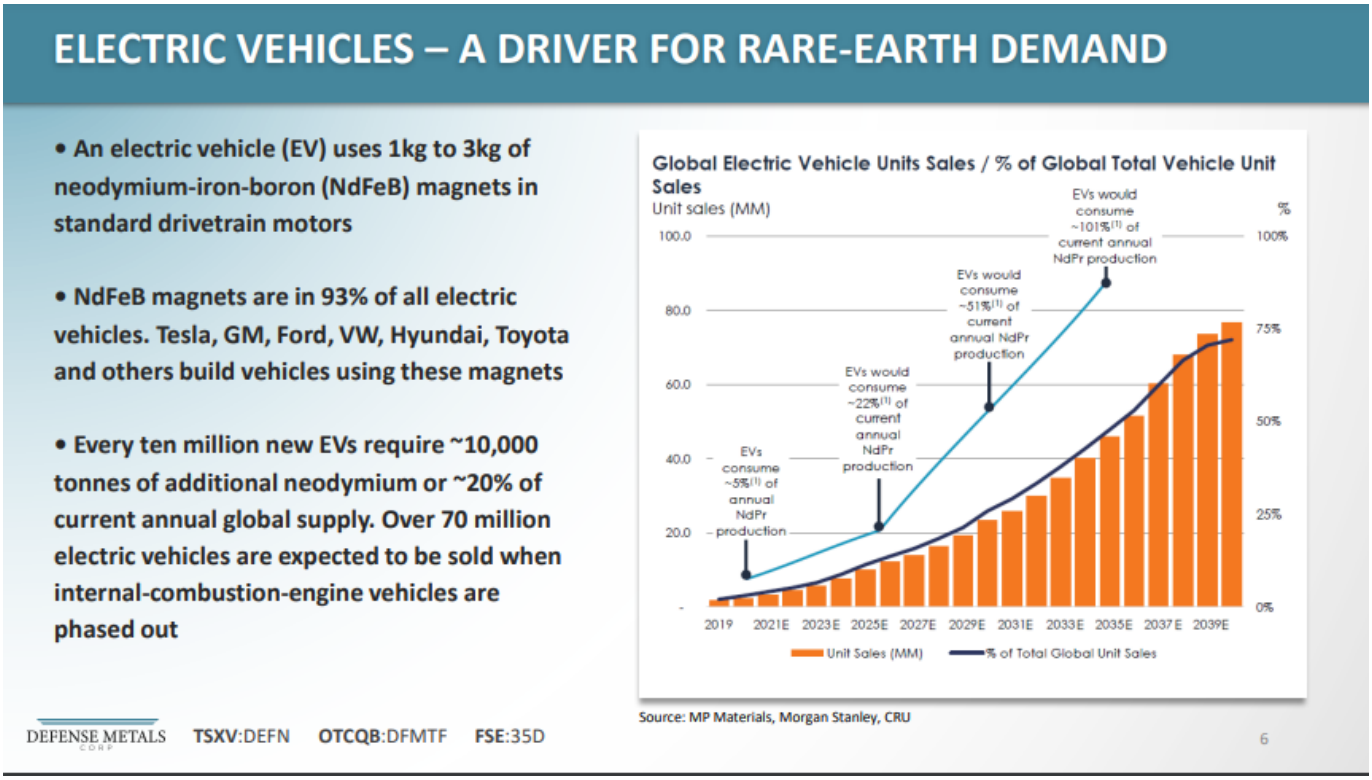
With plans to become a significant producer of the magnet rare earths, Defense Metals deserves a deeper dive

written by Tracy Weslosky | June 5, 2023

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.

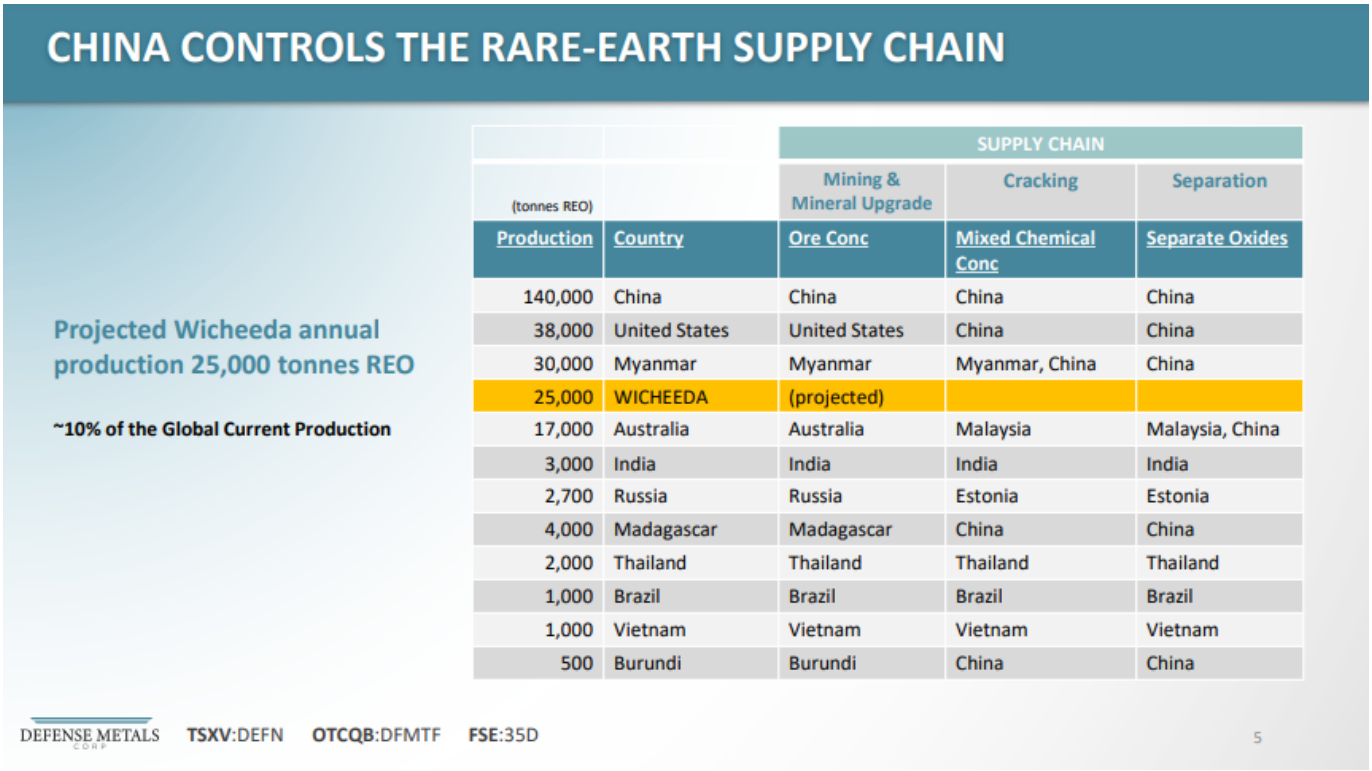
- WI21-59 – 2.76% TREO over 212 metres.

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



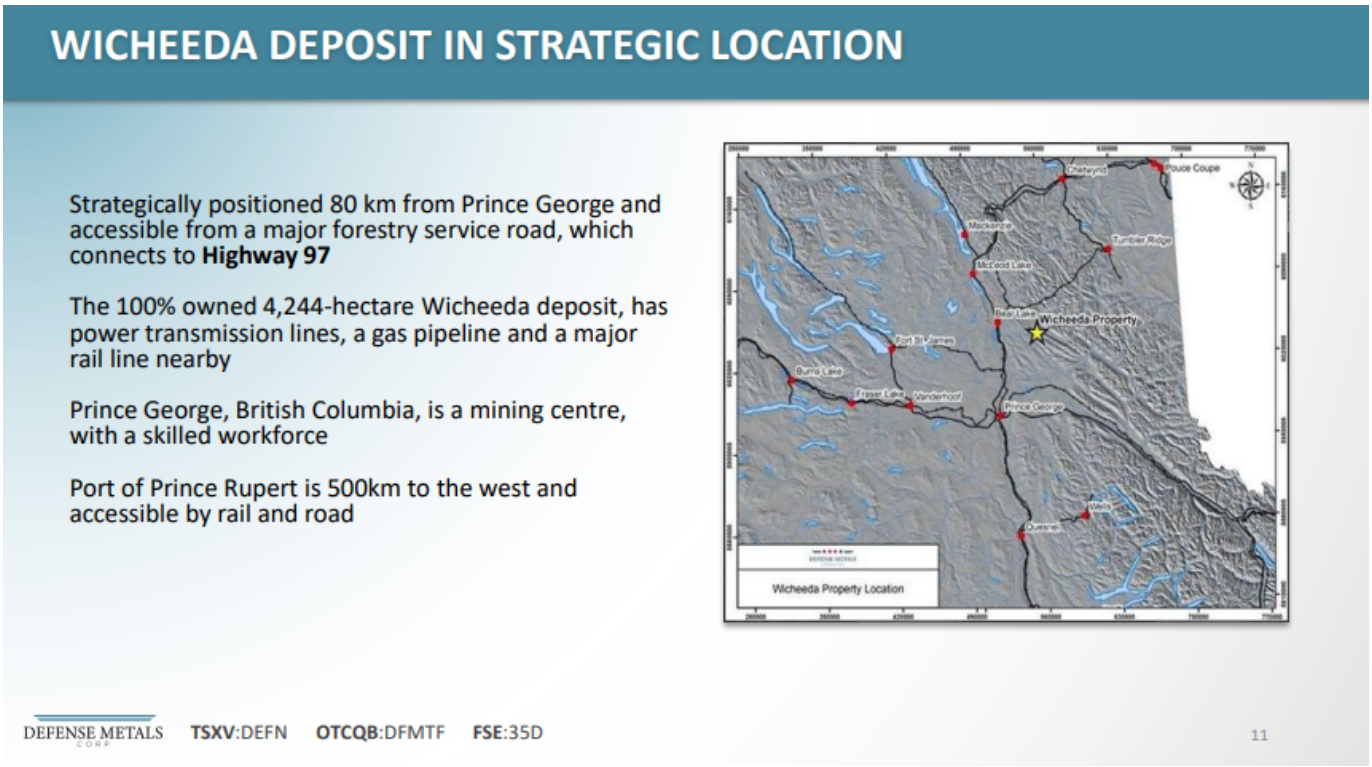
Source: Company presentation

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.]

All Eyes on Australia in 2022 as a Global Rare Earths Production Leader

written by InvestorNews | June 5, 2023

The rare earths sector, particularly the rare earth magnet metals (such as neodymium (Nd)), had a great 2021; but given that the electric vehicle (EV) and clean energy booms are just getting started, 2022 should be another strong year. The most powerful electric motor magnets used today are known as permanent magnets, and they typically are made of neodymium iron boron (NdFeB). Dysprosium (Dy) and praseodymium (Pr) are also commonly used in permanent magnets.

As shown below, neodymium prices had a very strong 2021 reflecting a very strong demand for permanent magnets used in powerful electric motors. It is interesting to note the correlations of price and EV car sales from the chart below especially when considering that the peak months for global electric car sales in 2021 were March, June, October, November, and most likely December (usually the best month of the year).

If you think electric car sales will boom again in 2022 and throughout the decade (as I do), then there is a strong case for owning the rare earth miners of these key magnet metals.

Neodymium 1 year price chart – Currently at CNY 1,110,000/t (USD 174,134/t)

Source: Trading Economics (red arrows by the author to show peak e-car sales months in 2021)

Where is the opportunity in rare earths?

Most rare earths reserves are found in China, followed by Vietnam, Brazil, Russia, India, Australia and the USA. Canada also has some rare earths. Most of the global rare earths production is from China followed by USA and Australia.

For Western investors, the two largest rare earths producing mines are owned by Lynas Rare Earths Limited (ASX: LYC) and MP Materials Corp. (NYSE: MP). A third smaller producer is Energy Fuels Inc. (NYSE American: UUUU | TSX: EFR), which, however, is a processor, not a rare earth miner.

For investors looking at the next potential rare earths producer then best to look to Australia and Canada. Today I will focus on Australia.

Australian rare earth miners

Lynas Rare Earths Limited (ASX: LYC) (Lynas)

Lynas is the second largest NdPr producer in the world. Lynas owns the Mt Weld rare earth mine and Concentration Plant in Western Australia (WA), one of the world's highest grade rare earths mines. Lynas ships concentrate from WA to their Malaysian plant for separating and processing into commercial rare earths' materials. As part of their 2025 plan, Lynas is progressing their new Kalgoorlie Rare Earths Processing Facility in WA as well as their LRE/HRE separation & specialty materials facility in the USA.

Boosted by strong prices and production (5,461t of NdPr in FY 2021), Lynas reported record sales of A$498 million and a record profit of A$157 million in FY 2021. I would expect this to continue in 2022.

Lynas is no longer cheap and trades on a market cap of A$9.69

billion, and a 2022 PE of 24.9. A top tier Western rare earths (NdPr) producer.

Australian Strategic Materials Limited (ASX: ASM) (ASM)

Australian Strategic Materials is an emerging integrated producer of critical metals for advanced and clean technologies based in Australia and South Korea. ASM plans a "mine to metal" strategy to extract, refine and manufacture high-purity metals and alloys that they can then supply directly to global manufacturers. ASM plans to produce a range of high-purity metals, alloys and powders from their metals plant in South Korea. Products will include titanium, zirconium and rare earths, required for permanent magnet production with the raw materials initially sourced from the market. The plan is to later source some materials internally, notably from their flagship Dubbo Project.

The Dubbo Project deposit contains rare earths, zirconium, niobium and hafnium. The Dubbo Project is ready for construction, subject to financing. In December 2021 ASM announced an updated base case in which the 20-year life of mine is expected to achieve a pre-tax NPV of A$2,361 million and a pre-tax project internal rate of return of 23.5%.

In November ASM announced the commissioning of their Korean Metals Plant in Ochang Province, South Korea. In December ASM announced they had formed a JV with Resource Corporation (KOMIR) (formerly known as Korean Resources Corporation (KORES)) to enable the supply of critical minerals and metals into Korea.

Korea is a tech-based manufacturing powerhouse, and this JV is very timely as non-Chinese tech manufacturers try to wean themselves from dependence on China-centric supply chains.

ASM trades on a market cap of A$1.34 billion.

Arafura Resources NL (ASX: ARU) (Arafura)

Arafura own the shovel ready Nolans rare earths (NdPr) Project in the Northern Territory of Australia. Arafura is aiming to be a trusted global leader for sustainably mined and processed rare earth products and plans to mine and process ore to separated commercial oxides at a single site at their Nolans Project. The main focus being to produce NdPr oxide. The Project has all Federal & NT Environmental approvals secured and Government and Minister support for A$300 million senior debt facility. Basically, the Project is ready to go subject to final project funding being secured. Subject to that funding, first production is targeted to begin late 2024.

Arafura trades on a market cap of A$333 million.

An interesting side note to end on is that Arafura quote:

- "EV market growth is exponential: 10 to 40 times in the next 20 years. This will require 6–15 times more rare earth elements.
- Most EVs need about 1kg of rare earths for their motor magnets.
- Just 0.05% of the vehicle cost: but it can't run without it.
- Market analysts forecast a supply gap that represents 109% of global supply today and is in excess of 11 Nolans Projects."

Source: Arafura Resources October 2021 company presentation

Closing remarks

We should remember that in 2021 the Morrison led Australian Government announced a A$2 billion loan facility for Australian critical minerals projects. These funds have the potential to help Australian rare earths juniors to move towards production.

Combine this with high magnet rare earths prices and surging demand, and we have all the ingredients for a strong 2022 from the Australian rare earths' miners.

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

written by Jack Lifton | June 5, 2023

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.