

Is there going to be a North American lithium “rush”?

General Motors has now announced that in partnership with Korea's POSCO Chemicals they would construct a lithium-ion battery cathode active material (CAM) manufacturing facility in Quebec, Canada, with a capacity to produce the cathode active material needed for 1,000,000 battery electric vehicles (BEVs) annually by 2025. This would mean that the factory's output would be enough for cathodes for at least 90 gigawatt hours of lithium-ion battery storage. This capacity would be more than all of the North American capacity planned or built up until now combined. The GM dedicated POSCO Chemical plant is projected to cost \$500 million. The cathode active material will be utilized in the new GM “Ultium” EV battery plants to be constructed by GM in the USA.

Doug Parks, GM executive vice president, Global Product Development, Purchasing and Supply Chain, said, “GM and our supplier partners are creating a new, more secure and more sustainable ecosystem for EVs, built on a foundation of North American resources, technology and manufacturing expertise,”

A 100 kWh lithium ion battery requires 6-8 kg of lithium, measured as but so far not used in its metallic state, so that 1,000,000 BEVs will require 6,000 to 8,000 tpa of lithium, which will be initially delivered as lithium carbonate or lithium hydroxide and then chemically transformed into cathode and electrolyte specific materials for use. Today, 8,000 tons of lithium metal would represent 10% of global production and 15% of all of the lithium used for battery construction.

Note also that GM produces, annually, in the USA today some 2.5 million cars and trucks, so that 1,000,000 represents 40% of GM North American production.

The key takeaway from Mr. Parks' statement is the term, "North American resources."

North America today does not produce anywhere near enough lithium for the new GM/POSCO facility's planned capacity.

North American car and truck sales are today 7 times those of just GM's domestic production. If GM is looking to differentiate itself and gain a competitive advantage from domestic sourcing of battery materials, lithium, in particular, then it will have to compete with its peers for the critical raw materials.

The biggest problem will be sourcing and processing lithium domestically.

The Biden administration's announced policy is to have 50% of car and truck production be EVs by 2030. This means that at least eight times as much lithium will be required per annum by 2030 as GM will need in 2025, or 50,000 to 75,000 tons of lithium, measured as metal, per annum! This would be essentially equal to the total global production of new lithium in 2021, and this is just for North America!

North American lithium exploration, mining, processing and fine chemical production of battery grade chemicals need to expand dramatically right now for there to be any hope of meeting the EV production goals even at the lower end.

There needs to be a North American "Lithium Rush."

Perhaps, lithium should be considered as white gold after all.

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

General Motors (NYSE: GM), has announced supplier agreements with both U.S. Based, MP Materials Corp. (NYSE: MP), and with Germany's Vakuumschmelze (VAC). This is very significant news, I think, because it means that GM will engage to support (financially, most likely,) Germany's Vakuumschmelze 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.