Jack Lifton on how the lithium shortage makes the EV dream – a nightmare.

written by InvestorNews | December 19, 2022

In this video, Critical Minerals Institute's (CMI) Co-founder and Chairman Jack Lifton talks about the growing lithium demand from the electric vehicle industry. Discussing the current state of domestic American lithium supply, Jack explains why the target outlined by President Biden of 50% electric vehicle sales share in 2030 with 100% domestic content is impossible to achieve.

Speaking on the United States' Inflation Reduction Act, Jack discusses how the automotive industry has failed to accept the problem of an adequate domestic American lithium supply chain. He goes on to say, "If it is not even possible to buy enough lithium to make enough batteries in the United States for half of our own production, what about the rest of the non-Chinese world?"

To access the full episode, click here

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About The Critical Minerals Institute

The Critical Mineral Institute (CMI) is an international organization for companies and professionals focused on battery materials, technology metals, defense metals, ESG technologies and practices, the general EV market, and the use of critical minerals for energy and alternative energy production. Offering an online site that features job opportunities that range from

consulting roles to Advisory Board positions, the CMI offers a wide range of B2B service solutions. Also offering online and in-person events, the CMI is designed for education, collaboration, and to provide professional opportunities to meet the critical minerals supply chain challenges.

Nano One's cathode materials are inventing the zero-emission battery future

written by InvestorNews | December 19, 2022

Every once in a while, something that you have been working on, seemingly forever, starts to come together and that momentum starts to snowball. Today we are going to discuss a company that recently announced Q2 results with several exciting highlights that are the result of many years of hard work and determination. And although this article isn't part of the critical minerals series, this company is inextricably linked to EV batteries, the processing of critical minerals and has already received funding from the Canadian Federal Government as well as the National Research Council of Canada Industrial Research Assistance Program and is engaged in the Mines-to-Mobility initiative. And if that isn't enough of a teaser for you, their stock price has rallied over 140% since hitting its 52-week low in mid-May. It has been a solid couple of months, to say the least.

The company that has been on a pretty good roll of late is Nano One Materials Corp. (TSX: NANO), a clean technology company with

a patented, scalable and low carbon intensity industrial process for the low-cost production of high-performance lithium-ion battery cathode materials. The technology is applicable to electric vehicle, energy storage, consumer electronic and next generation batteries in the global push for a zero-emission future. Nano One's One-Pot process, its coated nanocrystal materials and its Metal to Cathode Active Material (M2CAM) technologies addresses fundamental performance needs and supply chain constraints while reducing costs and carbon footprint.

The second quarter news flow began in late May with the acquisition of 100% of the shares of Johnson Matthey Battery Materials Ltd. located in Candiac, Québec. The acquisition included the team, facilities, equipment, land and other assets, with highlights of the deal being:

- A team with more than 360 years of scale-up and commercial production know-how
- Team and facilities proven in supplying tier 1 cell manufacturers for automotive
- LFP facility and land strategically located near Montréal and operational since 2012
- Facility and equipment that can serve Nano One's process needs with room to expand
- Expedites Nano One business strategy for LFP and other battery materials

The fully funded C$10.25 million deal is strategically located and has the benefit of access to a North American ecosystem that will serve the broader global community with cost-effective, resilient, and environmentally sustainable cathode materials. If you've been following my critical minerals series you'll recognize that this is an opportunistic deal that is the right asset in the right location at the right time.

Nano One quickly followed up with another, even more important

(in my opinion), corporate announcement less than a week later by signing a joint development agreement (JDA) for lithium-ion battery materials with industry giant BASF. The JDA will see the companies co-develop a process with reduced by-products for commercial production of next-generation cathode active materials (CAM), based on BASF's HED™-family of advanced CAM and using Nano One's patented One-Pot process and metal direct to CAM (M2CAM®) technologies. The multi-phase agreement includes a detailed commercialization study for pre-pilot, pilot and scaled up production. BASF, a global leader in chemistry and high-performance lithium-ion battery cathode materials, has recognized Nano One's advanced technology that has the potential to improve the product performance of BASF's high-performance CAM and further simplify the synthesis of battery materials.

And if all the above wasn't validation enough that Nano One has finally made it to the big leagues, less than 2 weeks after the BASF news the company announced a US$10 million equity investment by one of the world's largest mining companies, Rio Tinto. In addition to the investment, Rio Tinto has agreed to enter into a strategic partnership to provide iron and lithium products, all of which will accelerate Nano One's multi-cathode (multi-CAM) commercialization strategy and support cathode active materials (CAM) manufacturing in Canada for a cleaner and more efficient battery supply chain for North American and overseas markets. The collaboration agreement includes a study of Rio Tinto's battery metal products, including iron powders from the Rio Tinto Fer et Titane facility in Sorel-Tracy, Québec, as feedstock for the production of Nano One's cathode materials, which dovetails nicely with the first deal noted above.

Nano One finished Q2 with cash and cash equivalents of C$48 million, which represents roughly 14% of their C$343 million

market cap. With abundant capital to deploy, plenty of tailwinds for the industry as a whole, and a team with ample experience in financing, capital growth, technology management, chemistry, engineering, materials science, batteries, and intellectual property, it seems the company is really hitting its stride. I dare say, based on the recent news flow, there could be a lot more to come from Nano One.

The Dean's List – Part 3: What graphite company could benefit from Canada's commitment to critical minerals?

written by InvestorNews | December 19, 2022

Part 3: Northern Graphite Corporation

It's time for another installment in our series that looks at Canadian companies in the mining sector that could be impacted by Federal and Provincial government announcements with respect to critical materials, supply chain, EV battery manufacturing, etc. As a reminder, the province of Ontario first announced in March its strategy for 'critical minerals' followed shortly by a C$4.9 billion electric vehicle battery plant in Windsor, Ontario. This was followed in April by the Federal Government's Budget 2022 proposing up to C$3.8 billion in support over eight years to implement Canada's first Critical Minerals Strategy. The Fed's followed this up in late June with a House of Commons

Standing Committee on Industry and Technology report entitled: Positioning Canada as a Leader in the Supply and Processing of Critical Minerals. Just to highlight a few of the momentum building actions in the sector.

Today we're going to have a look at what I consider to be the least publicized critical mineral that comprises a lithium-ion battery (LiB) – graphite. Not only is graphite the largest component in a lithium-ion battery (up to 48%), it also requires the largest production increase of any battery mineral in order to meet forecast demand.

Source: Northern Graphite Corporate Presentation

Conversely, over 80% of graphite mine production in 2021 came from China, while China makes almost 100% of the graphite anode material for lithium-ion batteries. Does this sound like a recipe for disaster for the rest of the world to you? Perhaps it's stats like these that have put graphite on the critical minerals list of virtually every country that is attempting to develop a critical minerals strategy.

Assuming governments get their strategies at least partially right, that could result in opportunities galore for miners and explorers of these critical materials. This includes Northern Graphite Corporation (TSXV: NGC | OTCQB: NGPHF), a Canadian company focused on becoming a world leader in producing natural graphite and upgrading it into high-value products critical to the green economy. Northern is the only significant graphite producing company in North America and will become the third largest non-Chinese producer when its Namibian operations come back on line in the first half of 2023. The Company also has two large-scale development projects, Bissett Creek in Ontario and Okanjande in Namibia, that will be a source of continued

production growth in the future. All projects have “battery quality” graphite and are located close to infrastructure in politically stable countries.

Looking a little closer at the Bissett Creek project, testing has indicated that graphite from Bissett Creek is very well suited for the manufacture of high capacity, durable, long-life lithium-ion batteries. Bissett Creek is projected to produce 20,000 tonnes of graphite per year in phase 1 of development and has the resources to increase production to approximately 100,000 tpy as demand grows. By comparison, Canada’s graphite production in 2020 was estimated to be only 10,000 tonnes. An independent study has rated Bissett Creek the highest margin graphite project in the world, including existing producing mines. This is due to its very high percentage of valuable large flake graphite, simple metallurgy and favorable location which provides ready access to equipment, supplies, labor, grid power, natural gas and markets.

Why is this important? Along with the above noted Windsor battery plant JV between Stellantis and LG Energy Solution, the latter has also announced two projects in Michigan, just across the US border from Ontario. It is investing US$1.7 billion to expand its LiB cell plant in Holland, Michigan and has a third joint venture with GM to build a US$2.5 billion cell plant in the City of Lansing and Delta County, Michigan. Combined with the investment in Ontario, LG will have a collective LiB production capacity of 200 GWH in North America, requiring 250,000 tpy of graphite. And Bissett Creek is the nearest graphite deposit to these megafactories which provides Northern Graphite with a unique opportunity to deliver a secure, local, responsibly sourced supply of graphite.

It seems Northern Graphite might be sitting pretty as LG Energy Solution looks to start sourcing supply for all its facilities.

This could dovetail nicely with two upcoming milestones the Company has stated. In Q3, 2022 Northern is planning to announce an LiB anode production strategy, which also aligns with two of the Ontario government's strategies: Growing domestic processing and creating resilient local supply chains and Investing in critical minerals innovation, research and development. Then come Q4, 2022 they are looking to arrange financing for the Bissett Creek Project which could potentially include government support or possibly loan guarantees, a strategic offtake agreement with LG Energy Solution or just an old-fashioned capital raise. Regardless, the appetite should be there for whichever means the Company determines is its best course of action with the current tailwind for critical minerals.

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Did you miss a previous edition? *Check it out….*

The Dean's List – Part 2: What nickel company will benefit from Canada's commitment to critical minerals?
The Dean's List – Part 1: What rare earths company will benefit from Canada's commitment to critical minerals?

American OEM automotive industry's big problem with lithium

written by Jack Lifton | December 19, 2022

… and why Elon Musk is wrong.

There isn’t enough lithium mined, and there can never be enough lithium mined and processed into end-user forms economically, to replace the use of fossil-fueled internal combustion engines in the powertrain systems of the current one and one-half billion personal and mass transportation vehicles with electric motors powered by rechargeable lithium-ion type storage batteries.

I think that most of the managers of the global OEM automotive, aerospace, and shipbuilding industries know this, but they are powerless in the face of the demands of politicians who have given in to the greens who are unaware of the limitations of physical natural resource production and processing for non fuel minerals, and who rely on the advice of narrowly and poorly educated and just plain dumb “experts” who have credentials but no experience of business operations, real-world economics or even rudimentary geology. The more often these experts repeat such mantras as “settled science” (to prove that climate change is caused by or can be remedied by human activity) or proclaim the unlimited resources of “earth abundant minerals” (to prove that non-fuel natural resources are unlimited) the more destructive their ignorance impacts our cheap energy based (which they neither see nor understand) standard of living and quality of life.

In order to preserve their industry and their high paying jobs long enough until they can safely retire, the current top managers of the global OEM automotive industry have accepted the economic power and poison of the green energy “transition” in making their decisions rather than the free marketplace.

It is typically stated that a modern internal combustion engine powered vehicle has over 6,000 components and that an EV, an

electric powered vehicle, is “much” simpler. In fact, the much simpler vehicle still has some 4,000 parts.

Henry Ford pioneered the vertical integration of his eponymous car company in the teens of the last century to avoid being controlled by the natural resource “trusts” (monopolies) of his time. By the early 1920’s the Ford Motor Company manufactured internally all of its necessary component parts except for tires (Ford was a personal and lifelong friend of Harvey Firestone) and produced all of its own needs for electricity.

As the decline of the auto-industrial age proceeded after the oil price shocks of the 1970s the OEMs shed their then advanced vertical integration (almost always in order to raise money to cover losses and declining margins) and adopted just-in-time delivery of necessary parts from the then reborn and expanding external supply base. Rising American labor costs in the 1980s created a mass exodus of OEM automotive suppliers to Mexico and Asia. Shortly thereafter that Asian vehicle makers entered the US markets and rapidly learned enough to destroy the postwar global dominance of the OEM American car industry. Chrysler needed rescuing first, then GM. Ford survived the downsizing better than the others, but like them had to withdraw from the global markets of the heyday of the globalization of the pre-war (WW2) era.

Now, in 2022, the OEM American car and truck assemblers – for that is the correct term for a company that imports all of its components and assembles them into a vehicle – are being told that they must reduce and eliminate the use of imported components and find or develop domestic or friendly nation sources to redevelop domestic vertically integrated manufacturing.

At the same time, they are being told by the government that

they must convert all power trains to electric drive fueled by rechargeable storage batteries.

The answer, of course, is to rebuild domestic factories to once again produce the 4000 components per vehicle they will need for EVs. There will be components which are common to both fossil-fueled and electric powertrains and vehicles, but such electromechanical marvels as modern multi-speed transmissions as well as efficient gasoline and diesel fueled internal combustion engines will cease to receive attention and the skills to build them will wither away.

The key component to be researched and manufactured domestically now has become the lithium-ion battery to be used to power the battery electric vehicles to be built. No such mass production industry for this type of component has ever been successfully built or operated by a domestic American company. The supply chain for manufacturing lithium ion batteries for vehicle powertrains does not exist today in the USA.

Let me explain how the contemporary (legacy) global OEM automotive industry finds and chooses among its parts suppliers, so you can understand the dilemma that the contemporary geopolitics of globalization has caused, in particular, in the United States and Europe.

The outside OEM automotive suppliers, of course, must have experience in building and successfully selling the components for the same or same type of use. This is not taken for granted just because of the size or reputation of the seller. All production parts accepted for use by the domestic American OEM automotive industry must undergo the PPAP (production part approval process) and the suppliers must pass a financial due diligence.

PPAP involves real time passing of the test of operating under

real-world conditions for at least three years in general and for the life of the part's warranty. For a lithium-ion powertrain battery, this means today's operation with no more than the stated degradation of capacity for up to 8 years.

Upon passing the PPAP, the due diligence requires that the component meet the following requirements:

- On-time delivery, to specification, in the volumes agreed, and at the agreed price,
- Just-in-time delivery to agreed locations, no matter the weather conditions,
- All parts must meet agreed customer specifications within a narrow quality range, and
- Prices are agreed for the life of a vehicle model

It has been the practice of the OEM automotive industry to make the direct supplier of the component or subassembly, the Tier One supplier, responsible for the all of its (sub) suppliers to meet their PPAP requirements, even if it is the assembler who PPAPs the mechanical and electrical quality of the sub-tier supplier.

Very recently, for the first time in 25 years, the OEM domestic American automotive assemblers have begun to look at the entire supply chains for critical (without them the vehicle cannot be sold) components.

In the last year, General Motors and Ford have announced "agreements" with domestic, non producing, semi-finished raw material suppliers, of lithium and the rare earths, to provide them with raw materials (lithium) and critical component parts (rare earth permanent magnets), which the companies will somehow get processed into the forms necessary to produce rechargeable storage batteries and electric motors from a currently non-existent domestic American manufacturing base.

Tens of billions of dollars have already been allocated by the domestic American OEM automotive industry to build 7 battery "gigafactories" and several EV platform (the battery plus the electric motor) factories. Among the domestic OEM assemblers nearly 100 billion dollars has also been allocated to the construction of dedicated and multi-functional BEV plants.

The OEM automotive assemblers have bet the farm that they can become domestic vertically integrated manufacturers of battery powered electric cars and trucks.

Yet, as of today, not one gram of ESG lithium or rare earths is produced in the United States or Canada.

Look at the following chart:

This chart from the IEAE tells you that there is no possibility of producing enough lithium to manufacture the batteries that would be required by the currently planned demand after this year.

I think that the ignorance, by politicians and journalists, of the steps universally and necessarily required in the operations of any and all global original equipment manufacturing business is due to intellectual laziness, intelligence limitations and the rapidly declining coverage and quality of American "education" at all levels. The attempt to eliminate selection by merit, rather than expand it, and replace it with superficial characteristics as the criteria for education has rapidly eroded the ability to select those best qualified for specialized education and training and given over world leadership in science and engineering to Asian nations.

I repeat that the success of a transformation of the fuel for vehicular transportation from liquid fossil fuels to electricity

stored on board in rechargeable batteries depends entirely on the supply of the element lithium.

And that energy and resource illiteracy and innumeracy among our managerial and credentialed classes are the only reason that the domestic American OEM automotive assembly industry has blindly bet the farm on a green fetish pursued by some of the dumbest (or most corrupt, or both) politicians in the history of our Republic.

The BEV revolution will not engender a second Auto-Industrial age in America. It will, in fact, end the dominance of that industry, and ensure that BEVs survive only as luxury vehicles to be driven between enclaves with charging facilities.

Elon Musk tweeted two weeks ago that Tesla may have to get into the lithium mining business. He said that although there is lithium everywhere and lots of it, the mining industry is very slow to bring it to market.

Elon Musk is a brilliant businessman and an even more brilliant financier, but he is a mineral economics moron.

I invite readers to please challenge my assumptions and conclusions with data, logic, experience, and educationally based counterarguments.

NEO Battery Materials’ next

generation EV battery is the focus of its new Korean R&D hub

written by InvestorNews | December 19, 2022

I’m going to make a bold prediction. The electric vehicles we see on the road today will be virtually obsolete in 5 years. The amount of capital and brain power being applied to battery technology coupled with the desire/need for fewer and lower carbon footprint resources that go into those batteries is going to result in material step changes in vehicle range, speed of charging and hopefully the corresponding cost. Whether the electrical grid can keep up with this rapid transition to EVs remains to be seen but we can save that discussion for another day.

Imagine you want to go on a road trip in your EV, but every 300-400 miles you have to spend a few hours charging. What if the next generation of EVs could add 50+% to that range and fully re-charge in 15-30 minutes. How much would you be willing to pay for the old generation of EV versus the convenience of a new one? For sure there will still be a market for used EVs as some people only need it for their daily commute or trips to the grocery store and otherwise the vehicle sits idle for hours, at which point in time there is little to no inconvenience to charge it. But for me, as someone who likes to fish and hike in the great outdoors of the Rocky Mountains, I can assure you there is no chance I’m buying a current generation EV with its theoretical range that potentially leaves me stranded in the middle of nowhere when the actual range ends up being 25% lower than optimal operating conditions.

One company leading the charge into the next generation of

batteries is NEO Battery Materials Ltd. (TSXV: NBM | OTCQB: NBMFF), a Vancouver-based company focused on lithium-ion battery materials for electric vehicle and energy storage applications. NEO has a focus on producing silicon anode materials through its proprietary single-step nanocoating process, which provides improvements in capacity and efficiency over lithium-ion batteries using graphite in their anode materials. The Company intends to become a silicon anode active materials supplier to the electric vehicle industry with their all-star management and technical advisory team cherry picked from LG Chem, Samsung and various renowned universities.

The numbers are impressive both from a capacity/capability perspective and relative cost to their competition. In mid-2021 the Company announced that in a half-cell coin test that its nanocoated silicon anode allowed for a safe full charge within 5 minutes, which demonstrates the potential for scaling and implementation in larger cells such as those used in high power EV batteries. Through a mix of treatments and nanocoating materials, NEO utilizes pure metallurgical-grade silicon (Si) particles, which provide a 40-70% higher initial capacity compared to current competitors that employ SiOx, SiC, or other composite silicon materials. Due to NEO's advantage of retaining a higher initial capacity, on average, a 5% silicon weight loading of NBMSiDE™ can have the equivalent impact of a 10% loading of a competitor's materials. Initial coulombic efficiencies (ICE) – the ratio of the discharge capacity after the full charge and the charging capacity of the same cycle and is usually a fraction of less than 1 – for NEO's 100% micron-size level Si anode have exceeded the 86% level, and cycling performance presents excellent capacity retention after 300 charging/discharging cycles.

And all this technology is advancing beyond research lab theoretical work. The latest press release from the Company

confirms an MOU with the Province of Gyeonggi (basically Seoul, South Korea, and the surrounding area) to establish grounds for investments and cooperation between NEO and the Province to advance the mass production of silicon anode materials for EV batteries. NEO Battery Materials will initially invest, over the next 5 years, 24 billion KRW or approximately C$25 million to support the construction and expansion of the silicon anode commercial plant located on a 107,000 sq. ft. site in Oseong Foreign Investment Complex, Pyeongtaek City, Gyeonggi-do. The Company aims to transform the Province into an essential manufacturing and R&D hub of silicon anode materials. The first phase of the commercial plant will possess an initial annual production capacity of 240 tons of NBMSiDE, and the facility will be built as a 4-story office building with additional space that can accommodate production expansion to 1,800 tons annually of the Company's anode material.

I have no idea if NEO Battery Materials will be one of the success stories to advance the next generation of battery technology for EVs and energy storage. I do know that they have generated some interesting results and have NDAs signed with over 20 globally established industry players in the battery cell manufacturing, materials manufacturing, and automotive industries. With a market cap of roughly C$30 million, you can decide if this is one of the companies you'd like to hold if you are investing in the future of EVs.

NEO Battery Materials fast

tracks their silicon anode EV battery material plant in Korea

written by InvestorNews | December 19, 2022

NEO Battery Materials Ltd. (TSXV: NBM | OTCQB: NBMFF) ("NEO") is advancing at full speed with their recent announcement that they have "completed a contract for the Commercial Plant's construction, design, and permits with an architectural firm". The plant will be located in Gyeonggi Province's Oseong International Investment Zone in South Korea, near major battery manufacturers LG Energy Solution and Samsung SDI.

As a brief reminder for new investors, NEO has developed high-performance silicon anode materials to replace parts of the graphite used by anode and battery manufacturers in their battery anodes. Their leading product is NBMSiDE™, a silicon anode material for EV lithium-ion batteries. NBMSiDE™ is manufactured through the Company's proprietary nanocoating technology, achieving a high specific capacity of >2,500 mAh/g. This essentially means the NEO silicon anode material helps improve the all-important battery energy holding capacity and ultimately the charging speed of the EV.

As NEO states: "Through a mix of treatments and nanocoating materials, NEO utilizes pure metallurgical-grade silicon particles, which provide a 40-70% higher initial specific energy or capacity compared to current competitors that employ SiOx, SiC, or other composite silicon materials."

South Korea anode plant design progressing with an increased production target

Regarding the new anode materials plant, the final site approval has now been granted. Due to the land site being in a Foreign Investment Zone, NEO will receive a range of benefits including a 99% reduced lease rate and tax incentives. NEO may also access Provincial financial support for equipment purchases, employment subsidies, and education/training subsidies.

Additionally, NEO recently stated that the "Company will now advance to the detailed process design for the production lines and will proceed with early orders of components that have long lead times for the commercial plant. Through a structured execution plan of performing procurement and construction processes one after another, NEO expects to achieve the initial commission of the Commercial Plant by the first half of next year… We are currently working on pursuing strategic investments and communicating with the respective companies and investors to finance the construction of the commercial plant."

In another very interesting development from NEO, the Company has increased their anode material production targets again. The original pilot plant capacity was 10 tons, which last year was increased 12 fold to a commercial scale of 120 tons pa. This was recently increased to 240 tons pa. Even more impressive is the longer term target of the full facility capacity after installing the maximum number of mass-production lines through expansion, of 2,000 tons of NBMSiDE™ anode material pa.

NEO has also been busy sending NBMSiDE™ product samples to several potential off-take companies for testing. If this stage goes well then usually off-take agreements follow, which then typically helps the project financing process.

"The first refined sample of NBMSiDE™ has been provided to a Europe-based battery materials company," NEO recently stated, "and a second delivery is planned in April. NEO is additionally

conducting sample tests with several Asia-based and European battery manufacturers."

NEO has also recently internally developed NBMSiDE™ pouch-type full cells which have been manufactured to evaluate product performance, viability, and durability in genuine battery charging conditions.

In an April 5, 2022 news release NEO stated that: "NEO Battery Materials will commence construction in June 2022 and will follow stringent timelines and protocols to aim completion in June 2023." I would assume this is subject to project financing.

Closing remarks

NEO is making great progress with their silicon-anode material commercialization plans, with the excellent advantage of locating their manufacturing facility in the Oseong International Investment Zone in South Korea.

Investors should understand that the next stages of product evaluation and testing, off-take deals, financing, and project construction all carry risks and the possibility of delay. Nonetheless, NEO is certainly making all the right moves and looks to be very well connected to the major Korean battery manufacturers.

NEO Battery Materials trades on a market cap of C$52 million.

Quebec, Canada set to become a critical battery materials' production hub

written by InvestorNews | December 19, 2022

Imperial Mining's world-class Crater Lake Scandium-Rare Earth Project in Quebec will soon complete a PEA

There have been some great news releases recently of new lithium ion battery materials projects coming to Quebec, Canada. The first was BASF's cathode active materials and recycling facility planned to be located in Bécancour, Quebec. The second was General Motors and POSCO Chemical's $400 million facility to produce cathode active materials for vehicle batteries, also in Bécancour, Quebec. It is looking like Bécancour in Quebec is to become Canada's battery cathode manufacturing hub. This bodes well for the development of an EV manufacturing industry in Quebec at some stage.

Today's company has key EV related metals, scandium and the magnet rare earths, as well as gold exploration; with three projects located in Quebec, Canada.

Imperial Mining Group Ltd's. (TSXV: IPG | OTCQB: IMPNF) (Imperial) three projects in Quebec are the:

- Crater Lake Scandium-Rare Earth Project,
- the Opawica Project (gold exploration), and the
- La Roncière Project (gold exploration)

Imperial has progressed significantly over the past 6 months,

announcing a Maiden Resource, drill results, and commencement of a PEA at their 100% owned Crater Lake Scandium-Rare Earth Project. Today we will look at the Crater Lake project and at what's next for the Company.

Crater Lake Scandium-Rare Earth Project

Maiden Resource

As announced in September 2021, Imperial's NI 43-101 Maiden Resource estimate for the TG Scandium-Rare-Earth Zone at its Crater Lake Scandium-Rare Earth Project is an **Indicated Resources of 7.3 million tons grading 282 g/t Sc_2O_3** and **Inferred Resources of 13.2 million tonnes grading 264 g/t Sc_2O_3.** This is an excellent result putting the Crater Lake Project among the top scandium resources in the world. The Resource estimate also highlighted valuable magnet rare earths Nd, Pr, Dy and Tb. The Resource remains open to further expansion.

Maiden Resource estimate and Resource Model for the TG Zone at the Crater Lake Scandium-Rare Earth Project

Source: Imperial Mining Group company presentation

Recent drill results

Since the Maiden Resource, Imperial has had some stellar drill results including:

- **115.8 m (379.9') grading 252 g/t scandium oxide (Sc_2O_3)** at the STG Zone. There are also elevated levels of total rare earth oxides plus yttrium (TREO+Y) of up to 0.475 %. The STG Zone is a new discovery, 2km south of the TG North Lobe Resource.

PEA

Work on a 43-101 Preliminary Economic Assessment (PEA) on the TG Zone scandium-rare earth zone resource is advancing well, despite some delays. The PEA results were targeted for Q1, 2022, but now look like being in Q2, 2022.

Imperial's Crater Lake Project location map and highlights

Source: Imperial Mining Group company presentation

Next steps and targets

- Q2, 2022 – PEA results for the Crater Lake Scandium-Rare Earth Project to be announced.
- Late June 2022 – A 2,500m drill program on the TG Zone (Northern Lobe and Southern Lobe) to commence.
- End Q3, 2022 – Hydrometallurgical flowsheet development program results due.
- H2, 2022 – An update to the previous 43-101 Maiden Resource Estimate of the TG Zone.
- Late 2022 – Engineering design for Imperial's pilot plant program.
- Mid-2023: Definitive Feasibility Study (DFS), IBA, receipt of construction permits.
- Late Q4, 2025/Early Q1 2026: Delivery of first product (subject to permits and funding).

Closing remarks

Imperial Mining Group is making good progress and has already delivered a solid Maiden Resource at their flagship 100% owned Crater Lake Scandium-Rare Earth Project. The PEA is expected to be out soon in Q2, 2022, with numerous catalysts to follow.

Meanwhile, the magnet rare earths prices keep rising. All of this bodes well for the Company, as shown by the successful recent raise of C$3 million and a C$245,355 Quebec Government award to optimize their Crater Lake Scandium recovery process.

Scandium is the rarest of the "rare earth" metals. Small additions of scandium to alloys with aluminum give properties of corrosion resistance, tensile strength, ductility, and low weight that make them ideal for weight reduction and safety in large scale battery boxes for EVs and in load bearing aircraft parts.

Imperial Mining Group trades on a market cap of C$26 million and looks to be in the right place at the right time. And let's not forget their gold exploration potential. Stay tuned.

Is there going to be a North American lithium "rush"?

written by Jack Lifton | December 19, 2022

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.

Northern Graphite moves to become a North American producer

written by InvestorNews | December 19, 2022

Did you know that 'graphite' is on the list of 35 U.S critical minerals? It is because graphite is important in steel manufacturing and also in batteries. An average sized electric vehicle ("EV") lithium-ion battery typically has about 55 kgs of graphite, larger size EVs can use 75-115 kgs per vehicle. This is why in 2016 Elon Musk famously said: "Our cells should be

called Nickel-Graphite, because primarily the cathode is nickel and the anode side is graphite with silicon oxide."

Graphite demand is set to soar this decade as EVs takeoff

Source: Northern Graphite company presentation

Today's company has recently signed a company changing deal that will see them soon become a North American graphite producer, assuming the deal finalizes.

Northern Graphite to acquire two graphite mines from Imerys Group

Northern Graphite Corporation (TSXV: NGC) announced on December 2, 2021: "Northern Graphite to acquire two graphite mines from Imerys Group."

The two graphite mines are the Lac des Iles, producing graphite mine in Quebec, Canada, and the Okanjande graphite deposit/Okorusu processing plant in Namibia. The purchase price is approximately US$40 million. Northern Graphite plans to fund the deal and raise extra working capital, according to a term sheet with Sprott Resource Streaming and Royalty Corp., through US$40 million in debt/royalty/stream financing plus a US$15 million (~C$20 million) private placement equity raise.

Northern Graphite CEO, Gregory Bowes, stated: "This is a truly transformational deal that will elevate Northern from one of over 20 junior graphite companies looking for project financing to being **the only North American and the world's third largest[1] non-Chinese graphite producing company.**"

Note: Bold emphasis by the author.

Northern Graphite's existing graphite project

Northern Graphite owns the Bissett Creek Graphite Project located 100km east of North Bay, Ontario, Canada and close to major roads and infrastructure. The Company has completed an NI 43-101 Bankable Feasibility Study and received its major environmental permit. The next step is project financing. More details on the Bissett Creek project here.

Northern Graphite's company goal and strategy

Northern Graphite is focused on becoming a world leading producer of natural graphite and on the upgrade of mine concentrates into high value products critical to the green energy revolution including lithium-ion battery anode material for EVs and stationary power systems, fuel cells, and graphene, as well as advanced industrial technologies. The upgrading of mine concentrates usually means upgrading flake graphite (sells at ~US$550-1,000/t) to active coated spherical graphite (sells at ~US$7,000+/t). Northern Graphite is not yet at this stage, but it is their plan to go in that direction, which makes good business sense, to increase profit margins. Manufacturing and selling graphene is another way to add value.

Source: Northern Graphite company presentation

Closing remarks

Northern Graphite has made a company changing deal by purchasing two graphite mines (and a processing plant) for only ~US$40 million. Combine this with their existing advanced stage Bissett Creek graphite Project, and Northern Graphite will own 3 graphite projects/mines, two in Canada and one in Namibia.

A key to the new acquisition is that the Quebec based Lac des

Iles Mine is already a producing asset. The Okanjande is a fully operational, permitted, mine in Namibia (currently on care and maintenance). With graphite demand set to surge this decade as electric vehicles takeoff, the timing of the recent acquisition could not be any better and propels Northern Graphite from being a junior to being a North American graphite producer. Or as the company states: "Northern will become the only North American, and the world's third largest non-Chinese, graphite producing company."

The deal still needs to go through the usual approvals but is expected to finalize soon. Higher graphite prices are needed in the sector to make it more profitable; however, this may happen in 2022 as flake graphite is expected to move into deficit. Also, note the higher sovereign risk for the Namibia operation.

Northern Graphite Corporation trades on a market cap of only C$69 million. One to follow closely in 2022.

Will Technology Metals' Supply Meet the Demand for EVs?

written by Jack Lifton | December 19, 2022

Since market economics' common sense was codified by Adam Smith in the 18th century, people have been aware of the fact that the price for a good or service is what a willing buyer will pay a willing seller. Of course, the seller must be able to get the good or perform the service and the buyer must have or be able to get the money. These last requirements seem to have escaped the notice or understanding of the market manipulators also

known as Western politicians.

The global OEM transportation vehicle market is really not free. It is being politically manipulated by climate change politics, based on the belief that eliminating the carbon dioxide output from the use of fossil fuels in vehicle powertrains, based on internal combustion engines (ICEs) and replacing them with onboard stored electricity in batteries driving electric motors (BEVs) will have a significant “positive” effect for humans on the earth’s climate. Whether or not this cause-and-effect hypothesis is true the total conversion of the world’s transportation fleet to battery electric power is not possible for the size of the present fleet and its projected growth. This is because the (battery) technology metals necessary to effect this change simply do not exist in sufficient quantities that are accessible to mankind’s engineering abilities, willingness to deploy capital, and the real global energy economy.

This supply limit will not become apparent until after 2025, so it is being ignored as a problem easily solved by the “efficient” market, whose actual strictures the political class does not understand.

One clue about structural limitations, which politicians either do not understand or do not believe, is that the current Western commodity price inflation is driven by efficient market supply shortages, which will automatically correct from infinite supply resources, not by free market excess (unsatisfiable) demand. Another, perhaps more insidious, supply limitation is simply the price ceiling, the maximum amount that the consumer can/will pay for a metal, before that metal becomes too expensive for the intended use. This is happening now, for aluminum, as soaring energy costs in Europe, for example, force the shutdown of aluminum electrolytic smelters, the production cost from which has become more than the market price of aluminum. This was

caused by an entirely man-made shortage of electricity through sheer political short-sightedness, not by the aluminum marketplace.

The politically driven demand pull for BEVs has already skewed the lithium market by driving lithium prices high enough to allow mines and sources, that would have been marginal or worse, to appear to be economical and to develop. But lithium prices are already too high for the continuing decline in battery costs to achieve par with fossil-fueled engines in the near term, if ever. The politicians' answer to this is to restrict fossil fuel production and make it more costly. Thus a (n inflationary) price spiral has begun that could price BEVs as well as reduced production, thus more expensive, ICEs and their fossil fuels "out of the mass market!"

The structural metals and materials used to make vehicles used for the transportation of people and freight can be, and mostly are, recycled. This is driven by the fact that it takes less energy to recycle structural metals than to produce new material from mines. A significantly large proportion of the iron, aluminum, copper, zinc, and lead used to construct new vehicles is recovered each year from the recycling of end-of-life scrapped vehicles. Cars in North America, have average useful lives of 12 -17 years. The North American car "fleet" is over 300 million vehicles and each year about 5% of the fleet is scrapped. This means that enough iron, copper, aluminum, and lead is recycled each year to build 15 million new vehicles if 100% perfect recycling is assumed. It is noteworthy that the recycling efficiency of the American scrap, iron & steel, aluminum, copper and lead industries is very high and that most American steel for automotive use is made from scrap in, reliable, fossil or nuclear fueled (electrical) baseload requiring, electric arc furnaces. The North American OEM automotive industry considers 17 million vehicles produced and

sold to represent a good year, so it does not have a problem sourcing structural metals for components. In fact, enough new vehicles are imported into North America that the need for structural metals for just domestic production by the OEM American automotive industry is met by just the metals produced from recycling.

So far, so good.

Now comes the not-so-good news about the technology metals required for manufacturing automobiles. Today's internal combustion engine powered motor vehicles use, on average, about 0.5kg of rare earth permanent magnets (REPMs), so the annual need for such by the domestic OEM industry is between 6,000 and 8,500 tons of REPMs (here I assume that of the 17 million units sold each year up to 5 million are imports from another country (including Mexico and Canada besides China, Japan, Korea, Germany, France and the UK).

And, a Tesla Model 3, electric vehicle (EV) with the range required by American buyers uses up to 5kg of REPMs, and 6-8 kg of lithium, measured as the metal, in its lithium-ion rechargeable battery-based powertrain.

How many Gigawatt hours of lithium-ion battery storage for use in EVs and stationary storage can be produced with the earth's known physically and economically accessible deposits of the necessary critical materials? I was going to submit that question as an abstract to a coming battery conference, but I realized that the academics and bureaucrats, and corporate researchers who attend the conference don't have enough background in industrial mineral economics to understand what I want to say, and, in any case, don't want to hear it.

Below is Bloomberg's guesstimate of the demand growth for the supply of all of the metals necessary to build (projected levels

of) EVs through 2030. It is very important to understand that the only increased demand for metals for building EVs that matters are for those metals that are non-structural, **the EV Technology Metals**. EVs will use no more of structural metals in the aggregate than ICEs do, so that as the ICEs are replaced by EVs, there will be no increased demand for iron, aluminum, or zinc, and a marked decline in the demand for lead as starter lead-acid batteries are phased out.

Source

But those technology metals specifically required for an EV's powertrain, the battery and the electric motors will see a dramatic increase in demand if and when EVs achieve a significant market penetration.

For some reason, which I think is just ignorance, the major news media "predictors" pay no attention to the distinctions between the demand for structural metals, which will simply be the same total, with the exception of that for copper, as is used today unless the annual global total production of motor vehicles increases dramatically, which is very unlikely. Mature Western (and Japanese and Korean) domestic markets will decline in demand as longer lived vehicles become necessities due to price. This may well have a negative effect on recycling efficiency for all metals as the scrap market re-adjusts to lower supply and lower annual demand for new vehicles.

EVs, however, as they replace ICEs will not increase the demand for structural metals per unit, but it is the demand for EV technology metals that could skyrocket, if that much supply were possible.

To reiterate: The above chart is wrong with regard to iron and aluminum demand for vehicles; they are a function of the total

number of vehicles built in a year, and, since Western markets are mature in transportation vehicles, the demand for new iron and aluminum for that use is unlikely to increase more than 25%, if that, to add new vehicle production, perhaps mostly for the Indian and African home markets.

For EV Technology Metals the story is very different. An EV uses about 50 kg of copper for its wiring harness, electric motor windings, and lithium-ion battery internal circuitry. This represents a 50% increase over the demand for copper in an average ICE, so that the demand for copper for EVs could add fifty percent to the overall demand for copper by the OEM automotive industry today if and only if ICEs are completely replaced by EVs. Thus, the factor for copper in the above chart, 10X, should be 1.5X.

The potential demand growth for the most critical EV Technology Metal, lithium, is the limiting factor in the projected transformation of power trains from fossil fuels to battery moderated electricity. Today BEV sales are reported to be 3% of the global total vehicle sales. This is projected to reach 10% by 2025, so that by 2025 at least three times as much lithium will be needed to satisfy the demand for batteries.

In 2021 some 86,000 tons of lithium, measured as metal, were produced. 60% of that total was used to manufacture lithium-ion batteries. Let’s call that 50,000 tons for batteries in 2021.The 36,000 tons of lithium used for non-battery uses is unlikely to grow, so the necessary supply increase to satisfy the needs for producing 10% BEVs in 2025 is 3x, for a total demand in 2025 of 150,000 tons of lithium, measured as the metal. Adding the 36,000 tpa of lithium demand for other uses we get a total lithium demand of 186,000 tons for 2025, which is essentially 2X 2021 total demand for lithium. This is most likely do-able by the lithium mining industry, but the downstream supply chain to

turn 150,000 tons of lithium into fine chemicals and battery electrodes does not now exist, and although capacity increases may be planned it cannot be determined how much will actually be constructed in time. This is determined by the availability of capital, its proper allocation, the availability of engineering skills, and the availability of construction capacity. Although these can be quantified, government interference, also known as regulation, is the single largest time, and frequently capital, consuming impediment to mining and process engineering in the West.

The (mineral) economic illiterates who populate our universities and governmental bureaucracies live in a fantasy world of infinitely available natural resources and their unimpeded economic production. In that world, and only that world, is a green energy transition possible without an unacceptable decline in global standards of living, and the creation of a have and have-not society on a global scale. Let the UK’s current

Production and processing of the EV Technology Metals are and will continue to be a good investment until a consensus is reached about a balanced energy economy, in which fossil fuels continue to be used for critical needs for which they are irreplaceable. Continued production of EV Technology Metals after that will be determined by price.