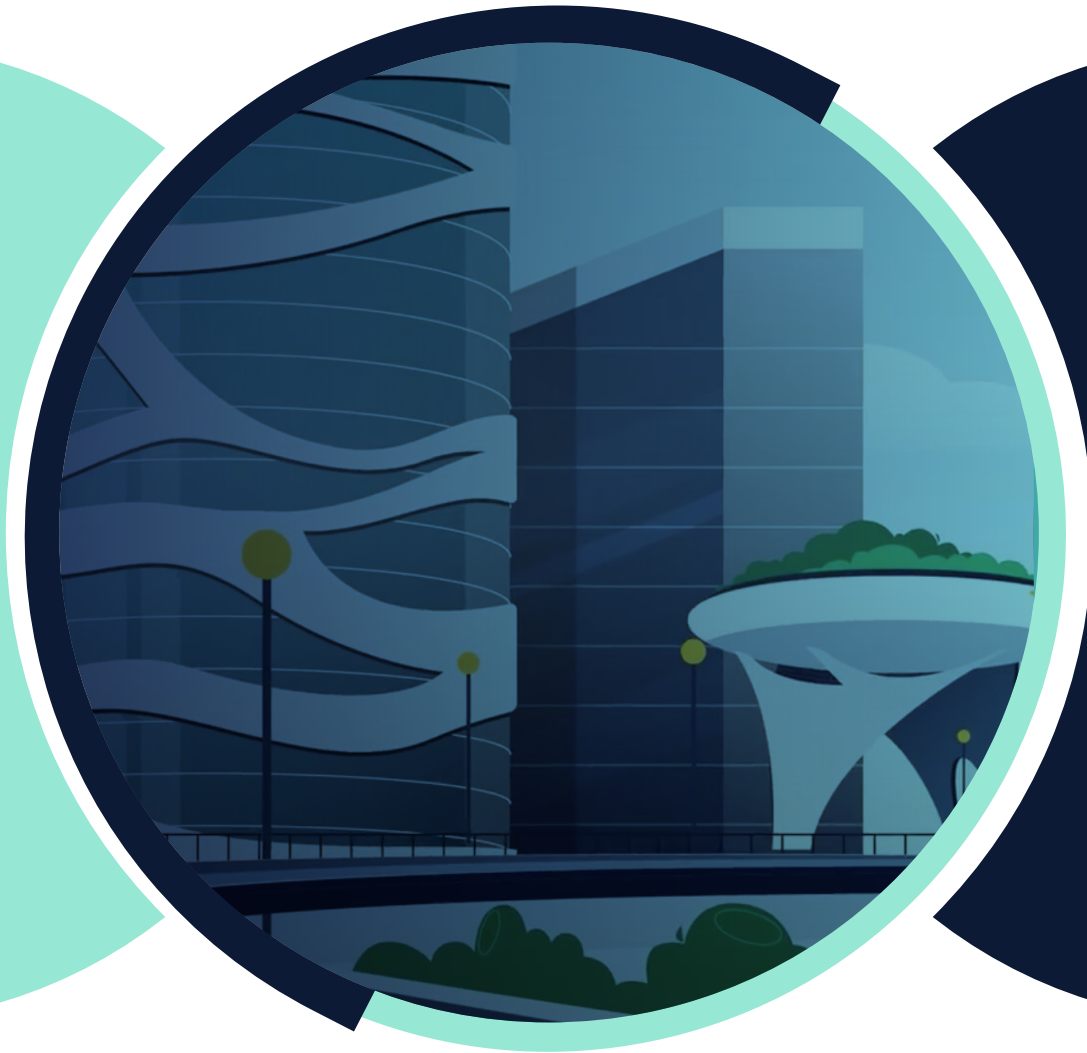




accelerate
Canada's ZEV Supply Chain Alliance



Seizing Canada's Opportunity:

Defining and Building a Successful ZEV Industry

Perspectives from Business Leaders

In our 2024 pre-budget submission, Accelerate called on the federal government to work directly with industry and other critical stakeholders to develop a public-facing Canadian ZEV Industrial Plan to guide policy and investment decisions.

There are multiple motivations behind the establishment of such a plan: economic development, job and value creation, innovation, and climate action. Canada, of course, is situated within a highly interconnected North American free trade zone, while our mining sector operates within global commodities markets.

Our country is uniquely positioned to succeed in the transition to electric mobility. For much of the post-war era, Canada has benefited from cross-border trade arrangements that have allowed us to

become the world's 12th largest automobile manufacturer, home to numerous major assembly and Tier 1 supplier plants. Canada's geological resources, in turn, are unrivaled, with extensive deposits of the critical minerals required to produce ZEV batteries and motors. It's also significant, in an era when investors are increasingly focused on Scope 1, 2 and 3 emissions, that more than four-fifths of Canada's electricity comes from clean energy sources. Finally, Canada has a well-deserved reputation for the quality of its academic research and innovation output. All these factors position us to succeed in a ZEV world.

But to fully capitalize on this generational opportunity, Canada has to develop and execute against ambitious strategies to bring these segments and elements together in order to build a comprehensive ZEV industry.



Economic Development



Job and Value Creation



Innovation



Climate Action

Some advancements have been made, with Canada committing significant resources to develop a battery manufacturing sector and successfully attracting foreign direct investment into this ecosystem. These public and private investments now must be leveraged by developing a concrete and measurable plan

to connect Canada's upstream mining and materials sectors to our battery sector and our downstream parts and assembly sectors. At the same time, we must also foster advancement and commercialization in evolving Canadian manufacturing and battery technologies, as well as in fuel cells.

“Just 10 years ago, the ZEV ecosystem was in its infancy, and Canada has made remarkable strides,” comments Marc Bédard, CEO and founder of the Lion Electric Co. “To be successful, Canada’s ZEV industry has to position itself strongly on the international stage and maintain a unique approach from “mine to road.” Few countries have the natural resources, facilities, and skills to produce cells, battery modules, battery packs and vehicles at the same place. The Canadian ZEV industry will be an immense source of pride and a real example to follow around the world.”

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-Marc Bédard,
CEO and Founder, the Lion Electric Co

In this report, 20 senior corporate executives situated in various sectors within Canada’s ZEV supply chain share their insights on how to advance the objective of a thriving industry for Canada. These business leaders—including those from growing

Canadian firms and large global companies allocating capital, innovating, taking risks, and building the connective fibres across this ecosystem—were asked what they consider to be a realistic vision of success and what actions are needed to achieve that vision.

Three overarching themes emerge:



Optimism about the potential for Canada to navigate the transition, thanks to an abundance of natural resources, clean energy, talent and decades of manufacturing expertise.



Enthusiasm for the long-term potential of emerging technologies, including in anode/cathode processing, battery recycling and material recovery, and other battery innovations.



Concern about issues such as the current lack of investment in certain pivotal segments of the supply chain, particularly in mid-stream processing, the deployment of charging infrastructure, the permitting timelines for critical mineral mines, the need for more technical know-how within the ZEV supply chain labour force, and the impact of U.S. Inflation Reduction Act incentives on foreign direct investment to Canada.

Against this backdrop, these executives discuss elements they consider to be of strategic importance to their firms' prospects within the ZEV supply chain. Areas of

common strategic importance that cut across businesses and segments are then identified to inform and advance Canada's zero-emission vehicle industrial planning.



Manufacturing: building on a core strength

Among many executives with both Canadian and international OEMs and auto-parts manufacturers, the opportunity presented by the coming transition to ZEVs represents a baseline in their thinking about the future of this industry.

"It's the most exciting time in history to be in the automotive industry," observes Linda Hasenfratz, Executive Chairman and CEO, Linamar. "There's so much opportunity because every vehicle is being rethought. We see it as the biggest opportunity in our history, and we're winning billions of dollars in business. It's really transforming what the future looks like in terms of the products we're supplying. We think it's pretty exciting."

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-Linda Hasenfratz,
Executive Chairman and CEO, Linamar

In her view, Canada is well positioned to succeed in the ZEV space because of a multitude of factors: the intersection of one of the world's strongest manufacturing sectors with one of the world's strongest technology sectors; our clean energy grid, abundance of water and critical minerals; strong talent and training systems, as well as positive immigration policies that attract additional talent; a positive tax regime; and the availability of lucrative R&D tax credits, to name a few.

Building batteries is a particular area of opportunity for Canada because of the abundance of the kinds of mineral resources needed to build the next generations of lithium-ion batteries in conjunction with the country's clean energy grid. "This is really relevant because when it comes to building a battery electric vehicle, building the battery itself is enormously energy intensive," Hasenfratz adds. "If you do it in an environment where the energy is not clean, you generate an enormous amount of emissions."

Pat D'Eramo, CEO of Martinrea International, agrees: "One of the biggest advantages that Canada has is green energy," he says. "Canada's very attractive from an energy point of view." He and others point out that the way to maximize the environmental benefit of ZEVs is to reduce the length of supply chains, both by re-shoring and also by ensuring that the pathway from mine to battery to assembly plant is as compact as possible. "For us as a supplier, the key is to have the assembly plant. The OEM needs to be local. They want their supply base, at least the type of parts that we make, as close as possible."

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CEO, Martinrea International

Others point to the opportunity to leverage Canada's global presence and take a global leadership role in both the automotive sector as well as the mineral industry. "Canada is a major player in terms of vehicle production around the world, and it exports more than imports," says Pierre Boutin, president and CEO, Volkswagen Group Canada. But, he cautions, "when you

look at the shift of our industry to electric vehicles, we are really at a crossroads. Major decisions need to be taken. People would love to have the transformation turned on overnight, but in every transformation, this never happens that way."

Many industry executives, including those involved with OEMs, stress that a realistic vision of success must engage all the sectors along the ZEV supply chain, including, but not limited to, assembly plants and new battery production facilities. "We hear a lot about support for auto manufacturers," comments Paul Soubry, President and CEO, NFI, the Winnipeg-based multinational bus manufacturer. "A pan-Canadian strategy has to be holistic, from minerals all the way through to cells and modules and related systems, such as charging infrastructure, and ultimately recycling or reuse. Most of what I read about now talks about elements of the chain rather than a holistic approach."

Ultimately, the success of the development of a Canadian ZEV supply chain turns on the ability of the various players, both private and public sector, to work in concert with one another. Many of the contributors underscored that cooperation across industries that previously didn't have much in common—e.g., assembly, mining and electrical utilities—will be a critical factor in the years to come.

"Success, in my view, is going to be a collaborative effort, with the OEMs and the federal government working together to ensure we have the proper infrastructure in place—not only for charging, but also

getting the right power to the necessary facilities, making sure it's clean, and then educating the consumer along the way," says Jason Stoicevich, President and CEO of Stellantis Canada.

Consumer acceptance, of course, depends on a range of variables—the provision of charging infrastructure, price, reliability, range and so on. Perhaps the most obvious KPI for assessing progress towards the goal of creating a national ZEV strategy is to focus on unit sales, to both individuals as well as fleet purchasers, such as transit agencies or logistics firms.

Yet not all ZEVs sold in Canada will be built in Canada, so other metrics must come into play, say industry leaders. "The KPI could be, for example, the percentage of the minerals we are extracting in Canada, and that stay in Canada in the value chain that we have here," says Marissa West, GM Canada President and Managing Director. "How much of it is being connected to value added manufacturing activities also taking place in Canada, for example, what GM is doing in Quebec with cathode active materials."

Some jurisdictions have established hard procurement targets for electric buses, against which progress will be measured. "Quebec, for example, has introduced a commitment to make all new bus purchases from 2025 onwards be zero emission," says Ralph Acs, president of Nova Bus (Volvo). "That is taking a longer-term vision, bringing it forward and making it into a commitment."

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-Marissa West,
President and Managing Director,
GM Canada

Calculating Canadian value added as a percentage of overall bus value, adds NFI's Paul Soubry, "has got to be a big measure of success. Quite frankly, the more we can do in Canada, the more competitive we become here and in the United States."

However, Pierre Boutin, of VWC, acknowledges that the question of how to precisely measure progress—and what kinds of metrics can be used as reliable proxies—remains up for discussion. "We still have a lack of agreement today on KPIs," he says. "I'm not here to tell you what are the right KPIs. We're just basically saying, let's have an agreement on KPIs and then let's push in the direction where sustainability improvements can be monitored and audited, so we understand where we can play a role as an automotive manufacturer."

The OEMs and parts manufacturers point to a range of headwinds they'll have to surmount in order to contribute to the growth

and consolidation of the overall ZEV supply chain. These include lack of charging infrastructure and electricity grids that aren't yet ready to handle the additional load demand from large-scale ZEV deployments.

"What we're hearing from our customers is that while we have these [electric bus] orders, they may want us to slow down delivery because they're not ready with infrastructure," says Paul Soubry. "The availability of green energy is one thing, but having the charging infrastructure in place is non-trivial."

"If you look at the plan set up for Canada right now," adds Jason Stoicevich, "where 60% of the vehicles [sold] are zero emissions by 2030, there's going to be one charging station for every 24 vehicles. To put some perspective around that, California will have one charging station for every 12. I don't think we're on pace at all for the charging infrastructure to meet these targets so we get the acceptance of the consumer."

Building up a ZEV labour force is another top priority. "In the last 10 to 15 years," observes GM's West, "the U.S. and Canada have lost significant ground in terms of developing the talent and the knowledge base to enable the processing of critical minerals and battery manufacturing. Even though some of the IP that was developed for lithium batteries was held by North American universities, we significantly lost ground to China and in general to Asia. Bringing the talent and the IP back will take some time."

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-Paul Soubry,
President and CEO, NFI

A further hurdle has to do with time horizons. Almost everyone interviewed for this report pointed to the lengthy permitting periods for new Canadian mines—anywhere from ten to 15 years, as compared to the two or three years required to build a new battery production facility or retool an assembly plant. That gap means that Canada's new battery manufacturers may have to use components made with critical minerals sourced outside Canada.

What's more, OEMs say they are also acutely aware of the differential in grant/tax credit processing times between Canada and the U.S., as well as Buy American procurement rules for electric transit vehicles. "One challenge we've been facing in the industry right now, especially in Canada, is the time it takes between when you actually submit an application and then officially get a term sheet completed," says West. "This is very challenging, and it's not

just as GM. Everybody's facing the same challenge right now."

She continues: "The U.S. Internal Revenue Service process is very simple. There is a clear metric on how to qualify [for tax credits] and as long as those metrics are met, you'll get it. It's much easier for us to navigate through that process than submitting an application [to the federal government] and waiting for it [to be processed]. When we look at placing a project, and are considering a variety of jurisdictions, the certainty of the investment supports by the governments involved is one of the criteria. If there is an application process with an unknown outcome, that presents challenges to business planning."

For firms at the production end of the ZEV supply chain, another hurdle at the moment—and one that seems likely to grow in the medium term—is competition for battery minerals. "One of the biggest obstacles is that everyone is going electric," observes Ralph Acs. "You want electric cars, you want electric buses. You want your buildings to be all-electric. You have to now imagine the supply chain that has to produce all this battery capability and the associated technology that connects the batteries to whatever you want to use. That is a monumental undertaking."

It's also the case that ZEV battery technology is very much a moving target, something that [Accelerate's Battery Innovation Roadmap](#) project is working to plot out. This means that battery chemistries will evolve and could eventually exist

alongside other dominant energy technologies. "The rapid change of battery technology—think of it like your mobile phone," Acs adds. "Every six months, I could go get a new phone. You have to think of batteries in the same way. Battery technology is continually developing. Will we eventually settle on a few technologies? I don't know. We'll see over time. How mature is the technology? Am I ready to jump in?"

This makes investment in R&D that prioritizes next generation technologies important. "Battery electric is a bridging technology to fuel cell electric," observes Linda Hasenfratz. "They're both electric vehicles. They both run off the same propulsion system, but where are they getting their energy? From a battery, or are they getting it from a fuel cell that's running literally off water? This is where we need to get to. There will be some segments that may always be battery electric, but I think a lot of segments should switch to the fuel cell electric and we should have that in our minds as we're developing policies, making investments and thinking about the future."

Business leaders offered a range of suggestions about short- and medium-term policies that the federal government could adopt as a means of hastening the consolidation of ZEV supply chains. These include focused efforts to educate consumers and procurement officials about the benefits of ZEVs and encourage federal officials to negotiate with their U.S. counterparts to expand market access for Canadian vehicles, parts, minerals and battery components.

Domestically, says Pierre Boutin, "we need a legislative framework that is stringent but simple enough for people to be motivated at meeting the specific requirements.

Complexity always will create some hesitation and some friction for investors." Indeed, while the federal government has made significant strides in the past two years investing in ZEV and battery production and clean electricity, industry executives argue that more needs to be done. "A facility that we develop in North America can cost three to four times more than the same facility in

Asia," says Marissa West of GM. "So we've got to have strong government support from an incentive standpoint to make it economically viable."

As for longer-term policy objectives, some contributors pointed to the importance of fostering a policy and program environment that encourages battery recycling and material recovery, and other opportunities to re-use components as a means of further reducing the climate impact of what will still be a heavy industry.



Battery manufacturing: leveraging Canada's kick-start

There's little doubt that efforts by the federal and provincial governments to entice global battery manufacturers using long-term production subsidies represent the biggest ticket component of Canada's move to build an EV supply chain. PowerCo (Volkswagen), Stellantis-LGES, and Northvolt AB will all build large scale facilities following significant combined federal and provincial funding pegged to production targets.

All these deals have been completed during a period when automakers and battery manufacturers are hurrying to make substantial investments in production capacity, and weighing inducements offered by governments in various jurisdictions, including the U.S.

"Canada needs to attract battery manufacturers," observes Danies Lee, CEO of NextStar, the battery joint venture established in Windsor by Stellantis and LGES. "The quantity of battery manufacturers they attract is important, but what is more important is the quality of those manufacturers. Everybody is trying to jump into the EV space, and the same is true for the battery manufacturing." In his view, Canada's bid to attract battery manufacturers will spur investment in a domestic supply chain for battery components and other upstream materials.

Others point out that domestic investment in battery manufacturing will support both upstream supply chains as

well as efforts by Western governments to de-risk their exposure to Chinese production. "Lithium-ion batteries is a difficult business to get into," says Frank So, executive vice president for E-One Moli Energy. "We're right in the middle between up and downstream. We'll stimulate the upstream supply chain which produces precursor materials for cathodes." He notes, however, that 95% of E-One's current supply chain is outside Canada, much of it in Asia. Yet the company has roots in B.C. and recently announced its plan to open a lithium-ion battery plant in Maple Ridge in 2028.

While industrial subsidies for Canada's new battery plants are linked to production, Lee, of NextStar, argues that another way of assessing success is speed of execution: "how quickly the firms can ramp up and produce quality batteries at scale," as he puts it. "There is no single battery manufacturer who successfully manufactures quality batteries at scale so far." Frank So agrees and adds that governments should also be watching KPIs such as jobs created, the number of people driving EVs, the number of factories making EVs, and how Canada's EV growth rate compares with the rest of the world.

Because the battery industry is relatively young, and much of it is clustered in Asia, the new plants here will need to focus on hiring and training technicians to work on production equipment that is completely different than what would be found in a conventional engine plant.

"Batteries are both capital intensive and labour intensive," says Lee. "For the Windsor

plant, we invested more than C\$5 billion. More than half of that goes to capital equipment because our process has been highly automated. But in the meantime, we are also creating more than 2500 jobs. That's a huge number and success will heavily depend on the stability and the maturity of the equipment, as well as the labour that can handle the automated equipment in a professional and skillful manner."

The firms that are establishing manufacturing facilities here are attracted by Canada's clean electricity, a critical factor for a sector that must pay attention to the OEM's concerns about scope 3 emissions. But Frank So points out that some regions need to accelerate their investment in renewing the electricity grid to ensure that clean power can flow to both the new plants as well as to the ultimate users of EVs. "The Site C [hydro-electric dam] is coming online but there isn't sufficient infrastructure in southern B.C.," he says. "There's a lot that needs to be done on infrastructure upgrades."

For Lee, however, the most impactful policy move would be for Canada to try to keep abreast of the U.S. in terms of incentives for firms investing in the EV supply chain. He admits that this ask is a tall order. "[Inflation Reduction Act funding] is such an astronomical amount of money. They see that as a kind of generational opportunity to make a change. From Canada's perspective, the same is true. I know it is quite hard for Canada to compete with the United States dollar for dollar,

but that's what the market is about."

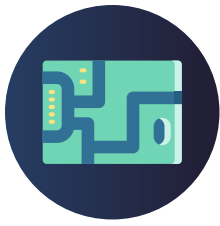
"Canada has its own advantages, like a supply chain including minerals and mining capability. But that's not sufficient to compete with the incentives the U.S. is now putting on the table."

-Danie Lee,
CEO, NextStar

He continues: "Canada has its own advantages, like a supply chain including minerals and mining capability. But that's not sufficient to compete with the incentives the U.S. is now putting on the table. So, there should be some additional measures taken by Canada to compete directly against the United States."

Yet Volkswagen Canada's Pierre Boutin stresses the potential that exists here: "Canada has most of the critical minerals required to manufacture a battery electric vehicle. Canada has great expertise in the automotive industry. Canada has one of the cleanest mining industries in the world and one of the cleanest energy grids in the world. So I think it's an extraordinary time for Canada to take a leadership role, helping to develop sustainable mobility, not only for Canadians, but beyond our borders."





The mid-stream link

One of the dominant themes in interviews with firms that are working in this segment of the EV supply chain will be familiar to Canadians who have previously participated in debates about the use of our country's natural resources. As with previous generations of raw materials—everything from crude oil to softwood lumber and hard rock ores—there is a strong interest in finding ways to add value to Canada's raw materials instead of seeing them shipped elsewhere for processing and refining.

"We need to be getting into the value-add of those resources that Canada has, so that the metals and metallic supply chains that are needed for these EV vehicles are in place and in Canada," says Pat Ryan, Chairman and CEO of UCore Rare Metals. "We can go further downstream as well, and get into the alloy and metal making, into the component making. Whether it's permanent magnets for electric motors or actual battery production, let's make sure our resources and our intel and our inputs get us to that final point."

Other leaders in this mid-stream segment agree: "We have a generational opportunity, here and now, to diverge from the typical Canadian 'hewers of wood and drawers of water' story and to refine and process our raw materials in Canada, or at least North America, rather than shipping them overseas only to be brought back as finished

products," says Dan Blondal, CEO and founder of Nano One, a producer of high-performance cathode materials.

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-Dan Blondal,
CEO and Founder, Nano One

"But," he continues, "we can't really do it if we just copy how it's done in Asia today, because ultimately, we can't compete with China's ten-year head start on manufacturing volumes and their lax environmental regulation. We have to differentiate through environmental stewardship, through cost and efficiency, but also through energy usage and very much through the elimination of the damaging and unscalable waste streams that are dominant in China. To do that, industry needs the support of government while it ramps up to competitive levels."

For the firms in this segment, a vision of success revolves around expanded investment in mid-stream processing for elements that go into cathode and anode materials. "You want to have homegrown or direct foreign investment companies setting up all along the supply chain, to some extent," says Boyd Davis, Principal at Kingston Process Metallurgy (KPM).

"We need to recognize that measuring success has to fall outside of political cycles. It requires a long-term strategy."

**-Chris Burns,
CEO, NOVONIX**

Others, however, argue that the refining and processing segment is so large that Canada should avoid the temptation to try to cover all the bases. "We should not be afraid to specialize in some part of the supply chain and not being able to fulfill all the supply chain in Canada," says Éric Desaulniers, President and CEO of Nouveau Monde Graphite. "I don't think it's realistic to think we'll do the whole thing by ourselves in Canada. We need to integrate ourselves very well with our friends south of the border."

Leaders in the mid-stream sector offer various suggestions on how to measure success—everything from reducing mine approval times to the number of well-paying jobs in this industry. But Chris Burns, CEO of

Novonix, adds a caution: "We need to recognize that measuring success has to fall outside of political cycles," he says. "It requires a long-term strategy that needs to be implemented and measured against the right times-cales so we don't end up thinking the industry is not being successful when we're taking all the right steps forward."

Besides price competition from Asian producers, firms in this space argue that Canadian public policy has yet to recognize the lift it can generate, both up and down the supply chain, by investing in processing and refining. "The government as a whole is trying to hit things along the supply chain, says KPM's Boyd Davis. "[They are saying], 'this [idea] is amazing, wonderful'. But we have no mechanism to fund this." In his view, tactical investments in testing facilities or scale-up plants would better support the supplier side and produce a needed lift to existing firms.

Large industrial subsidies, on one hand, and seed funding for tech start-ups, on the other, can produce what Davis describes as "false economies" or labour shortages for small but growing firms seeking to add talent. "You have to incentivize the industry in a way that works."

Others point to the mismatch in the business/production cycles between the various players along the supply chain. "If you don't have any refined product and you open a mine," says UCore's Pat Ryan, "then the mine will only have one option and that's to take the product and send it back to China for processing. And it'll never leave China."

It'll stay there and it'll feed that market."

Chris Burns expands on the problem, pointing out that large battery manufacturers are ready to buy material here or in the US in the next couple of years. "If we had a mining asset, then we'd have to ask, where is our customer, likely a mid-stream processing company? Process capability has to happen in that sequential order so that companies can finance these projects. But the problem is the time to build these mining, processing and manufacturing projects is actually the inverse order. Mining takes the longest, then midstream, then cell manufacturing, and auto plants. So how do you stand up the supply chain?"

Finally, some mid-market players have expressed concern about the cost of capex in Canada, combined with the relative lack of in-house expertise among the potential major funders of such projects. "Even within the large pension funds we do have here, they don't have quite the expertise to analyze such complex projects," says Éric Desaulniers of NMG. "The capital market isn't developed just yet for the processing of battery material. It's a new expertise."

In terms of short- and medium-term policy moves, Boyd Davis argues that Canada should and could play to its strength in terms of the country's low-carbon grid and adopt ESG-oriented rules and standards for new entrants as a means of encouraging private sector investment from ESG-minded asset managers. "Recycling is a way of kickstarting the supply chain," he adds. "It's not the only answer, but it is an answer to

getting a supply chain going. You have to understand these are globally traded commodities."

"Even within the large pension funds we do have here, they don't have quite the expertise to analyze such complex projects."

-Éric Desaulniers,
President and CEO,
Nouveau Monde Graphite

Pat Ryan argues that the industry needs to spend more time educating both its customers and policy makers about how the supply chain actually works. "We need to get more of our customers involved, meaning the customers that are actually using the product at the end of the day—the automotive companies or wind energy companies," he says. "They need to be very involved, actually helping the government understand what specific critical metals they need, when they need them, and what volumes they need them in.

Ryan continues: "For example, on the rare earth side, there's a real shortage in metal alloy making. There are a number of up-and-coming resources companies that are rare earth, but a rare earth mine in North America has not been opened in 70 years. It seems like a little bridge between separated oxides and magnet making, but that metal alloy bridge is missing. And without that

metal alloy bridge, you're stuck. You have to have all the nodes working together. The customer has to help the government understand what nodes are the weakest. You know, a chain is only as strong as its weakest link."

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-Pat Ryan,
Chairman and CEO, UCore Rare Metals

Others point to trade policy as an important lever in this part of the supply chain. "The federal government has to look at all kinds of options," says Chris Burns. "If Canada is mostly going to live upstream and be exporting processed materials into the U.S. as a large customer, then our need to tariff inbound materials to Canada is maybe not as necessary because we're the producers of those materials. But policy-makers need to look at the strategy they want to implement for the country. We have to consider all of these trade policies, not just to understand how they directly impact us, but to understand how to ensure that the intention of the policies in neighbouring countries like the US are going

to be held, and not, for example, have Chinese materials come into Canada to be upgraded a certain amount and then flow to the US under USMCA and IRA."

Lastly, some industry leaders point to Quebec as an example of how governments and the existing firms in the supply chain have come up with not just an integrated approach but a broad political consensus that can serve as a foundation for further policy-making.

"They've been working for years to create a cross-governmental framework within Quebec that most everyone is bought into," observes Dan Blondal. "The feds are there too, with a willingness to be miners and refiners and makers of materials and batteries, as evidenced by the flurry of foreign investment and globally significant companies coming into Canada. It is important now for Canada and its provinces to lead with our raw materials, our highly skilled workforce, our history of mining, our track record of environmental stewardship, our manufacturing base and our proximity to the US markets. But it is also vital that Government support home grown technologies and companies, that are gearing up to address competitive challenges from China and other Asian markets. It is important that Canada and Québec diversify their NMC¹ strategy by adding LFP² and supporting the mines, refiners and mid-stream companies that truly make it localized, environmentally differentiated and cost competitive."

¹ Nickel Manganese Cobalt battery

² Lithium Iron Phosphate battery



Catalyzing our natural advantage

Leaders in the mining sector, and the nascent rare earths industry, offer a very broad range of views about the challenges associated with building an integrated ZEV supply chain in Canada. Over the past two decades, most of Canada's largest mining companies have been acquired by multi-nationals, which bring, axiomatically, a global perspective to the massive task of providing reliable, economic and sustainable raw materials to the firms further downstream tasked with refining minerals, embedding them in lithium-ion batteries or other components such as motors and magnets, and installing these in ZEVs.

Meanwhile, there's a growing domestic lithium mining space that sees opportunities to move its product into the North American supply chain. Lastly, emerging rare earth firms assert that they can provide sustainable raw materials as well as a hedge against geo-political risk in a vertical where 98% of processed rare earths come from China.

When Canadian miners talk about their vision of success in Canada, several mentioned the emergence of new and sustainable technologies that will differentiate domestic mining operations. "We're producing a very low carbon emission type of aluminum, being seven to eight times less carbon intensive than the rest of the world," says Sébastien Ross, Managing

Director of Rio Tinto's Atlantic operations. "We're also working on the breakthrough technology, Elysis™, with our partner Alcoa, the federal government and the Quebec government. We're able to produce a zero-carbon emission aluminum as we speak and in a smaller industrial fashion, but we need to de-risk and then scale up the technology."

Peter Xavier, Vice President of Glencore's Sudbury integrated nickel operations, cites the company's investment in a zero-emission heavy vehicle fleet in Sudbury. "We are leading when it comes to the deployment of zero emission vehicles, even in the mining operations, and that's a neat story. Northern Ontario is actually probably one of the leading jurisdictions in the world [for this kind of innovation]."

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-Peter Xavier,
Vice-president, Glencore's Sudbury integrated nickel operations

Novel recycling technologies such as that

developed by Cyclic Materials offers yet another example: "Basically, we close the loop for those most critical metals called rare earth metals by recovering them from various products and putting those back into newer applications, such as electric vehicles and wind turbines," explains President and Co-founder Ahmad Ghahreman. "Our raw materials will produce the magnets that we desperately need for those applications. I mention this because 96% of the magnets currently are supplied by one country and that puts a lot of supply chain risk in place."

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-Ahmad Ghahreman,
President and Co-founder,
Cyclic Materials

But mainly, those in the mining world point to the wealth of Canadian mineral resources that are ideally suited to supply the EV supply chain. "Start with what we have," says Trevor Walker, CEO of Frontier Lithium. "Canada's endowed quite heavily with critical minerals like lithium. That's a place we need

to focus on developing because that's where competitive advantage has always been for Canada—rich or high-quality resources in a safe jurisdiction."

When asked to define a metric of what constitutes success in the development of an EV supply chain, Walker points out that Canadian governments and industry should develop "a system for tracking how much [critical mineral] is used in Canada—like trade balance. If we can use trade balance and isolate critical materials right through to electric vehicle manufacturing, that's a great metric." Ghahreman points to KPIs such as substantial carbon and water use reductions associated with sustainable technologies like Cyclic's, and how these can be used to attract downstream customers concerned about cutting their scope 2 and scope 3 emissions.

Scott Montieth, CEO of Avalon Advanced Metals, says the most important measure is the degree of integration achieved with a critical minerals strategy. "My metric would be a fully integrated supply-to-refining solution, and then on to battery manufacturing. Instead of Canadian raw material suppliers producing, for example, lithium-concentrate and shipping it off to Korea or Germany or the US, let's refine that raw material into battery grade lithium. Let's manufacture the batteries here in Canada, whether it's Ontario, Quebec or elsewhere. And let's also provide the services necessary to complete the fabrication of the batteries."

Most in the mining community, as well as firms located downstream, say that the primary obstacle to Canada's success in the

emerging EV supply chain has to do with the duration and complexity of the permitting process, particularly in the face of intense competition from rival jurisdictions.

“My metric would be a fully integrated supply-to-refining solution, and then on to battery manufacturing.”

-Scott Montieth,
CEO, Avalon Advanced Metals

"If you look at nickel, a key metal, it hasn't really seen that much growth in Canada," says Glencore's Peter Xavier. "If you look at a jurisdiction like Indonesia, that went from nothing to approaching half the global market, that's a whole-of-government focused approach. Once that's there, all those other pieces will fall into place."

Trevor Walker points to the lack of public investment in the infrastructure required to enable new mines to operate. "A lot of my time is working with government to try and direct funds around building roads and bringing in the power lines that are essential to opening up the north for further development of the resources that we know are in the ground."

Many voices in this end of the supply chain also pointed to the fact that the bulk of public sector investment in the past two years has gone to OEMs and battery manufacturers, with relatively little directed

towards incentivizing the development of refining/processing plants and stabilizing the approvals process to reduce investor risk.

"We need to massively invest in smelting operations and Canada is a relatively high-cost jurisdiction for securing the capital to construct a new site," says Sébastien Ross of Rio Tinto. "A few months back when the government announced their new program for clean technology and manufacturing, aluminum was excluded, and for us this is a barrier because we're not as competitive a country in terms of a capex intensity."

“We need to massively invest in smelting operations and Canada is a relatively high-cost jurisdiction for securing the capital to construct a new site.”

-Sébastien Ross,
Managing Director
Atlantic Operations, Rio Tinto Aluminium

"They have enough lithium to start," adds Trevor Walker. But in the long term, we think there's going to be a constant pull of government support from the OEMs because the reality is they need to go to where the materials are or they need to find a way to have secure supply chains in the future. " He continues: "My view is if you have a resilient supply of raw materials and intermediate materials, then it's not as heavy as a lift to continue to attract the OEMs."

We think it's expensive now, trying to keep the OEMs that have a presence here or attract new ones. Just wait till in the future. I think it's going to continue to cost taxpayers money in the long term until we set up leverage around our materials here."

"My view is if you have a resilient supply of raw materials and intermediate materials, then it's not as heavy as a lift to continue to attract the OEMs."

-Trevor Walker,
President, Frontier Lithium

In terms of short- and medium-term moves, Peter Xavier points out that a one-window approach to mine approvals would make the Canadian sector more competitive. "Instead of a mining company having to deal with a couple of different ministries at the provincial level and a couple of ministries at the federal level, how can you have one shorter window approach and then address some of the other supporting elements, such as labour shortages."

But Scott Montieth, of Avalon, is optimistic about the firm's prospects. "I don't see major barriers. [Our] mine is literally taken care of. It's going to be in full production in three years. We'll be producing about 250,000 tons of petalite. We have a lot of raw material." With his firm, the challenge is building out a proposed lithium

hydroxide processing plant in Thunder Bay and then finding customers, both in the EV sector and elsewhere in the chemical industry.

"The thing that the feds and or the province can do would be to help companies like Avalon find the right strategic partner for constructing these refineries. Rather than the old-fashioned sales and marketing approach of cold calling people or letting them cold call you to see if there's some match, if there could be some facilitation that can be coordinated between the feds and Canadian industry matching with strategic partners, that would really help, not just financially but operationally in the planning, construction and operation of such facilities."



Finding common ground for an industrial plan

What constitutes a successful ZEV industry in Canada? Leaders in the companies situated at various points along this supply chain have many answers to this question, and it's important to note that their interests do not always align. But there is significant agreement that the end goal – building a broader, coast-to-coast-to-coast version of the kind of supply chain that grew up around the Auto Pact in the 1960s – offers clear economic and sustainability benefit for all of Canada.

Based on the feedback gathered in this report, four areas of common importance emerge to guide the development of an industrial plan aimed at building a thriving ZEV industry for Canada:

1. To meet this moment, Canada must invest significantly in every segment of the supply chain.

Because Canada is uniquely positioned globally to be relevant in many parts of the ZEV industry, significant public investment should be distributed across the entire supply chain, including in mid-stream sectors that are able to process and refine Canadian natural resources before they leave the country.

2. Canada is best positioned if it sees this industrial opportunity as one focused primarily on North America.

Despite the complexity and geographical scope of these intricate supply chains, Canada is best positioned if it views the challenge and opportunity before us as one primarily focused on North America. The reasons include the existing critical mass of vehicle production within the USMCA region, the availability of Canada's natural resources, and a growing consensus that the EV sector's heavy reliance on China represents a significant source of both geo-political and supply chain risk.

3. KPIs are integral to measuring Canada's progress towards success.

What gets measured gets done. KPIs are critical to establishing an industrial plan and to understanding if Canada is achieving what it sets out to do. Such KPIs could include setting targets for Canadian-sourced inputs into North American-produced ZEVs, production-related GHG reductions, or jobs created by the broad ZEV industry.

4. Industrial planning must focus on both the production of today's resources, materials, components, vehicles, and infrastructure AND innovating and scaling tomorrow's technologies.

Finally, many of the contributors stressed the importance of using such an industrial plan to not only drive production but to also propel Canadian innovation primarily focused on scaling new technologies that can make the production of ZEVs and their constituent components more sustainable, and thus properly suited to their promise of reducing global emissions.

“Canada needs to step on the pedal to accelerate the electrification of transportation, to maintain of its enviable position on the world stage and maintain a leading position. This will require, among other things, the implementation of regulations favoring ZEVs, the deployment of attractive financial incentives to facilitate the transition, and the development of a complete, diversified, high-performance supply chain.”

-Marc Bédard,
CEO and Founder, the Lion Electric Co

Report contributors and methodology:

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- Éric Desaulniers, CEO, Nouveau Monde Graphite
- Ahmad Ghahreman, President and Co-founder, Cyclic Materials
- Linda Hasenfratz, Chairman and CEO, Linamar
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- Paul Soubry, CEO NFI
- Jason Stoicevich, President, Stellantis Canada
- Trevor Walker, President, Frontier Lithium
- Marissa West, President and Managing Director, GM Canada
- Peter Xavier, Vice President, Sudbury Integrated Nickel Operations, Glencore

In the Summer and Fall of 2023, Accelerate interviewed these executives, representing a range of firms operating within the ZEV supply chain.

Each interview was structured around four central questions:

1. What is a realistic vision of success for the ZEV supply chain in Canada?
2. What do you consider to be a reliable metric of success?
3. What are the major barriers to success?
4. What short- and medium-term actions should governments and the industry consider in order to achieve success?

During the interviews, the leaders addressed Accelerate's four main questions and frequently raised other issues of concern and opportunity. The report includes those additional observations. The timing of the conversations reflected major federal and provincial government initiatives around battery manufacturing in Canada, new investments driven by the Inflation Reduction Act's climate initiatives as well as federal electrification programs.