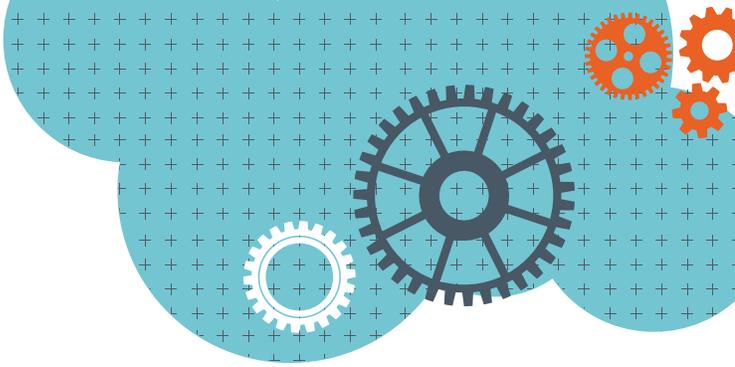




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Turning Talk into Action: Building Canada's Battery Supply Chain

 CLEAN ENERGY CANADA



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Executive Summary

The world's largest economies are ramping up their climate ambitions and radically reimagining their economies. Canada too must not only identify where our strategic opportunities lie in a future net-zero world—but also take steps today to ensure those opportunities don't pass us by.

Canada has a once-in-generation opportunity to establish itself as a major player in the global battery sector, but that window will close with or without us.

Why must Canada act now?

First is the scale of the opportunity. Driven largely, though not exclusively, by the rapid growth in electric vehicle manufacturing, the global market for lithium-ion batteries is expected to grow exponentially over the next few decades, as will demand for the metals and minerals that supply them.

Second, the benefits for Canada are economy-spanning. With known deposits of critical metals and minerals, plenty of clean electricity (to power lower-carbon operations), and access to a well-integrated North American market, Canada can do more than merely extract and supply the raw materials—we can be a leading supplier of sustainable battery materials and a producer of cutting-edge technology.

And finally, developing Canada's battery supply chain will help anchor our existing auto sector, ensuring we capture the jobs and value created in the transition to electric vehicles.

With Asia and Europe accelerating ahead, North America needs to catch up—or lose global market share.

In the Roadmap for a Renewed U.S.-Canada Partnership released earlier this year, President Joe Biden and Prime Minister Justin Trudeau identified the battery supply chain as a collaborative opportunity for our two nations.

But despite actions taken to date, industry stakeholders felt that **Canada is still a long way from having a mature battery supply chain**. Which is why Clean Energy Canada convened experts across the supply chain—including mining, battery manufacturing, auto parts and assembly, and battery recycling—to identify these no-regrets priority actions Canada must take in the immediate-term to establish itself as a player in the global battery industry.

1. **Form an intergovernmental battery secretariat** to enable decision-makers across departments and levels of government to act quickly, nimbly, and in a coordinated way.

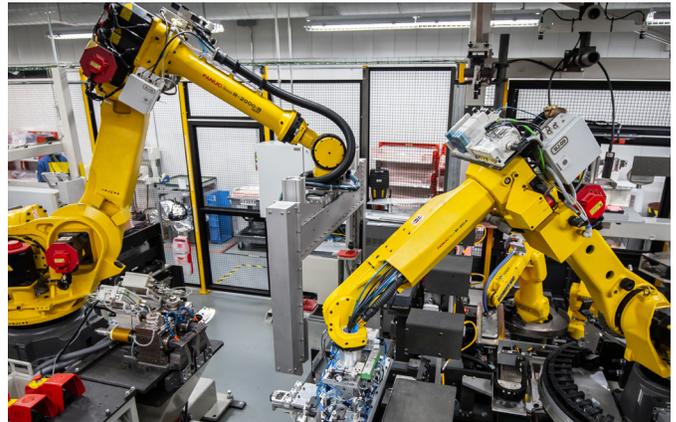


Photo credit: Blue Solutions

2. **Immediately convene an industry-led Canadian battery task force** to deliver advice to governments on how to develop Canada's battery industry by the end of 2021.
3. **Develop a North American Battery Alliance** within the next year to leverage the integrated Canada-U.S. market, connect players along the supply chain, and drive capital investment.
4. **Unlock Canada's sustainable battery metals, minerals, and materials supply** to realize one of Canada's major value propositions and attract battery-related investment.
5. **Ramp up Canada's midstream supply chain capacity** to feed battery materials and components to regional auto manufacturers.
6. **Launch a dedicated battery supply chain fund** to address challenges and invest in strategic projects along the Canadian value chain.
7. **Better promote Canada's clean and responsible battery brand** to secure investment and attract OEMs and tier 1 battery producers to locate their facilities here.
8. **Create a government-funded, industry-led Battery Centre of Excellence** focused on commercializing advanced battery technology and manufacturing R&D.
9. **Grow demand for batteries in North America** to ensure there is sufficient demand for EVs, batteries, and their input materials and parts.

The battery supply chain is a key one for Canada, as acknowledged by the federal government in its most recent climate plan and last month's budget. **But action matters more than talk, and more action will be needed to build a domestic industry.**

State of Play

As the automotive industry rapidly transitions to electric vehicles, the demand for batteries and the metals and minerals that go into them are projected to take off.¹ The global market for lithium-ion batteries is expected to exceed \$100 billion by 2030.² According to the World Bank, demand for minerals like graphite, lithium, and cobalt could increase by nearly 500% by 2050 in order to supply these batteries and other clean technologies.³

Currently, 80% of the world's batteries are produced in Japan, South Korea, and China. China alone controls the majority of global battery material processing and cathode production, giving the country significant influence over pricing and supply chain flows. The COVID pandemic, however, has exposed the vulnerability of global supply chains, from local vaccine manufacturing capacity to the microchip shortage plaguing the auto industry. The United States and the European Union have flagged their dependence on Asia, mainly China, for batteries and battery materials as a major risk to their auto industries. Both regions are working to restructure supply chains and source more batteries and materials from their own regions—and both regions have identified Canada as a secure and stable source of sustainable raw materials.⁴

The EU in particular has made rapid progress in the last few years on building a competitive battery industry. In 2017, it identified batteries as an area of strategic importance for the region and formed the European Battery Alliance to establish a complete domestic battery supply chain. Since then, the Alliance has put forward more than €6 billion to build out that supply chain, and the EU has surpassed China as the world's top market for EVs and top destination for EV-related investments.⁵

With at least 15 large-scale battery cell factories currently under construction and a draft Battery Regulation that would ensure European batteries are the cleanest in the world, the EU plans to become entirely self-sufficient on EV batteries by 2025.⁶

The Government of Canada has acknowledged our country's opportunity to become a global leader in the production of batteries. In its strengthened climate plan, the federal government commits to supporting the development of a battery supply chain in Canada through a “mines to mobility” approach.⁷ Efforts to date, including the *Canadian Metals and Minerals Plan*,⁸ the *From Mines to Mobility: What We Heard Report*,⁹ and the *Roadmap for a Renewed U.S.-Canada Partnership*¹⁰ are important starts. Recent investments supporting EV assembly in Ontario and battery module production in Quebec are putting Canada on the EV



Photo credit: Automotive Parts Manufacturers' Association

“Of course, we are familiar with Canada's huge base of key battery raw materials such as nickel, lithium, cobalt, graphite, copper and manganese. But the potential to add these into high value chemicals, cathodes, anodes and even engage in the production of lithium-ion batteries offers the country a major slice of this growing lithium ion and electric vehicle economic pie.”

- Benchmark Mineral Intelligence, 2021

and battery map. Further commitments made in the 2021 federal budget and strategic investments by the Government of Quebec will help grow some parts of the battery supply chain and keep Canada moving in the right direction.¹¹

But more action is needed to build our domestic industry, and Canada's window of opportunity to enter the battery market is now. Each of the “Detroit Three” automakers have announced major electric vehicle assembly investments in Canada over the past eight months.¹² President Joe Biden's proposed \$2 trillion infrastructure plan would pour US\$174 billion into developing the EV market, including through consumer purchase incentives, a national network of half a million chargers by 2030, and electrifying school and transit buses.¹³ With known deposits of critical metals and minerals, responsibly produced resources, abundant clean electricity, a skilled workforce, a cutting-edge battery R&D (research and development) ecosystem, and proximity to a well-integrated North American market, Canada can lead on sustainable battery material and technology production.¹⁴

Purpose & Process



Photo credit: E-One Moli Energy Corporation

Given the strategic importance of batteries in the energy transition and the federal government's ongoing work to develop its "mines to mobility" approach, Clean Energy Canada saw an opportunity to contribute to these efforts. Specifically, we wanted to drive forward discussions around building Canada's battery supply chain from "why we should do it" to "how we should do it." We therefore convened a representative group of experts on the issue of building Canada's battery supply chain in a virtual dialogue event on March 30 and 31.

In advance of the dialogue, Clean Energy Canada:

- reviewed literature on global battery supply chains and zero-emission vehicle (ZEV) trends,
- interviewed participants to understand their perspectives and test for areas of convergence,
- produced a discussion paper listing potential priority actions for discussion, and
- worked to shape an effective agenda and facilitation for the dialogue event.

A pre-recorded video greeting from federal Minister of Natural Resources Seamus O'Regan opened the roundtable. He discussed Canada's potential to become a global leader in producing advanced batteries, highlighted the actions the federal government has taken to date, and emphasized the

importance of groups coming together to work on solutions to fill the gaps.

The battery dialogue was a success. Experts were encouraged by the enthusiasm and level of alignment among those who participated and expressed interest in continuing to work together on developing Canada's battery industry. Following the dialogue, Clean Energy Canada staff worked with experts, often one-on-one, to produce this set of priority actions to develop the battery supply chain in Canada.

Some of the priority actions set out in this report require government action. Other actions will require leadership from industry, investors, and academia.

While this dialogue was originally designed to focus on batteries for electric vehicles because the vast majority of lithium-ion battery demand will come from transportation through 2030,¹⁵ experts recognized the broader opportunities for batteries in the energy transition. Canada's battery supply chain should be built with these broader opportunities in mind.

This report summarizes the priority actions Canada must take to build its battery supply chain and establish itself as a player in the global battery industry. It will be shared with key ministers and policymakers at the federal and provincial level. We look forward to working with governments, industry, and other stakeholders on advancing this topic in the months ahead.

A Battery Vision for Canada



Photo credit: Automotive Parts Manufacturers' Association

Canada has many of the ingredients needed to produce batteries and their input materials and parts. But experts felt that **we need to better define what Canada's battery opportunity actually is and set out an ambitious vision to guide industrial development.** The experts we convened jointly developed this working battery vision for Canada:

By 2030, Canada is a global leader in clean, innovative battery technology and strategic materials production and recycling, and is a hub for sustainable battery production in North America.¹⁶

Canada has much to gain by developing a domestic battery supply chain and positioning itself to lead in the global battery market. Specifically, **experts agreed that achieving the vision set out above would benefit Canada in the following ways:**

- Secures Canada's competitive advantage and strategic position in an emerging net zero global economy.
- Retains and creates good, secure and diverse jobs across Canada.
- Builds on and accelerates Canada's cleantech leadership to capture and retain robust technology R&D and high-value intellectual property.
- Builds human and economic capital that supports the battery ecosystem and other sectors of the economy.

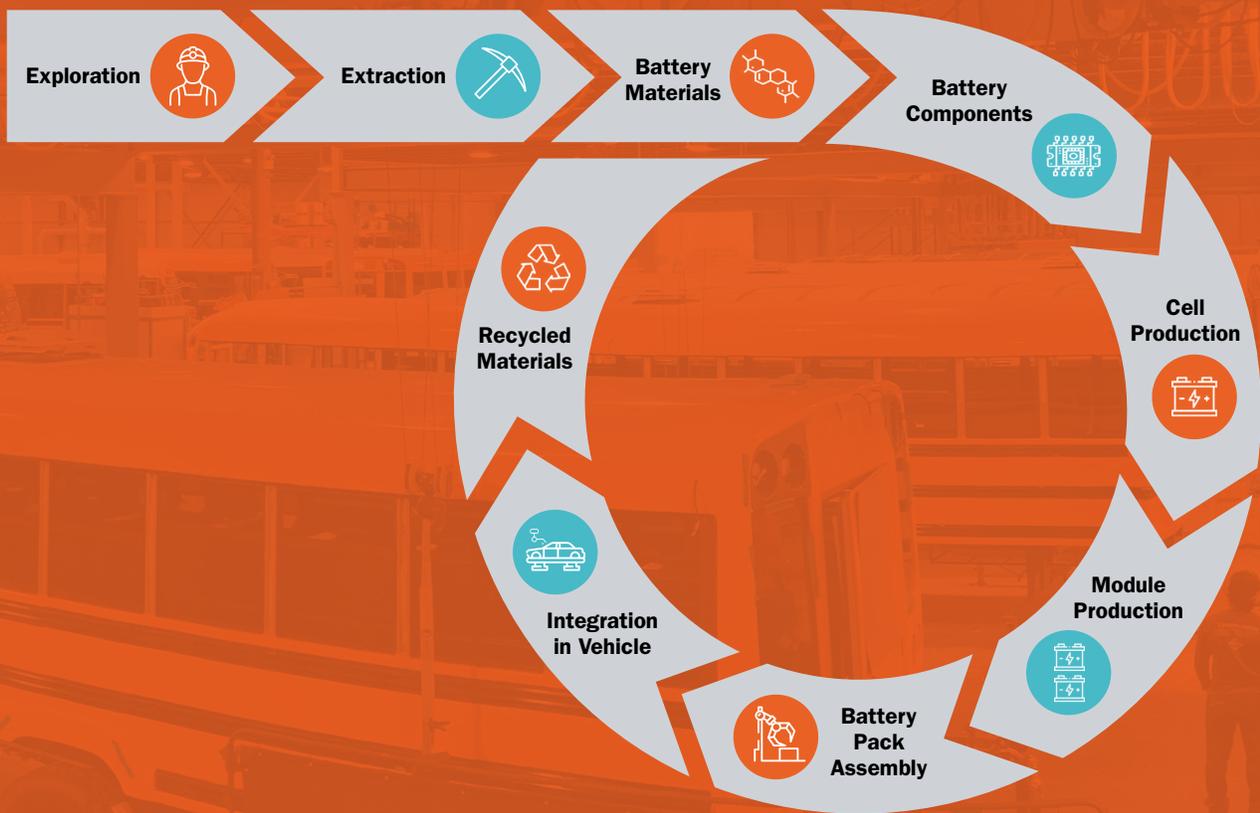
Future auto jobs are in batteries

A recent Boston Consulting Group analysis comparing EV and internal combustion engine (ICE) vehicle supply chains found that labour requirements for both types of vehicles are comparable, but because EVs have fewer parts and are easier to assemble, the EV jobs shift to different parts along the supply chain—namely, to battery cell manufacturing. This means the pivot to EV production could lead to job losses unless Canada captures jobs in the battery supply chain.

- Helps Canada meet its climate targets (e.g. greenhouse gas emission reduction and ZEV sales) and demonstrates global climate leadership.

Furthermore, opportunities to feed into the battery supply chain aren't limited to just one or two provinces; they exist across Canada. For instance, British Columbia already specializes in marine vehicle battery technology.¹⁷ In Alberta and Saskatchewan, companies are developing capabilities to extract lithium from oilfield wastewater brines.¹⁸ Manitoba assembles zero-emission buses.¹⁹ Ontario is home to cobalt and nickel reserves and production, a strong auto parts sector, one of North America's largest battery recycling companies,²⁰ and EV passenger vehicle assembly plants.²¹ Quebec has lithium and graphite resources, assembles electric buses and trucks, hosts one of the world's leading battery research labs, and is positioning itself to lead on battery recycling.²² Finally, Nova Scotia is home to a world-renowned battery research team.²³

The Major Stages along the Battery Supply Chain



Challenges to Overcome

Despite actions taken to date, experts felt that Canada is still a long way from a well-developed domestic battery supply chain. These are what they see as the biggest challenges Canada faces in building out its supply chain:

- **Lots of talk, limited action:** Despite being ranked fourth in the world by BloombergNEF for its battery supply chain potential, Canada has minimal existing or announced manufacturing capacity.²⁴ In fact, there is very limited activity happening at any stage along the supply chain. Notably, none of Canada's mined metals and minerals are feeding into the battery value chain. Canada generally lacks metal refining and chemical processing capacity related to battery grade materials. Canada doesn't have any significant active material manufacturing and is not producing battery modules, cells, or packs at commercial scale.
- **Market challenges:** Canada's small market size makes it challenging to scale up domestic battery supply chains and justify locating major battery manufacturing facilities here. For this reason, it will be important for Canada to maintain close ties with the U.S. as our major export market. A related challenge is that Canada has no domestic OEM (original equipment manufacturer) champion for passenger vehicles, making us wholly reliant on foreign investment. On the other hand, Canada does have some large, homegrown companies assembling vehicles in other segments (e.g. Lion Electric, New Flyer, Taiga) and producing auto parts (e.g. Magna, Linamar) that are already pivoting into EVs.²⁵ The nearly \$6 billion in recent investments made by Ford Motor,



Photo credits: Lion Electric Company



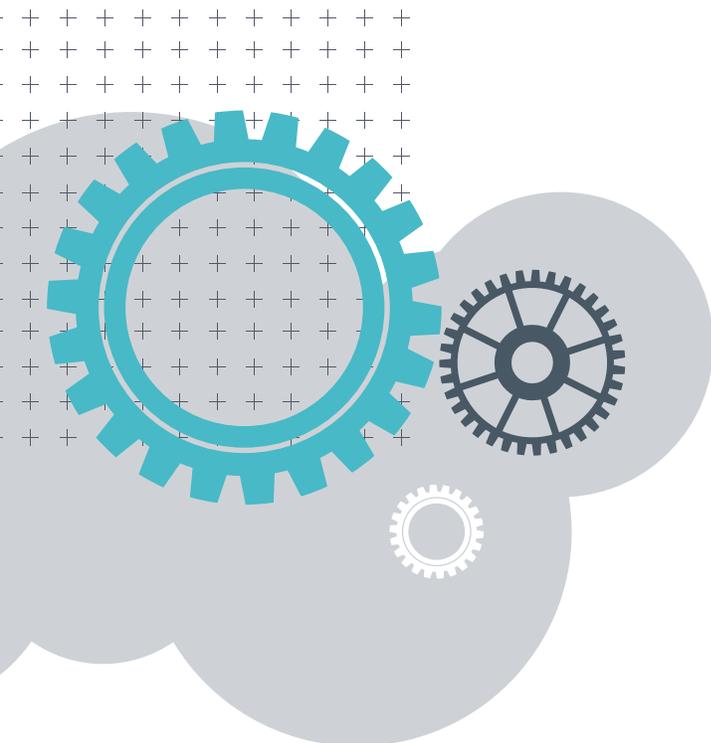
Photo credits: Lion Electric Company

Stellantis, and General Motors are also seen as a clear sign these companies view Canada as an attractive place to invest.

- **In the shadow of China:** China “sets the bar” on both cost and time between breaking ground and getting the first product off the assembly line. China's years of experience in the battery business, government intervention and support, lax labour standards, and ability to flood the market with a surplus of goods to drive down commodity prices all make it very difficult to compete with on cost—especially without similar government support coming from Canada. Canada may never be able to compete on lowest-cost and so should look to other strengths it could market, such as ESG and lifecycle greenhouse gas performance.
- **Slow decision-making:** Administrative processes, permitting decisions, and funding allocations can have long lead times, making Canada a hard jurisdiction to grow in. Companies that are looking to scale up fast and are under competitive pressure to move forward are forced to set up shop in other countries that can accommodate their needs—even if they were attracted to Canada for other reasons. Beyond China, other jurisdictions such as the U.S. are competing with Canada for battery-related investments, too. Canada must find a way to expedite decision-making processes while maintaining world-leading ESG (environmental, social,

and governance) standards if it wants to attract and retain companies in the battery industry.

- **Lack of investment:** Domestic sources of financing are limited and often focus on R&D versus commercialization. Canada has not secured enough foreign direct investment to fill the gap. This is particularly the case for mining projects, which carry higher levels of risk. Despite Canada having reserves of these mineral resources, we're seeing no significant investments in building and bringing future capacity online.
- **Market risk and uncertainty:** The global battery industry is growing fast. Uncertainty around technology, investment flows, and new players entering the market make it difficult for one sector in the supply chain to scale up without similar actions occurring up- and downstream. This challenge weighs in favour of an approach that builds out various parts of Canada's battery supply chain simultaneously, similar to the way "hydrogen hubs" are being used in Canada to address related challenges by bringing together and aligning supply chain players with end users. If mining companies see there will be a market for their products, it helps alleviate the risks, and if battery cell producers know they'll have a secure supply of raw materials, they'll be more likely to locate their facilities here.
- **Limited industrial policy:** Canada tends to take a more passive approach to economic development. Meanwhile, industrial strategy has played a big role in other markets such as the EU. If Canada wants to compete, it will have to explore similar approaches, such as an industrial roadmap or electric mobility strategy that identifies where the country wants to go and how to get there.
- **Fast-changing, proprietary technology:** Significant resources are going into battery research and development right now because it's the main way automakers control the cost and extend the performance range of an EV. It is challenging to build a supply chain around this technology when each battery "recipe" is unique, confidential, and quickly evolving. Increasing the supply of one critical input may benefit one battery technology but not another. Alternatively, by the time supply of that input gets to market, the latest battery technology may no longer need it. These challenges make a one-size-fits-all strategy more difficult to land on, unless Canada narrows in on certain materials and components that are used by a broader range of buyers, for example lithium or nickel.



Focusing on Priority Actions



Photo credit: Lion Electric Company

The experts were clear: If Canada wants to compete on batteries, from raw materials extraction to battery cell production, it must move swiftly and ambitiously. They identified the following no-regrets priority actions Canada must take in the immediate-term to establish itself as a player in the global battery industry.

1. Form an intergovernmental battery secretariat

Federal and provincial government efforts to build parts of Canada's battery supply chain have not been well-coordinated to date. To break down silos across government and better coordinate programs, policies, and investments, a federal-provincial battery secretariat must be formed.

The secretariat would bring together ministers and key department staff from federal and provincial governments. At the federal level, the secretariat must include representatives from Innovation, Science and Economic Development; Natural Resources Canada; Environment and Climate Change; Transport Canada; Finance; and Global Affairs. Experts felt that leadership at the cabinet committee level would elevate building the battery supply chain as part of a key economic strategy for Canada's auto, mining, and manufacturing sectors. Provincial representatives must also be involved. The secretariat would enable decision-makers across departments and levels of government to act quickly, nimbly, proactively,

and in a coordinated way. Finally, the secretariat would liaise with industry, communicating government efforts and outcomes regularly.

2. Immediately convene a Canadian battery task force

Experts emphasized that Canada's battery supply chain efforts must be coordinated with the U.S., as contemplated in the 2021 Roadmap for a Renewed U.S.-Canada Partnership,²⁶ but agreed that Canada must first get its own "ducks in a row" to strengthen its bargaining power. To lead this effort, an industry-led, government-supported task force must be convened immediately to advance work through the summer and deliver advice to governments on how to develop Canada's battery industry by the end of 2021. The task force must be made up of key players along the battery supply chain plus leaders from Canadian financial institutions, and it must liaise with the intergovernmental battery secretariat described above. Its deliverables would be to:

- To quantify Canada's battery opportunity (both domestic and export potential).
- Articulate a clear value proposition for policymakers, investors, and trading partners (jobs, economic development, ESG credentials, low-carbon competitiveness).

- Determine how much capital is needed to support scaling up and where along the supply chain those investments are needed.
- Develop an action plan that includes: (i) identifying key gaps in the supply chain that need to be addressed; (ii) determining top priorities for industrial development; and (iii) setting targets for investment and production capacity.

Once government and industry stakeholders across the supply chain are aligned and clear on what Canada brings to the table, Canada will be in a stronger position to engage with the U.S. on creating a North American Battery Alliance.

Some experts noted the ongoing development of a ZEV supply chain alliance in Canada and suggested this could be a forum for Canadian battery industry stakeholders to continue collaborating. Others around the table showed interest in this idea. Whichever forum is selected, the key will be to ensure the task force can move quickly and effectively in advancing its work and delivering advice.

3. Develop a North American Battery Alliance

Canada may be a relatively small market on its own, but the integrated nature of North American vehicle supply chains comes with considerable advantages. Canada and the U.S. already have a Joint Action Plan on Critical Minerals, which “sets the baseline for prioritizing domestic and North American production of metals and minerals required for the clean economy.” In the February 2021 Roadmap for a Renewed U.S.-Canada Partnership, Trudeau and Biden agreed to strengthen this Joint Action Plan and work together in building the necessary supply chains so that both countries can lead on battery development and production.²⁷ To this end, experts were adamant that Canada must do more than extract raw materials and supply them to the U.S. Rather, Canada must position itself to supply the growing North American market with batteries and their input materials and parts.

The federal government must build on these efforts and work with the U.S. to create a North American Battery Alliance that leverages the integrated market and ensures both countries are committed to working together in developing an industrial strategy for batteries that is competitive with the EU. Similar to the EU Battery Alliance, the North American

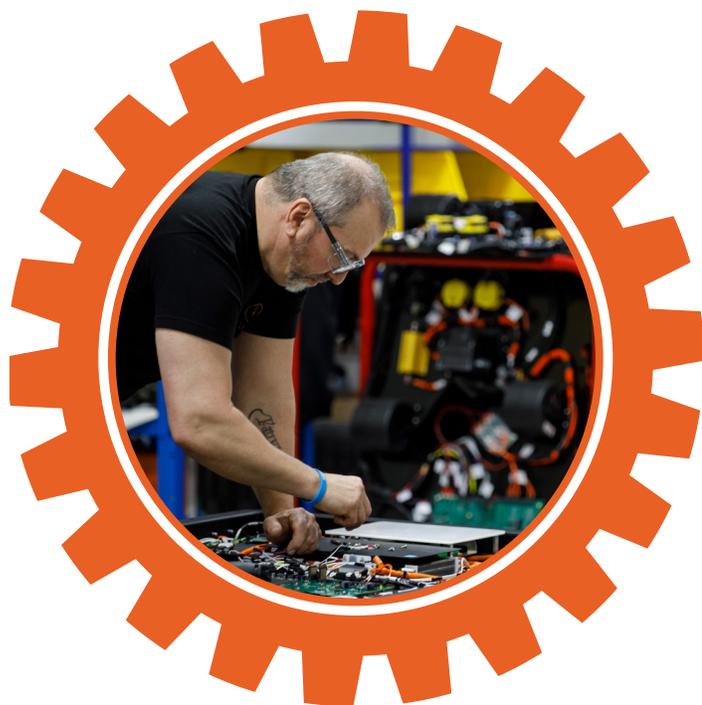


Photo credit: Lion Electric Company

CASE STUDY

EU Battery Alliance

The European Battery Alliance gathers the European Commission, interested EU countries, investment institutions, and key industrial, innovation, and academic stakeholders. The network is managed by EIT InnoEnergy, a European company supported by the European Institute of Innovation and Technology. The EBA's goal is to “create a competitive and sustainable battery industry in Europe by 2025 to capitalize on opportunities and capture a new market worth €250 billion per year.” Since its launch in 2017, the EBA has:

- Put forward over €6 billion to build out Europe's EV battery supply chain through to 2031.
- Supported industrial projects across the value chain in 22 countries.
- Dramatically increased Europe's market share of advanced lithium-ion batteries.
- Helped Europe surpass China as the world's leading EV market.

In 2020, the EU proposed a Batteries Regulation that focuses on (1) carbon footprint labelling, (2) ethical sourcing of raw materials, and (3) recycling criteria.

Battery Alliance would connect players along the battery supply chain, raise the profile of the battery industry, and drive capital investment. It must include senior leaders from government, finance, and industries across the supply chain who are committed to putting resources into this initiative. It must also focus on getting capital investment flowing by including an investment platform to accelerate transactions between members, or a buyer-supplier network to foster dialogue and connect buyers with budding suppliers looking for contracts. Finally, the North American Battery Alliance should follow the EU's example and focus on sustainability as its competitive advantage compared to Asia. The Global Battery Alliance's Battery Passport project could be leveraged to ensure traceability, transparency, and high ESG standards along North American supply chains. To capture a piece of the fast-growing global market, Canada and the U.S. should form this alliance within the next year.

4. Unlock Canada's sustainable battery metals, minerals, and materials supply

Canada's access to metal and mineral resources is a key strength and one of the major value propositions the country can highlight for global companies and investors to attract battery-related investment. To maximize this potential, Canada must:

a. Improve supply chain data and transparency. It is well-understood that Canada has reserves of metals and minerals that go into batteries, but details beyond that are limited. Industry and investors need more information on what portion of these reserves will feed into the battery supply chain and within what timeline these will become available. They would also benefit from a map of Canada's processing capabilities, supply chain gaps, and planned investments to fill them. To support the government in prioritizing these investments and

generating this information, a working group including industry associations such as the Mining Association of Canada, Battery Metals Association of Canada, Propulsion Quebec, Canadian Vehicle Manufacturers' Association, and Automotive Parts Manufacturers' Association should be convened to exchange information on the state of upstream material supply and downstream customer needs. A similar conversation could take place with U.S. buyers through a North American Battery Alliance. Better data and transparency will help governments, industry and investors make informed decisions and determine what can be sourced from Canada versus what must be imported from other countries.

- b. Develop a Battery Metals and Materials Action Plan** for the mining industry that allows it to sustain and expand EV mineral and metal production and processing while decarbonizing and supporting world leading sustainability criteria. The plan should also focus on establishing and scaling up a secure, complete, and sustainable critical minerals supply chain here in Canada. We must ensure Canadian companies have access to strategic materials and minerals for economic, environmental, geopolitical, and national security reasons. Efforts set out in the plan should also align with projected battery technology trends, which will see increased demand for nickel.
- c. Create a Clean Capital Plan for Critical Minerals** to accompany the action plan and get clean investment moving into Canadian mining projects. The capital plan should focus on: facilitating the discovery of new battery metal and mineral deposits through geological mapping and a supplemental mineral exploration tax credit; expanding mineral resource assessments; de-risking new projects until they can reach operational independence; supporting demonstration-scale processing facilities; and scaling up successful demonstration projects. Government



efforts must focus on attracting green capital from foreign investors, including U.S. investors. If Canada is going to supply secure, sustainable, and ethical mineral resources to the U.S., this should come with financial support. As an example, Sweden has successfully secured investments from other countries like Germany to support its mining projects.

- d. **Establish an off-grid electrification fund** that supports mine electrification where possible and accelerates the development of other technologies such as hydrogen and small modular reactors to deploy when grid connection is not an option.
- e. **Accelerate project permit timelines** while still ensuring Canada is meeting the highest environmental, social, and governance standards, including Indigenous consultation and partnership.

5. Ramp up Canada's midstream supply chain capacity

Key stages of the supply chain exist in between raw materials and battery integration into vehicles—namely, refined and precursor materials and components and active materials. These are big supply chain gaps for Canada. Precursor materials such as coated spherical purified graphite (coated-SPG), lithium carbonate and hydroxide, nickel-cobalt sulphate, and components like cathodes and anodes are some of the highest-value components along the battery supply chain. Benchmark Minerals Intelligence, an independent Price Reporting Agency, has stated that Canada's biggest opportunity for value generation is not in battery or EV production, but in developing the midstream supply chains that feed into regional manufacturers like the Detroit Big Three.²⁸ Experts agreed that Canada must build capacity in these areas—and fast.

Canada should start with a scan of current activities and capacity in these stages of the battery supply chain, followed by an assessment of where it is best positioned to compete. It may be necessary to develop domestic processing and refining capabilities using imported materials while building out Canadian production capacity for critical battery minerals and metals, similar to what the EU is doing.²⁹ The \$36.8 million proposed in the 2021 federal budget for federal R&D to advance critical battery mineral processing and refining expertise offers some support for early-stage activities. But in the near- to medium-term, Canada should aim to extract,

refine, and produce battery-grade cobalt and nickel sulphate, coated-SPG, and lithium hydroxide at commercial scale. Doing so would secure the upper part of the supply chain and feed into electrode (i.e. cathode and anode) as well as cell manufacturing in Canada.

Finally, federal and provincial governments should also engage with cathode and other active material manufacturers such as BASF and Umicore to understand what they would need to set up a plant here. With only three plants in all of North America currently making cathodes, there is a market opportunity to fill—especially when it comes to nickel-rich cathodes. A nickel-rich cathode manufacturing plant would also provide a direct client for Canadian mining and recycling companies, supporting both upstream and downstream supply chain development.

6. Launch a dedicated battery supply chain fund

The federal government has announced an \$8-billion Net-Zero Accelerator Fund, a portion of which will go to battery supply chain development.³⁰ While experts welcome all forms of government support for batteries, they agreed that this is not the right funding mechanism to solve the battery supply chain challenges Canada faces. The amount of money earmarked for batteries is also insufficient given the scale of this opportunity and the speed at which other countries are moving to capture it.

The federal government must create a \$15 billion battery supply chain fund dedicated to addressing challenges and investing in strategic projects along the Canadian value chain. The fund must be carved out specifically for the batteries versus being another stream within the Strategic Innovation Fund. The fund must be nimble and responsive to break down barriers along the supply chain—whether it's completing a low-cost feasibility study or tackling bigger questions requiring large investments, such as how Canada produces nickel sulphate at scale. It must use public funds to leverage private capital and enable public-private-partnerships. Experts suggested a “challenge fund,” which can be useful to solving problems the government doesn't yet have answers to by asking the private sector to bring solutions forward as part of their applications. The challenge must be designed with input from industry and be outcome-based. Finally, the fund must be accessible and administered expediently (something the existing Strategic Innovation Fund has historically struggled with).

7. Better promote Canada's clean and responsible battery brand

Canada will not be able to compete with China in offering the lowest battery and material costs, but we have plenty of other competitive advantages to attract global auto and battery companies—namely security, stability, and sustainability. Proximity to critical metal and mineral reserves is a big advantage as EV and battery companies move to localize supply chains, decrease the distance heavy batteries need to travel, and vertically integrate to drive down production costs.³¹

With an abundance of raw metals and minerals, proximity to the growing U.S. EV market, and more stringent rules governing tariff-free auto trade in North America under the Canada-U.S.-Mexico Agreement, Canada has a lot to offer foreign investors looking to get a foothold in North American

CASE STUDY

Sweden, Strategy for a Sustainable Battery Value Chain

Sweden's strategy for a sustainable battery value chain seeks to take advantage of the country's existing strengths: access to raw materials, processing and refinement capacity, battery cell production and recycling (Northvolt), auto manufacturing (Volvo, Scania), research capacity, cheap and fossil-free electricity, and proximity to a large and growing European market. Sweden's mining industry has remained competitive with lower-cost jurisdictions due to innovations in technology and business models, differentiating by operating in 'premium' segments of commodity markets. Sweden's mines are generally low-emission, with many existing processes and operations electrified, and the sector has a target of net-zero emissions by 2045. Initiatives to further reduce emissions include electrification of mining equipment and longer-term projects to decarbonize downstream processing (e.g. HYBRIT in iron ore and steel, Cementsa in cement). Sweden has also established close connections with neighboring countries such as Finland for upstream supplies and Germany for downstream buyers, as exemplified by the Northvolt-Volkswagen partnership established in 2019.

markets. Canada's responsibly sourced resources and clean electricity grid give it a further competitive edge as automakers increasingly look to source ethical materials and reduce emissions across the lifecycle of the vehicles they produce.³²

Experts stated that federal and provincial governments need to take a more proactive approach to securing investment and attracting OEMs and tier 1 battery producers to locate their facilities here. They must start by defining Canada's full value proposition, including responsibly mined resources with Indigenous equity and approval, proximity to the U.S., a cutting-edge battery research and recycling ecosystem, and the low-carbon advantage that comes with abundant clean electricity. Sweden, a country with strengths similar to Canada's, has done this effectively in its strategy for a sustainable battery value chain.

The federal government must then develop a branding and marketing strategy to better highlight Canada's clean and responsible battery brand—not only to sell to Canadians, but also to market abroad and to downstream buyers. Government departments like Global Affairs Canada and Natural Resources Canada, plus agencies like Invest Canada and Export Development Canada, would be well-positioned to take the lead on this effort.

8. Create a Battery Centre of Excellence

Canada is already a leader in battery technology and R&D. The University of Toronto has its own EV research centre, which specializes in autonomous EV development as well as designing new battery technology.³³ Tesla has built a battery-related research and development centre at Innovacorp's Technology Innovation Centre in Dartmouth, Nova Scotia, and signed a five-year research agreement with Jeff Dahn, a Dalhousie University professor and research pioneer on lithium-ion batteries.³⁴ Hydro-Québec's Center of Excellence in Transportation Electrification and Energy Storage is a world-class innovation hub for battery materials and home of key patents used worldwide in lithium iron phosphate cathodes and solid-state batteries.³⁵ Where Canada falls short, however, is on converting battery-related technology and R&D into mass production and manufacturing.

Experts want a government-funded, industry-led Centre of Excellence focused on commercializing advanced battery technology and manufacturing R&D. The centre would

cluster university researchers, mining companies, battery manufacturers, and auto OEMs into one hub to support testing, demonstration, and the commercialization of new technologies. An industry-led centre will ensure success is defined as the creation of intellectual property, economic value, and technology leadership, as opposed to academic publications.

The Centre of Excellence should have at least three focus areas:

- a. **Next generation battery technologies:** While lithium-ion batteries are the predominant battery type being deployed now, there are other technologies currently in development with greater ranges and energy intensities—such as solid-state batteries—that will come to dominate in the next 30 years. Canada is already home to Blue Solutions Canada, one of the first companies in the world to produce solid-state batteries for commercial use.³⁶ Large-scale verification and commercialization of this technology through the Centre could help companies like Blue Solutions move into mass production.
- b. **Advanced battery manufacturing:** In addition to technology, the centre should also focus on the development of advanced battery manufacturing techniques to support manufacturers. Batteries are becoming larger and more complicated. Each of the manufacturing processes needs to be fine-tuned for high-speed manufacturing. The Centre of

CASE STUDY

UK Battery Industrialisation Centre

The £130-million UK Battery Industrialisation Centre links promising early-stage battery technologies with successful mass production. It is a publicly funded battery product development facility that brings manufacturers, entrepreneurs, researchers, and educators together to commercialize technologies central to the development and manufacture of batteries. The centre helps companies scale up and move into high-volume battery and EV production. It is a key part of the Faraday Battery Challenge—a government program to fast track the development of cost-effective, high-performance, and recyclable batteries—and supports the U.K.'s mobility industrial strategy.

Excellence can be a hub for new manufacturing know-how and a testing ground before investment is made in full-scale production equipment.

- c. **Battery recycling:** Canada is home to some of the leading and largest battery recycling companies in North America. Battery design currently considers ways to maximize energy density, range, and performance, while minimizing cost. The ease and efficiency with which a battery can be recycled should also be optimized during the battery design stage.³⁷ The Centre of Excellence could bring researchers and battery recycling companies together to find ways to maximize battery recyclability in battery design.

Finally, the Centre of Excellence must build on existing national and provincial efforts. For instance, Quebec's Smart and Electric Mobility Innovation Hub brings together battery-related industrial, academic, and institutional partners to focus on industrial ecosystem growth.³⁸ Saskatchewan's Research Council is developing Canada's first Rare Earth processing facility.³⁹ The National Research Council of Canada hosts a pilot-scale battery manufacturing line facility in Boucherville, Quebec, that supports new battery technology development and de-risking.⁴⁰ It also runs a LiBTec industrial R&D group aimed at developing the Canadian supply chain



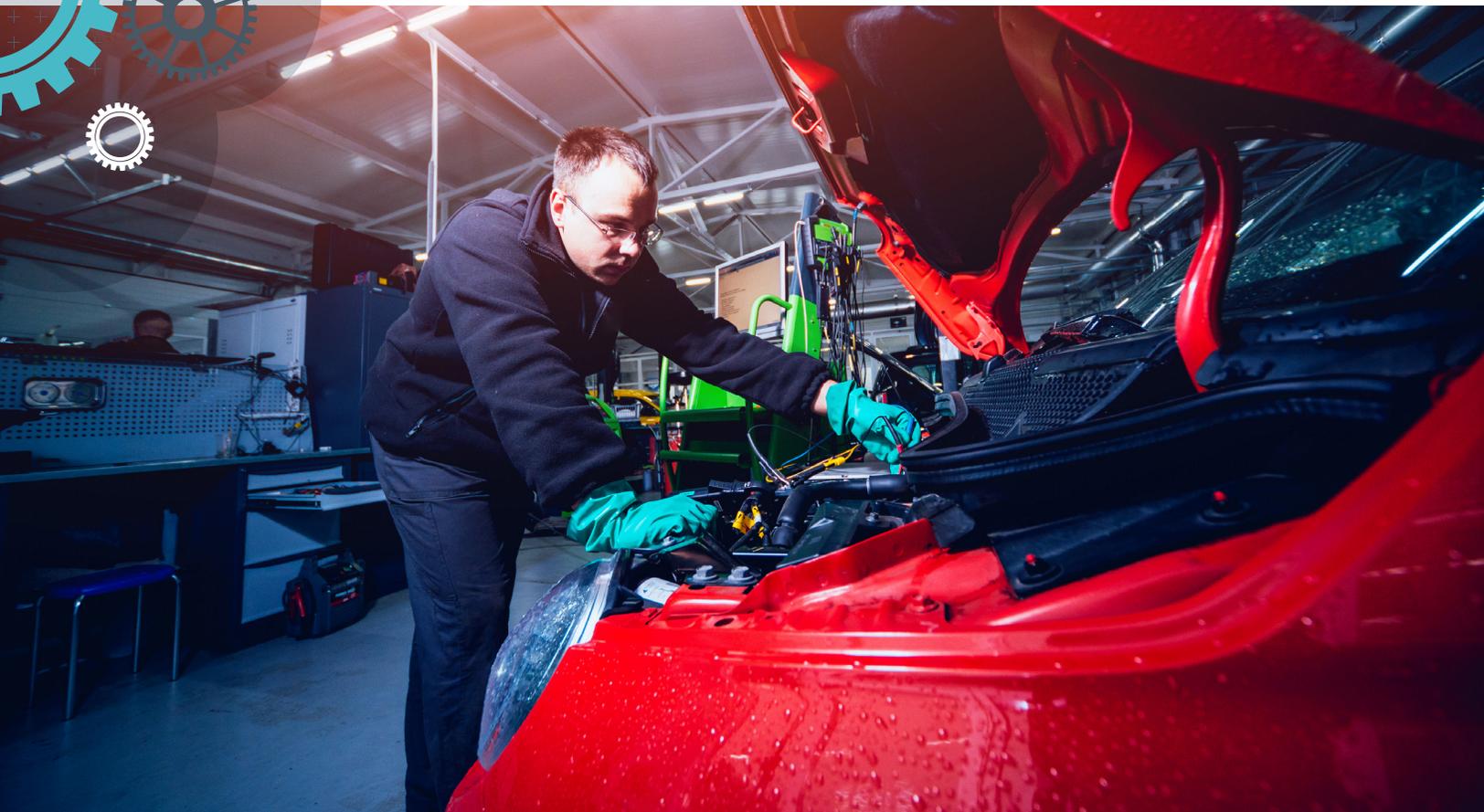
Photo credit: Lithion Recycling

in value-added graphite and lithium materials, specifically for lithium-ion battery applications.⁴¹

9. Grow demand for batteries in North America

Rather than seeking to build an advanced battery industry and supply chain in North America while demand for lithium-ion batteries is still centered off-shore, Canada must also support the growth of a robust domestic EV market and ensure there is sufficient demand for EVs, batteries, and their input materials and parts in North America. EV uptake in North America trails other markets like the EU and China. While EVs currently make up 2-3% of all new passenger vehicles sold in Canada and the U.S. today, other countries are seeing market shares in the double digits.⁴²

Existing federal incentive programs to make EVs more affordable for Canadians and efforts to date to build out a public charging network are a good start. But Canada must do more to catch up to its international peers. Experts did not align on the best way to grow the market for EVs in North America, but many discussed the need to accelerate adoption in different vehicle segments and provide market certainty for businesses and investors. A Canadian ZEV Market Development Strategy that bridges policies for deployment (such as EV purchase incentives) with charging infrastructure needs and economic development opportunities in the North American market could effectively pull the pieces together. Some experts stressed the need to make sure Canadian producers are meeting the growing demand by implementing “Buy Clean” provisions or other policies that encourage vehicles and components to be produced with the least amount of carbon emissions possible.⁴³



Next Steps



Photo credit: Lion Electric Company

Canada has a chance to establish itself as a major player in the global battery industry, but we must act fast to seize this opportunity. If we don't, other countries will fill the gap in meeting the growing demand for EVs and secure the advanced manufacturing jobs, intellectual property, and other economic gains that come with it. Developing Canada's battery supply chain and manufacturing capacity will anchor our existing auto sector, ensure we capture the jobs and value created in the transition to electric vehicles, and support the growth of new jobs and industries in the clean energy economy.

The priority actions outlined in this report are among the most important and immediate actions Canada must take to advance as a leader in the production of battery materials and technology.

We applaud the Government of Canada for its commitment to supporting the development of a domestic battery supply chain. We look forward to contributing further ideas to the design of specific policies, programs, and initiatives within and outside of government as they take shape.

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