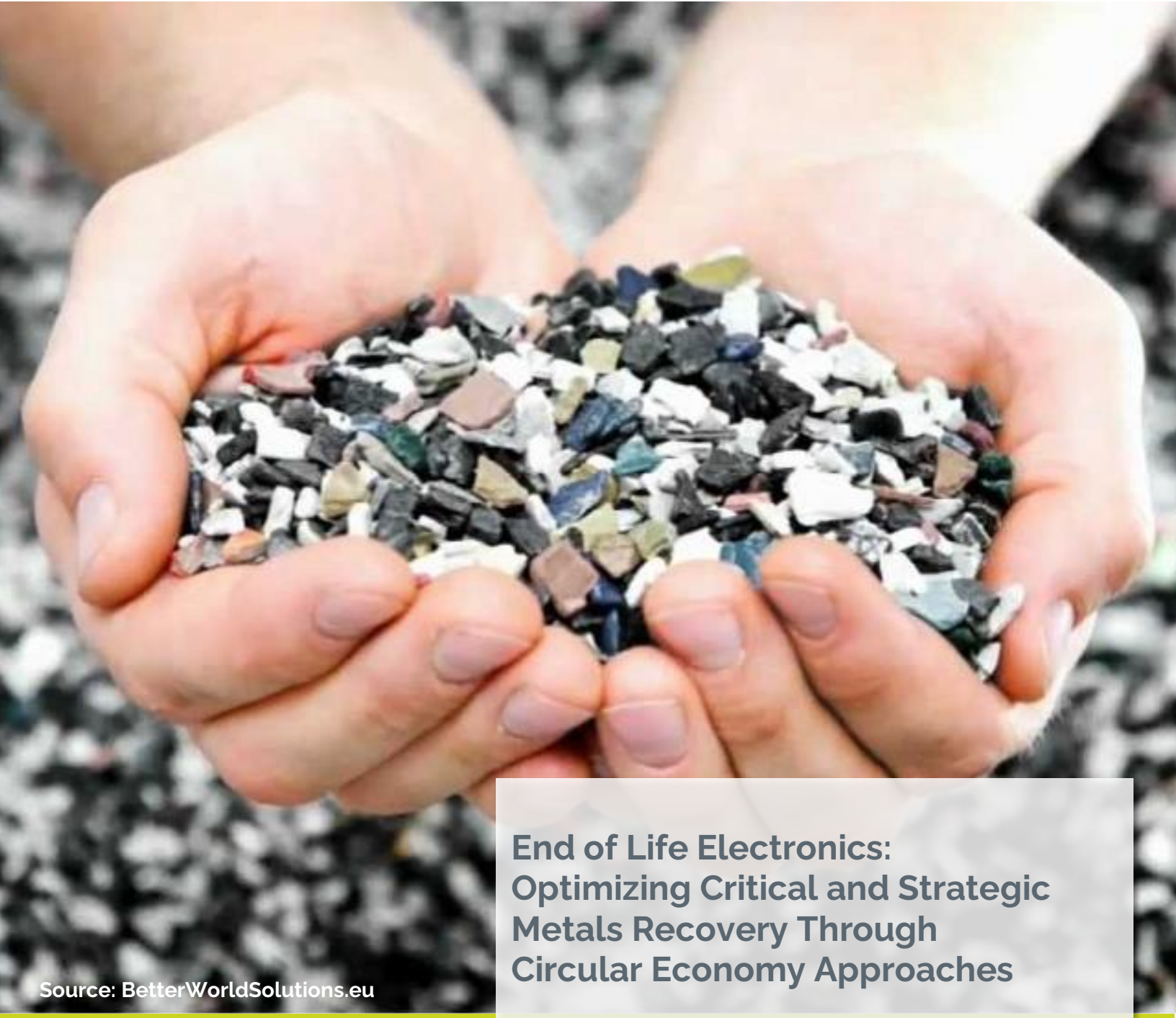

Source: BetterWorldSolutions.eu

End of Life Electronics: Optimizing Critical and Strategic Metals Recovery Through Circular Economy Approaches

World Circular Economy Forum Side Event
SUMMARY REPORT
January 2022

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End of Life Electronics: Optimizing Critical and Strategic Metals Recovery Through Circular Economy Approaches

SESSION SUMMARY REPORT

This event was held on October 13th, 2021 as a side event to the World Circular Economy Forum 2021.

Supporting Partner Acknowledgements

EPRA

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Background

Across the world, there are mounting concerns that the current state of End-of-Life Electronics (EOLE) waste has enormous economic, environmental, and social costs, and at the same time represents significant potential for economic gains. In Canada, an estimated 150,000 tonnes of unwanted electronic devices are collected annually, up to half of which is ferrous and nonferrous metals. Furthermore, up to 69 elements from the periodic table can be found in electrical and electronic equipment, including precious metals and strategically important 'critical minerals.' Some of these minerals have few substitutes and their supply is at risk, so their recovery from EOLE streams should be a strategic concern in the North American market and elsewhere.

Developing an integrated, value-oriented circular economy strategy for EOLE is becoming an urgent priority globally, with large private and public sector players beginning to collaborate on a range of issues, including design and demand management, take-back programs, and the technology and business models needed for responsible recycling.

Clearly EOLE is a global issue, but there are unique challenges that must be addressed in Canada and North America to both deal with our domestic economies and waste streams, and to contribute to global solutions. Additionally, Canada possesses skills in technology, metals smelting, and refining that create a potential domestic competitive advantage while contributing to EOLE solutions internationally.

This WCEF Side Event built greater awareness of the opportunity to improve critical materials recovery from EOLE in North America and identified strategic priorities for action among private sector and public sector actors that are consistent with circular economy principles and practices.

There were 274 registrants from 18 countries, including Canada, USA, Belgium, India, Spain, Turkey, Venzuela, Panama, Italy, Netherlands, Germany, Brazil, Portugal, Senegal, UK, Georgia,France, and Algeria.

To view a recording of the webinar, click the 'Play' button.

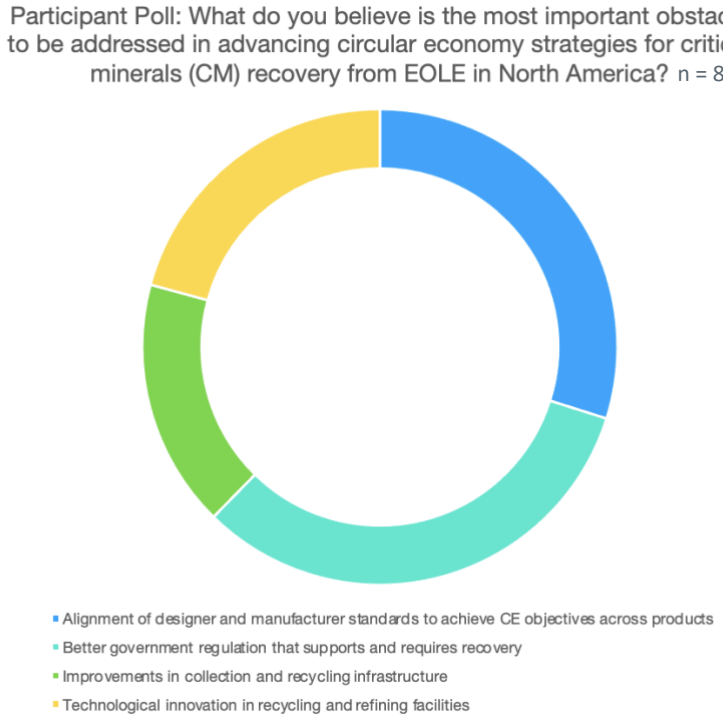
Session Presentations & Panels

Introduction

***Jeff Labonté**,*
Assistant Deputy Minister, Lands & Minerals Sector, Natural Resources Canada

- Canada is primed to capitalize on the rising global demand for critical minerals, driven in large part by their role in the transition to a low-carbon and digitized economy.
- Essential for renewable energy and clean technology applications (batteries, permanent magnets, solar panels, and wind turbines), critical minerals are also required inputs for advanced manufacturing supply chains, including defence and security technologies, consumer electronics, agriculture, medical applications, and critical infrastructure.
- Since projected global demand for critical minerals currently exceeds projected supply, there is a compelling need to maximize the collection and processing of products (like EOL) that contain these vital elements.
- Economies that optimize resource efficiencies and secure positions in dynamic supply chains will be well situated for long-term economic growth and prosperity.

- The recovery and repurposing of important minerals, metals and other materials is key to Canada's Critical Minerals Plan.



Keynote Presentation

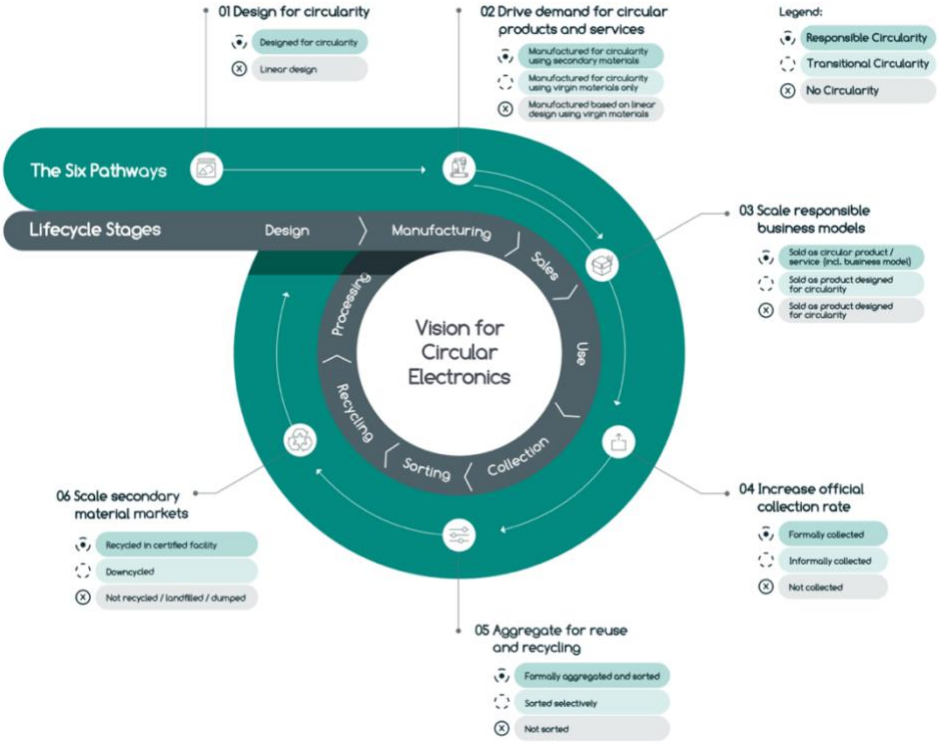
Dan Reid
Director of Environment & Circularity,
Responsible Business Alliance

- Founded in 2004 by a group of leading electronics companies, the Responsible Business Alliance (RBA), formerly the Electronic Industry Citizenship Coalition, is a non-profit comprised of electronics, retail, auto and toy companies committed to supporting the rights and well-being of workers and communities worldwide affected by the global supply chain.
- The RBA membership, with over 170 members, has been actively contributing towards the development of the Circular Electronics Roadmap via the global Circular Electronics Partnership (see graphic below).
- Primary materials, including minerals, used to manufacture today's electronic devices have environmental, social, and economic risks that can minimized through circular interventions along the supply chain, which encourage re-use, re-purposing and recycling of materials and components.
- In recognition of these impacts and potential mitigation strategies RBA also helped to establish the Responsible Minerals Initiatives to support responsible mineral

production and sourcing globally, including but not limited to conflict-affected and high-risk areas, providing companies with tools and resources that improve regulatory compliance, align with international standards, and support industry and stakeholder expectations.

- Minerals have great potential for CE solutions given that their value chains are relatively mature in terms of due diligence and standardization. Critical Minerals are even more attractive due to recent policy and regulatory prioritization in many countries globally to secure stable supply chains.
- Inconsistent supply chain coordination and misalignment were identified as important challenges for the electronics sector.
- It is Important that standardized data and definitions be established and widely adopted to enable the robust tracking of materials via a comprehensive traceability platform.
- In addition, further work is required to encourage, stimulate and/or support the market for secondary materials. Currently there is a tension between uncertainty in consistent supply required for attracting investors/buyers, and there is insufficient clarity of demand for producers to commit to the necessary production technology. This conundrum needs to be addressed through range of incentives and greater clarity in materials tracking and inventories.

Figure 1. A Roadmap Towards a Circular Electronics industry[1]



[1] Circular Electronics Partnership, Circular Electronics Roadmap: An Industry Strategy Towards Circularity

Panel One: Collection of EOLE Across North America

Moderated by **Alan Langdon**, CEO of Encorp Pacific

Lynda Hawton Kitamura
CFO and VP Operations,
Electronic Products
Recycling Association

Jason Linnell
Executive Director,
National Center for
Electronics Recycling

- Canada has had regulated, industry-led programs for electronics recycling dating back to 2007, and now most provinces have high consumer awareness levels related to take-back of EOLE.
- In assessing the performance of EOLE collection, you need to look beyond a straight weight-based metric, and instead consider public awareness, and program accessibility measures.
- Demand for the minerals and metals found in EOLE is only growing, and public awareness of recycling is heightened by examples like the Tokyo Olympic metals being made from EOLE.

- The US has a wide range of regulated and voluntary programs at the state level which has led to many inconsistencies with data on material recovery of EOLE. Canada's regulated programs seem to have better data.
- Significant advances in materials science and engineering have led to the light-weighting of most electronic devices and the inclusion of less common minor metals such as gallium and tantalum.
- The speakers strongly recommended increased market development efforts for some of the more problematic/difficult materials (plastics and leaded CRT glass for example).
- Disposal bans are a regulatory option in jurisdictions where mature, accessible take-back programs are available to drive collection of EOLE.

Panel Two: Processing Considerations related to EOLE and Material Recovery

Moderated by **Rob Sinclair**, Senior Policy Advisor, Natural Resources Canada

Sean De Vries
R2 Standard Director,
Sustainable Electronics
Recycling International

Kunal Sinha
Head of Copper and
Electronic Recycling,
Glencore Canada Corporation

- Sustainable Electronics Recycling International (SERI) is a non-profit organization based in the US with a mission is to help create a world where electronic products are reused and recycled in a way that promotes resource preservation, the well-being of the natural environment, and the health and safety of workers and communities.
- SERI programs aim to protect the planet and enrich lives by championing sustainable actions throughout the entire electronics lifecycle. SERI is an ANSI Accredited Standards Developer that develops the R2 Standard and oversees the R2 certification program.
- The R2 Standard is used in over 1,000 electronics reuse and recycling facilities across 33 nations globally. The latest refresh of the standard has been vetted by a diverse group of stakeholders.
- R2's use of focus materials enables the standard to require tracking and special care provisions be tied to critical components such as circuit boards.
- Glencore is a world-leader in copper recovery and helped Canada pioneer precious metals recovery from EOLE in the 1980s. The Horne Smelter in Rouyn-Noranda (Quebec) is a strategically important facility where the enhanced material recovery from EOLE is concerned.
- Glencore's CCR Electro-refinery in Montreal receives inputs (i.e., copper anodes) from the Horne smelter. These anodes are processed further to extract silver, gold, platinum group metals, plus various nickel, tellurium, and selenium products.
- About 15% (or 36,000 t/y) of this smelter's feedstock is recyclable material of which half Is EOLE. Regarding the EOLE, 60-65% Is from the US, 15% from Canada and the remainder from Europe
- Determining which early-stage processing techniques are viable (i.e., shredding) will be key to ensure the smelter is able to recover rare earth elements (REE). REE

recovery technology is still under development and is the source of some investment focus for Glencore.

- Smelting technology innovation needs to be accompanied by coordination with supply chain partners on design, manufacturing and data tracking standards that will enable more efficient recovery of minerals at EOL.
- We need to change the mindset from diverting waste to recovering resources. Market incentives should focus in part on inspiring specific material and component recovery strategies for high value resources. (e.g., magnets).

Panel Three: International Perspectives related to EOLE and Material Recovery

Moderated by **Jay Illingworth**, Director of Harmonization, EPRA

Yara Barkopoulos
Global Value Recovery Manager, Google

Pascal Leroy
Director General, WEEE Forum

- Google has put a priority focus on a circular economy approach to reducing e-waste across all their business entities. Beyond recycling, which is a last option, they focus on repurposing, remarketing, and recovering key components from their vast array of servers.
- The initiative has an internal component to optimize use of materials across and between various business units, and where appropriate with external partners where others can ensure that materials and components are meeting their highest value use.
- An example of external partnerships work is with Seagate (an American data storage firm) to harvest hard drive magnets from EOL servers and repurpose them in new servers.
- As part of the overall CE initiative, they are looking at opportunities to standardize products to make them more interchangeable across different applications, as opposed to developing customized components, which are not transferable or re-usable.
- With the WEEE (waste electrical and electronic equipment) legislation in Europe now being 20+ years in operation, across all member states and with a very wide scope of devices, there has been good progress on recovery of critical materials.

- Along with the EOLE waste focus the European Commission has taken a deeper look at the kinds of critical raw materials that will be necessary for products and technology of the future. The Action Plan on Critical Raw Materials looks at the current and future challenges and proposes actions to reduce Europe's dependency on third countries, diversifying supply from both primary and secondary sources and improving resource efficiency and circularity while promoting responsible sourcing worldwide.
- There has been a strong focus on incentivizing and making collection more convenient for consumers. EU reports 55% recycling of e-waste versus global levels of 17%.
- The WEEE Forum's Urban Mine Platform displays all "readily available data" on products put on the market, stocks (in use and hibernated), composition and waste flows for electrical and electronic equipment (EEE) and for vehicles and batteries as well. It lists the compositions specified for key components, materials, and elements, such as aluminium, copper, gold, or neodymium, contained in EEE. And it includes waste flow estimates.
- A key goal is to use aggressive collection and waste reduction targets in a way that drives and rewards eco-design principles which make recovery and re-use more efficient and economic.

Panel Four: Policy/Regulatory Perspectives related to EOLE and Material Recovery

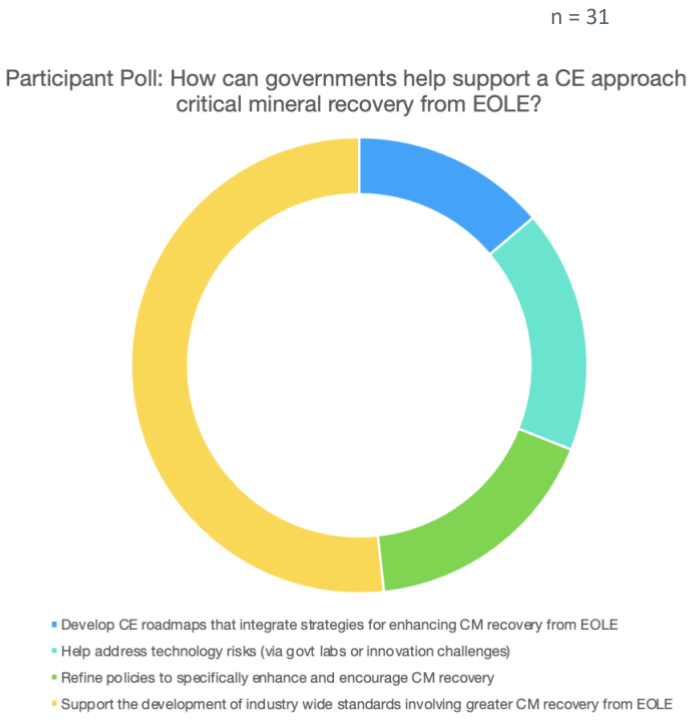
Moderated by **Rob Sinclair**, Senior Policy Advisor, Natural Resources Canada

Janice Zinck
Director Critical Minerals Task Force,
Natural Resources Canada

Ron Vance
Chief of Resource Conservation Branch,
US Environmental Protection Agency

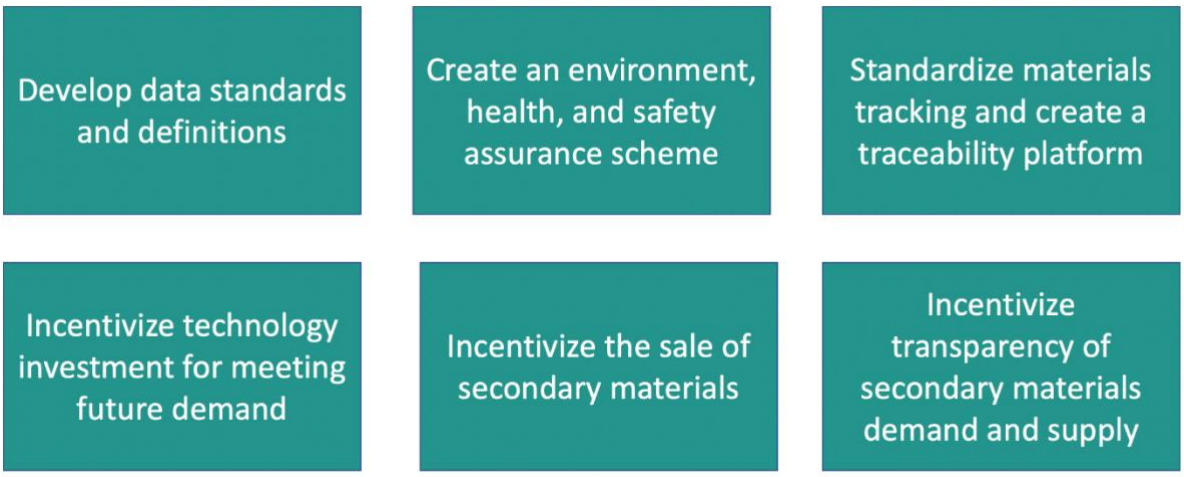
- In March 2021, the government of Canada unveiled a list of 31 minerals and metals critical to Canada. Unlike similar lists previously assembled by the US and European Union – which are focused on critical raw materials that are in high demand by technologies important to the national interests of these economic powerhouses but for which reliable supplies may not be readily available – Canada's list is more akin to a catalog of 31 critical minerals and metals it has in stock to meet global needs.

- The Canadian government is looking to attract investment into Canada to support the production of critical minerals. In addition, an R&D investment of $48 million over three years was recently announced that focuses on upstream processing and materials science.
- It is understood that most high tech/clean tech equipment contain critical minerals and metals that should be recovered and recycled. Upstream and innovative product design can help support circular economy goals (and in many ways already is).
- In February 2021 President Biden signed an Executive Order which identified key supply chains and 35 minerals of focus. In June 2021 a report on actions under the Order highlighted the key role of EOLE recovery/recycling.
- In 2020 US Canada Joint Action Plan was launched that looks at opportunities for cooperation and coordination to optimize primary and secondary minerals markets necessary for the green energy transition. Programs include industry engagement, data sharing, diversification of supply and multilateral collaboration.
- Coordination and integration across North America to inventory and track primary and secondary minerals materials flows is an essential step in developing a CE for EOLE and other minerals products.
- US EPA has a range of critical minerals and recycling programs underway, ranging from emerging technologies, to stakeholder engagement leading into a draft National Recycling Strategy (in which EOLE is a key focus), to market research that addresses questions of consumer demands and related infrastructure investment needs.
- The US government is also actively involved in developing and supporting markets for EOLE recycling through its own green procurement policies.



Conclusions & Key Takeaways

- From a North American perspective, there are a number of promising policy directions as well as research and technology innovation that can serve as a foundation on which to build CE strategies for EOLE.
- However, it is clear that we are in early days of addressing a range of issues, including the distributed geography of markets and waste, the diverse and uncoordinated nature of EOLE policy and regulations, complex supply chains with many diverse actors. The integrated and aggressive approach that Europe has implemented provides encouraging lessons.
- Supports and incentives for value recovery and market development for secondary materials will be a key factor in overall success. An important part of this puzzle will be investing in better data that help build more intelligent, efficient supply chains for electronic materials and components.
- More research and collaboration are required to answer several questions about the recovery of critical minerals found in electronic and electrical equipment. How big is this opportunity? Which critical minerals are recoverable and which ones are not? What are the technical and economic barriers to making this happen? How can we all collaborate to unpack these products as efficiently as possible to capture these magical elements that can help propel our economies forward, into a low carbon future.
- The Circular Electronics Partnership's Roadmap summarized a set of six actions that are necessary parts of an integrated strategy to move towards a circular economy for electronics in North America. These provide a good overview of the kind of diverse efforts that should be undertaken through the coordinated efforts of businesses and governments



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Source; Ed Jones/AFP/Getty Images

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