

# Circular Economy Considerations for Trade Policy in a Low Carbon Energy Transition

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WTO Trade & Environment Week

US Event – Trade Policy in Support of a More Circular Economy for Climate-Aligned Goods/Technologies

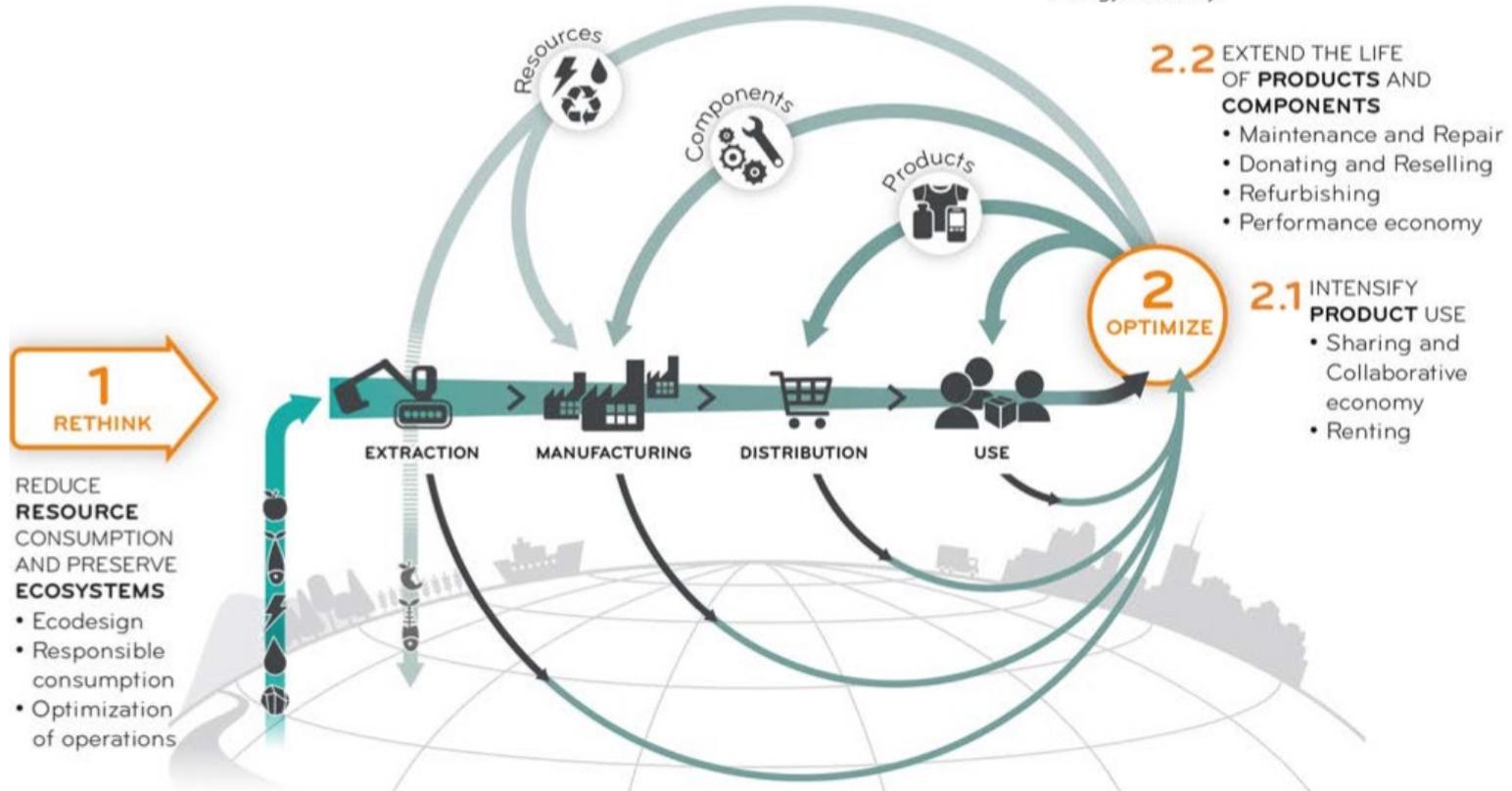


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# Models of the Circular Economy

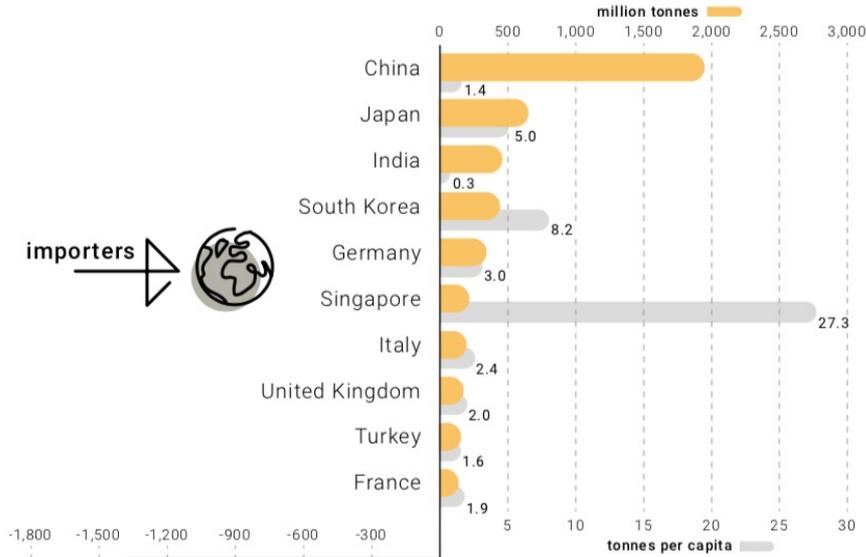


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# Top Importers of Materials (Physical Trade Balance):

Global Resources Outlook (2019)



## Circular Economy Roadmaps:

- China: Target to reuse 72% of industrial solid waste
- Japan: Targeted a cyclical use rate of 17% by 2020.
- EU: Quantitative Targets:
  - Landfill = 10% of municipal waste by 2030 (Binding)
  - 65% Municipal waste for re-use/recycling by 2030
  - 75% packaging waste for re-use/recycling by 2030
- Netherlands: objective of 50% reduction in virgin resource inputs by 2030.

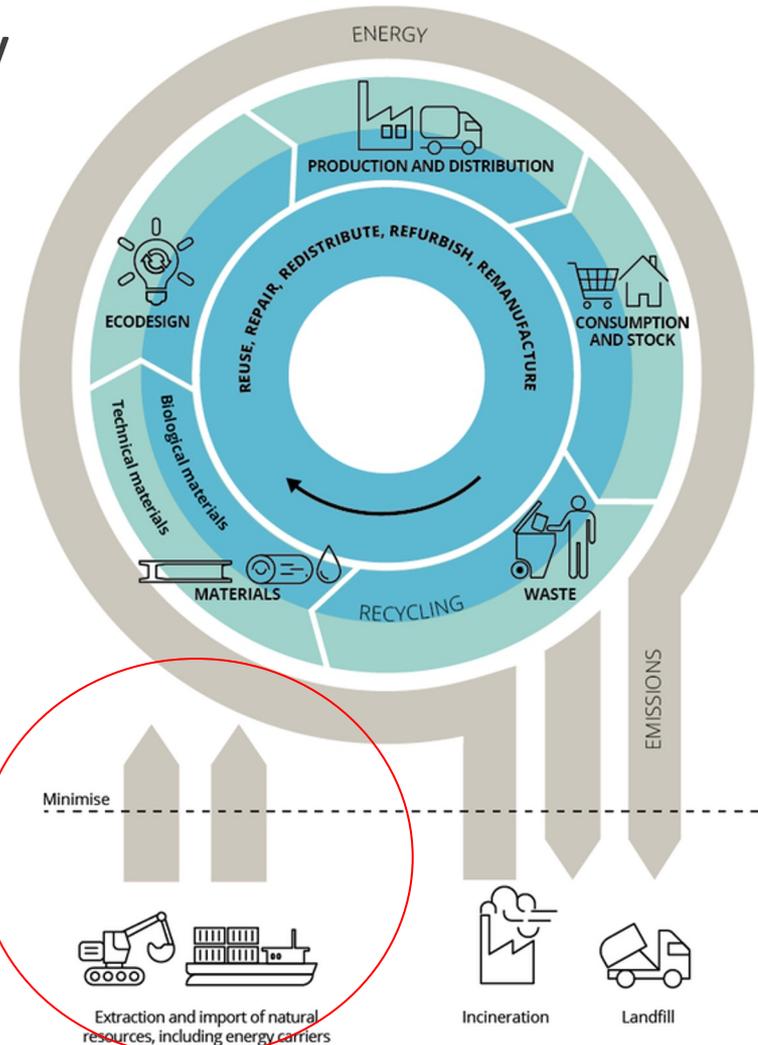


# Models of the Circular Economy

Most CE models have been proposed primarily from the perspective of resource importing countries (e.g. here from European Env. Agency).

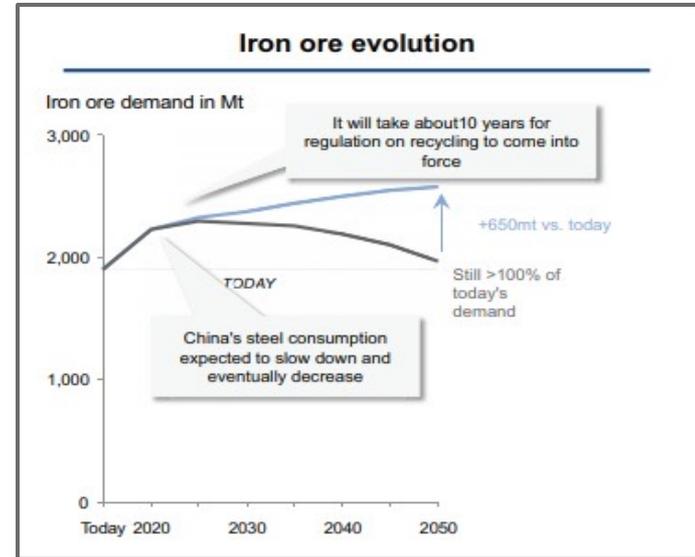
As a result, CE models place a greater emphasis on downstream production and aim to **minimize the role** of primary resource extraction.

*"European industries consume more than 20% of the metals that are mined globally, yet European mines produce only 1.5% of iron and aluminium, and 6% of copper." (Vidal, Goffé & Arndt, 2013).*



# Global Material Demand Projections

1. If emerging economies use a similar suite of technologies and lifestyles as developed countries, global in-use material stocks will increase **3-9 times**.
2. OECD projections indicate a **doubling** of global materials use by 2060.
3. Even IRP scenarios proposing ambitious resource efficiency transition only shave these needs by **one quarter**.



World Economic Forum (2015)



# Global Material Demand Projections

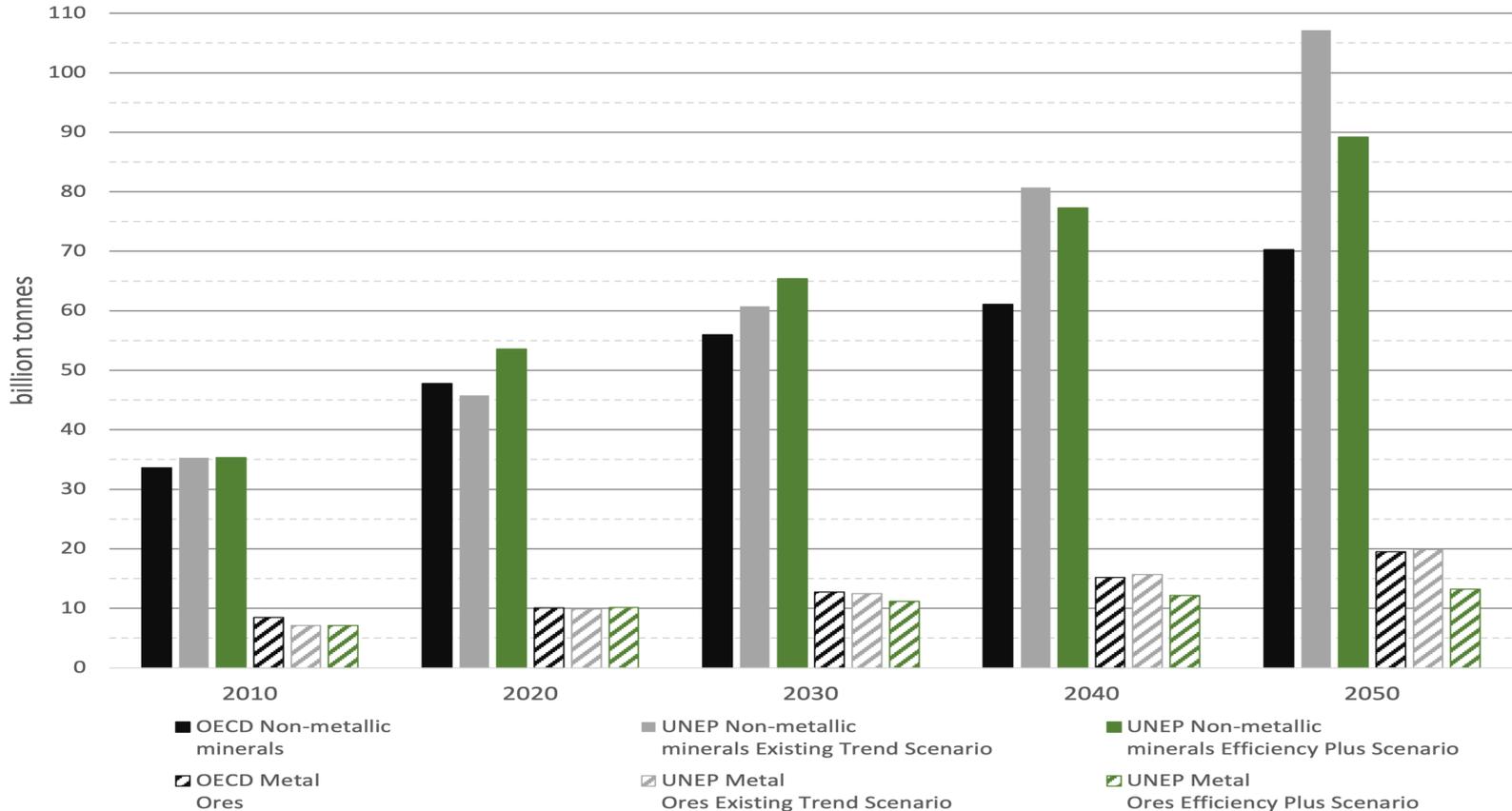
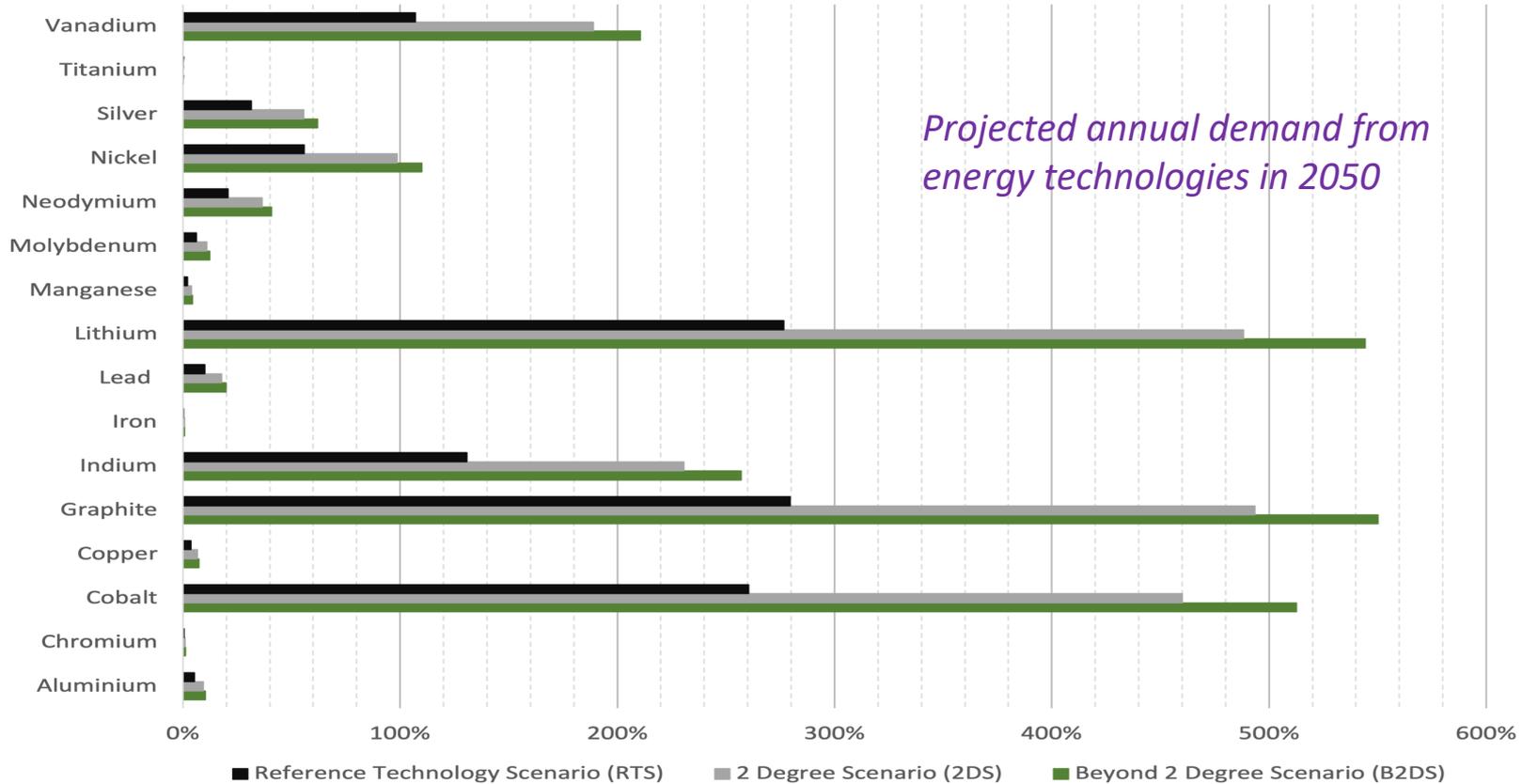


Figure 2: Projected Metal Ore & Non-Metallic Mineral Demand to 2050. Adapted from OECD (2019) and UN Environment Programme, International Resources Panel (IRP 2017)



# Global Context: Material needs of rapid decarbonization

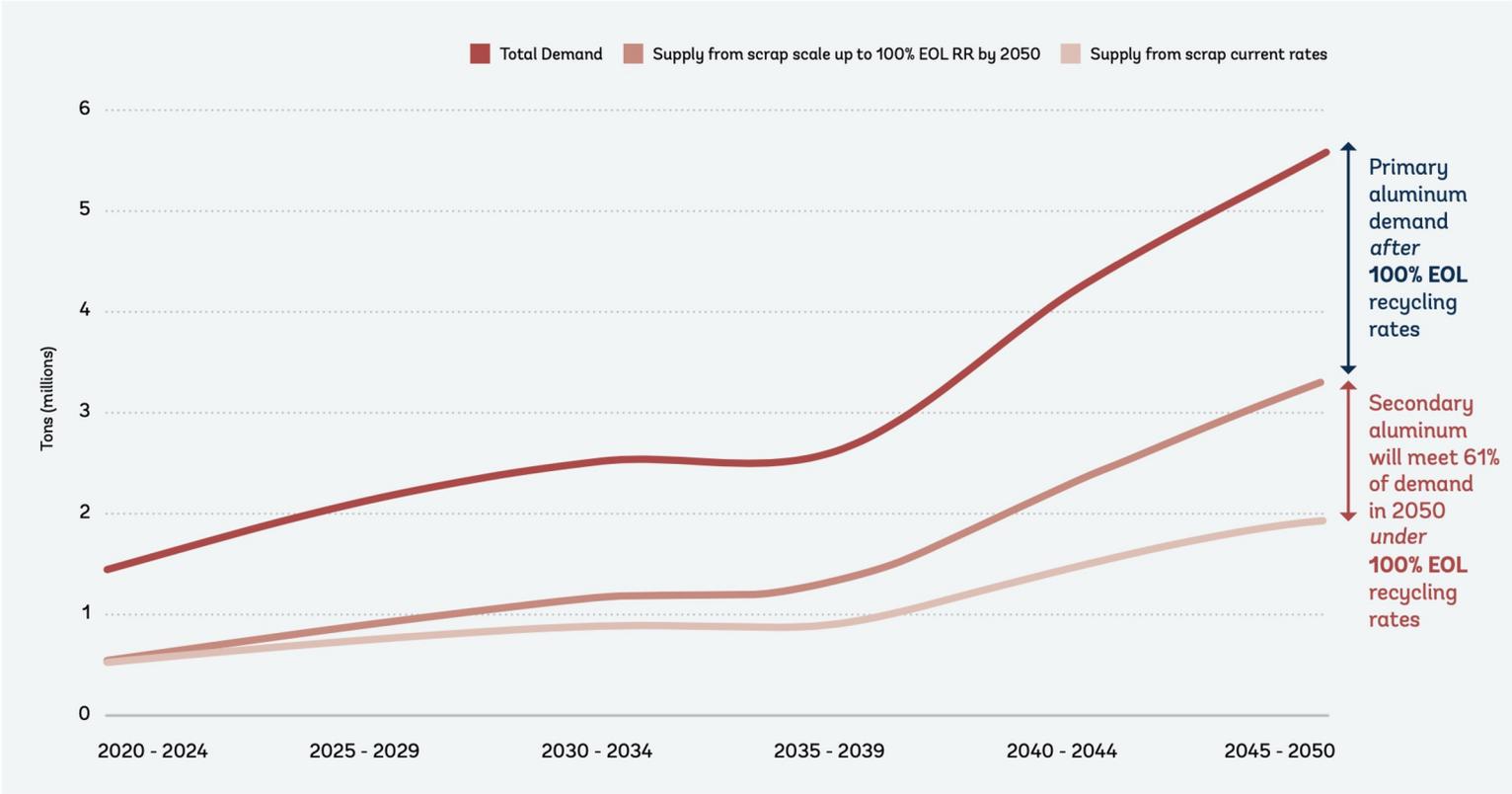
Source: Smart Prosperity Institute. 2021. [Primary Materials in the Emerging Circular Economy](#)



Adapted from World Bank (2020)



Figure ES.4 Aluminum Recycling Projections Relative to Annual Aluminum Demand Under 2DS Through 2050



Note: EOL recycling rates are assumed to increase annually to meet 100 percent EOL by 2050. This means that secondary aluminum meets an increasing amount of aluminum demand over time. 2DS = 2-degree scenario, EOL = end of life, RR = recycling rates.



# Connecting Circular Economy and a Renewable Energy Transition

**Canada must dramatically increase its deployment of wind, solar and storage technologies in order to reach its legislated 2050 net-zero commitments and combat climate change.**

Based on projections from the [International Energy Agency](#) and the [Canadian Institute for Climate Choices](#)



# Connecting Circular Economy and a Renewable Energy Transition

In Canada, even conservative scenarios of renewable-energy technology uptake suggest:

- **A 60-fold increase in accumulated end-of-life solar PV modules,**
- **A 30-fold increase in accumulated end-of-life wind turbines,**

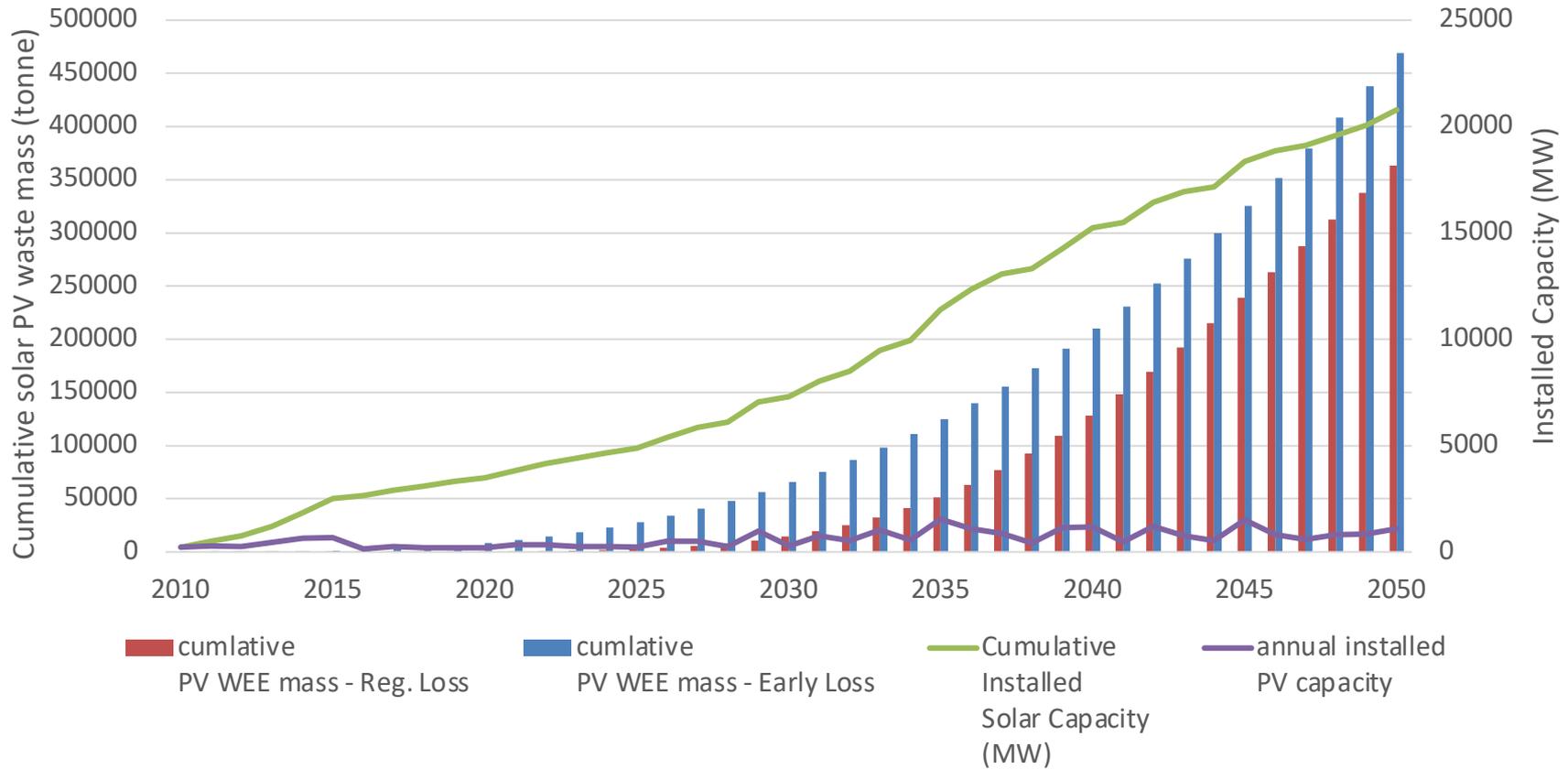
These technologies **require more materials** per unit of energy generation compared to fossil-fuel based energy technologies

They also use [critical and strategic minerals and metals](#), which are subject to [near-term economic or geopolitical supply constraints](#).

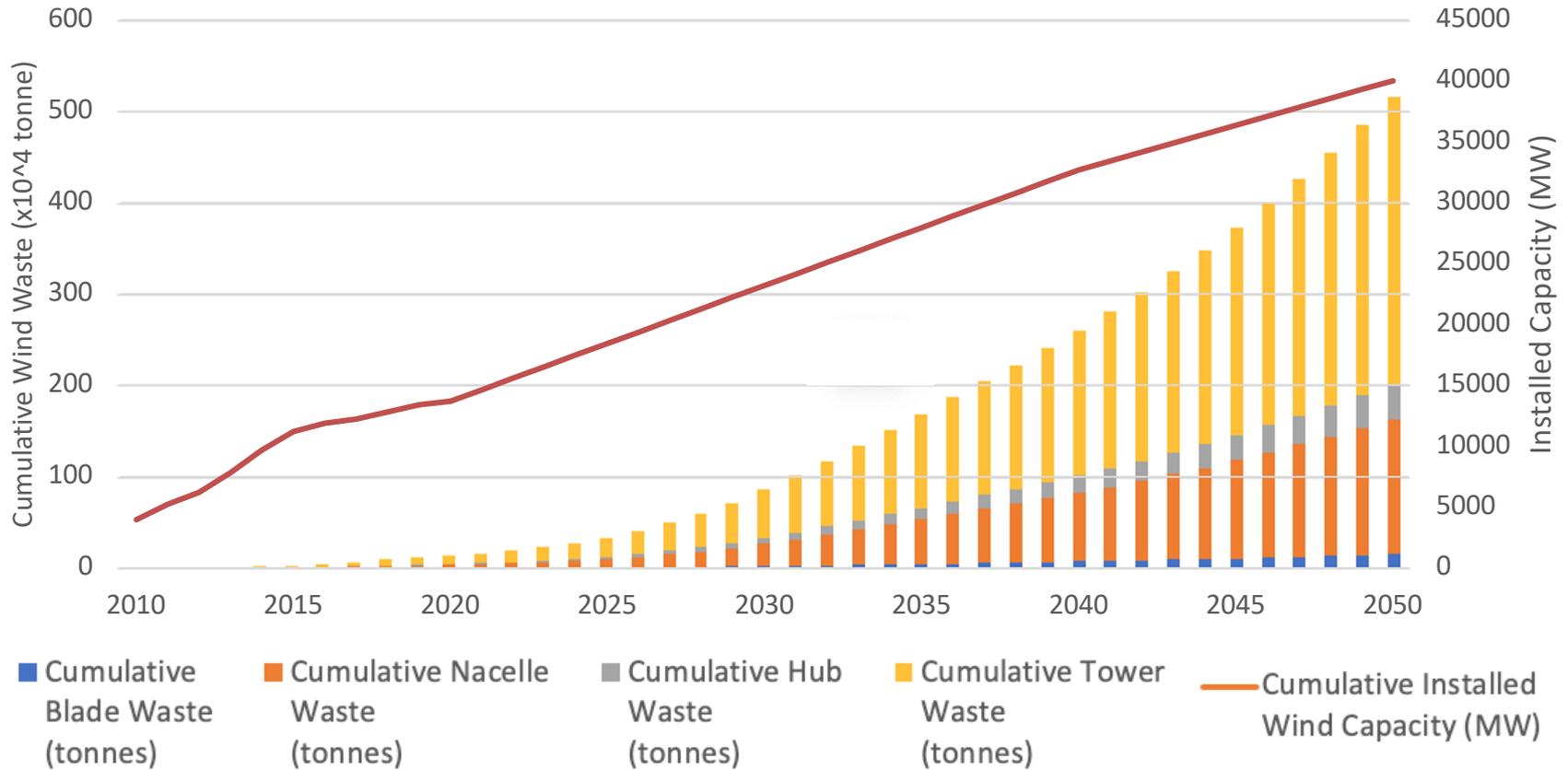
**These include 13 of the 31 minerals [designated as critical by Canada](#),** because of their importance to economic growth and national security, plus 4 rare-earth elements.



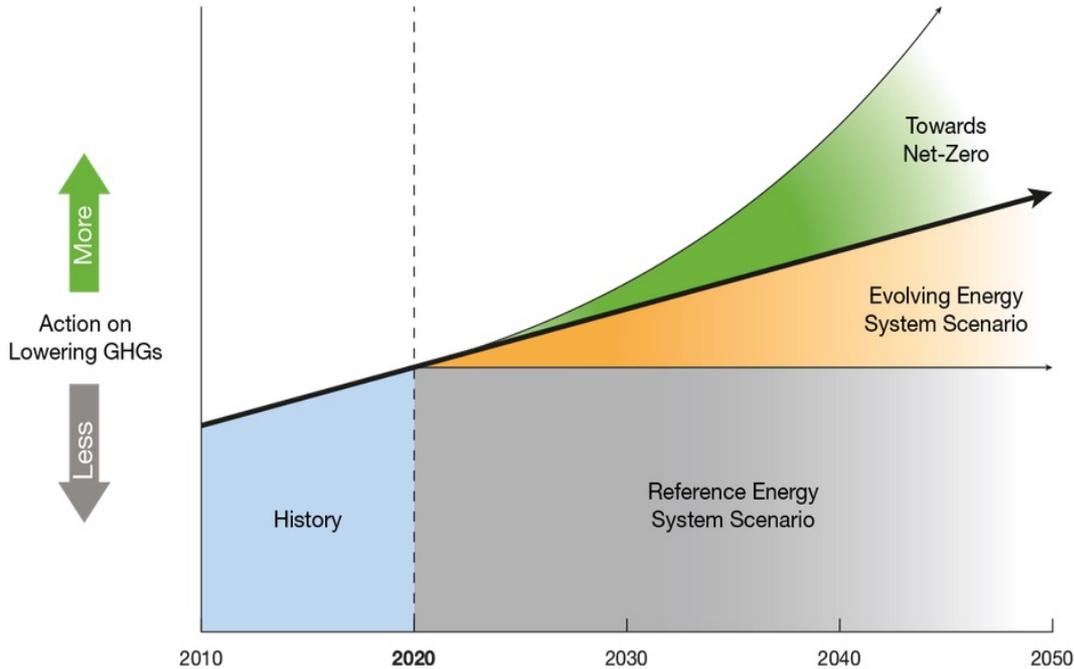
# Cumulative Solar PV Waste Evolution



# Cumulative Wind Waste Evolution



# Conceptual Illustration of EF2020 Scenarios and a Net-Zero Future

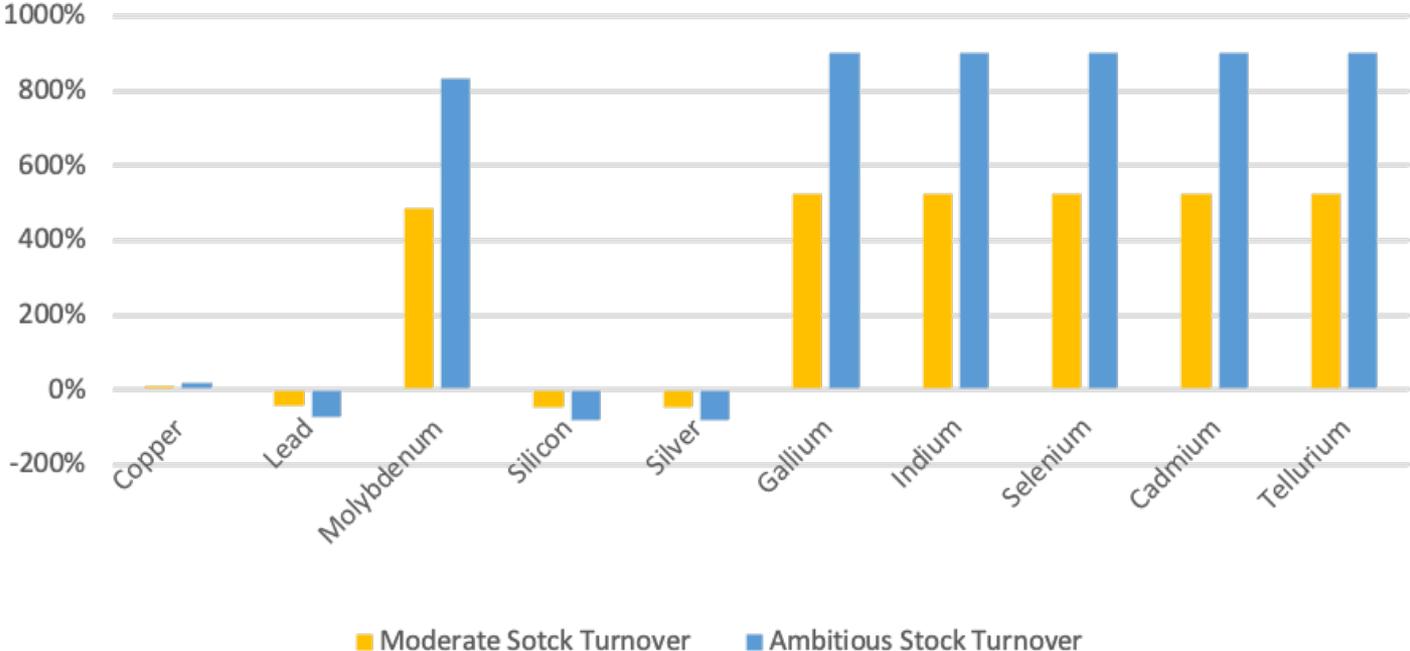


- Towards Net-Zero**  
The pace of action on addressing climate change increases from current levels.
- Evolving Energy System Scenario**  
Continues the historical trend of increasing action on climate change throughout the projection. Policies and agreements are strengthened after they sunset. Low carbon technologies continue to be developed.
- Reference Energy System Scenario**  
Climate change actions limited to only the measures that are currently in place. Technological development is modest, and generally limited to those with existing momentum and/or market share.
- History**  
Gradually increasing action on climate change, including policies, regulations, and development of low carbon resources and technologies.



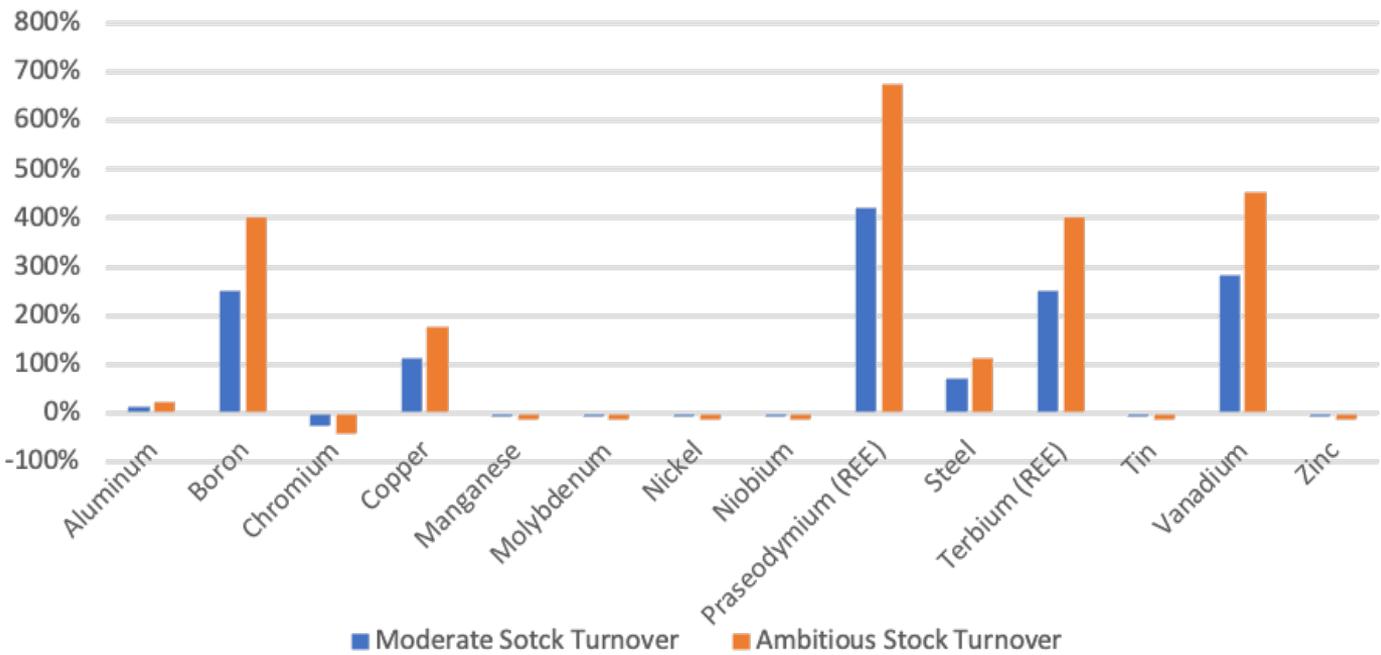
# % Change in Material Demand for Select Materials

[Relative to Reference Scenario]

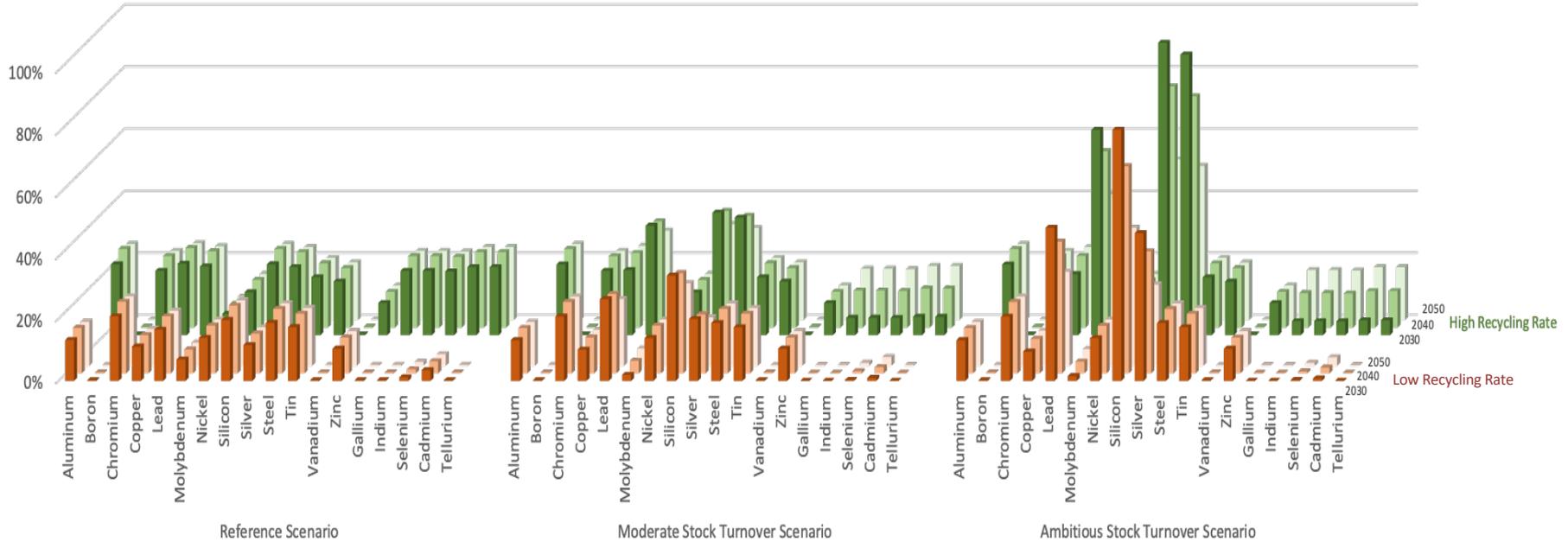


# % Change in Material Demand for Select Materials

[Relative to Reference Scenario]



# Potential of Select Secondary Materials from Renewable Energy Waste Streams to Satisfy Annual Material Demand



# Key Circular Economy Considerations that Emerge....

There is a need to strategically consider the investments and policies needed to sustainably and reliably manage the material requirements of this kind of low-carbon transition in the energy sector – with a greater attention to:

- What materials will be required to meet low carbon energy demand?
- Where will those materials be sourced from, and how are they produced?
- What risks exist along key (CSM) supply chains?
- How will we handle material recovery at end of life?

The landscape for waste streams will be dynamic and changing over this time frame, as already evidenced by [Vestas' new fully recyclable wind turbine blade](#).



# Emerging Trends: Mining, metals and minerals

**Growing pressure on mining companies to address their overall environmental impact:**

- **Electrified mining equipment** : The market for electric mining equipment is projected to grow at a CAGR of 19.6% and reach USD \$11.7 billion by 2030.
- **Technologies to improve production efficiency** : “Smart Mining” market is expected to grow to USD \$13-\$38 billion by 2027 at a CAGR of between 8%-20%.
- **Technologies to capture value from by-products** : It is estimated that there is about \$10 billion in total metal value in Canadian gold mine waste alone, according to conservative estimates.
- **Markets for equipment maintenance, sharing & rentals**: The market for electric mining equipment is projected to grow at a CAGR of 19.6% and reach USD \$11.7 billion by 2030.
- **Industry collaboration**: Potential for ‘pre-competitive’ collaboration

# Canadian Examples: Mining Innovations to support more Circular Value Chains

## Ideon Technologies Inc.

[Australia, USA]

Use detectors, imaging systems, inversion technologies, and artificial intelligence to map subsurface anomalies and reduce exploration drilling activity, reduce environmental impact and improve operational efficiencies.

## EnviroMetal Technologies Inc.

[USA, EU]

Chemistry technology extracts metals from conventional mine concentrates and secondary sources – reducing cyanide and smelter use.

## EnviroGold Global Inc.

[Australia, Mexico, Ghana]

Use electrochemical and surface probe techniques to recover up to 98% of residual gold from mine tailings on a commercial scale. It's processes also recover over 95% of other precious, critical and strategic metals, including platinum, lithium, cobalt, germanium and titanium.



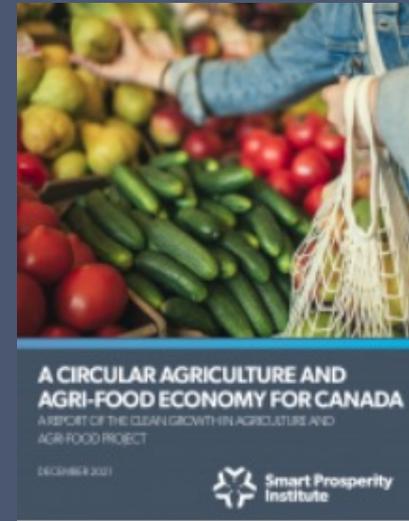
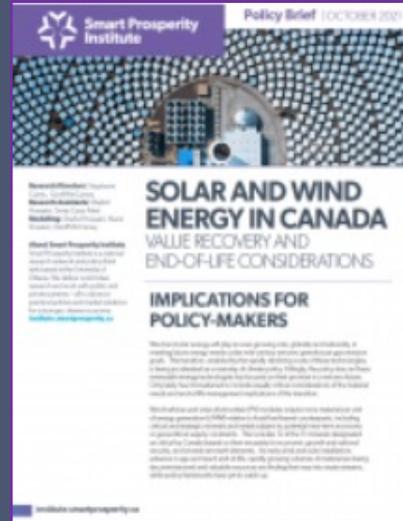
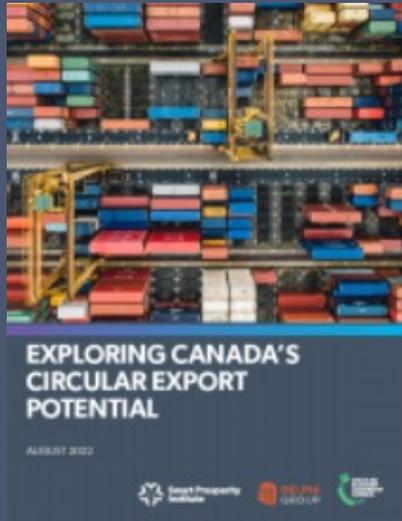
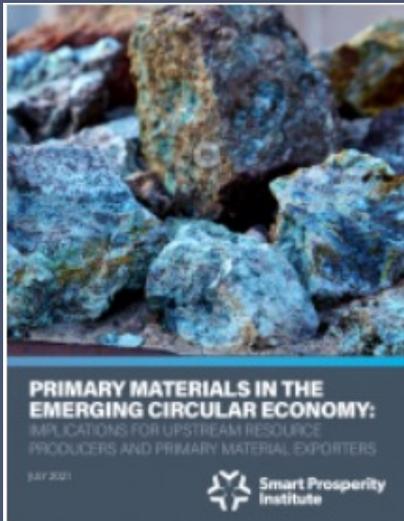
# Recommendations for Broadening Circular Trade Opportunities

- **Conduct deeper sector analysis and market assessments** through comprehensive business and industry association engagement, as well as an understanding of the emerging demand for circular solutions across sectors and value chains by market / region.
- **Identify financial, regulatory, and technical barriers** for growing circular trade and how existing trade agreements as well as new policies and programs can be designed to overcome these.
- **Build partnerships to create supporting regional ecosystems for Circular innovation**, to enable investment attraction, and trade, and economies of scale
- **Continue to track nascent clusters of circular business solutions**, with emerging companies advancing CE solutions in a rapidly evolving space that can help meet growing net zero and ESG goals, and ensure alignment and clarity of standards, taxonomies, certifications, and traceability schemes.



# Recent Circular Economy Research

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