Trade-Related Circular Economy Aspects of Wind and Solar Energy

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What does the term ‘circular economy’ mean to you?

Responses from Mining for Circularity Forum Participants (23 March 2021)
Models of the Circular Economy

1. RETHINK

- REDUCE RESOURCE CONSUMPTION
- AND PRESERVE ECOSYSTEMS
  - Ecodesign
  - Responsible consumption
  - Optimization of operations

2. OPTIMIZE

2.1 INTENSIFY PRODUCT USE
- Sharing and Collaborative economy
- Renting

2.2 EXTEND THE LIFE OF PRODUCTS AND COMPONENTS
- Maintenance and Repair
- Donating and Reselling
- Refurbishing
- Performance economy

2.3 GIVE RESOURCES A NEW LIFE
- Industrial ecology
- Recycling and Composting
- Energy recovery
In Canada, even conservative scenarios of renewable-energy technology uptake suggest:

- A 60-fold increase in accumulated end-of-life solar PV modules
Connecting Circular Economy and a Renewable Energy Transition

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

- A 30-fold increase in accumulated end-of-life wind turbines
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.

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.
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).

Generally, most CE models (e.g. here from the European Env. Agency) place a greater emphasis on downstream production, while aiming 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

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


Adapted from World Bank (2020)
Figure ES.4 Aluminum Recycling Projections Relative to Annual Aluminum Demand Under 2DS Through 2050

- Total Demand
- Supply from scrap scale up to 100% EOL RR by 2050
- Supply from scrap current rates

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.
Potential of Select Secondary Materials from Projected Renewable Energy Waste Streams in Canada to Satisfy Annual Material Demand

Current (Estimated) Recycling Rates

Assumed 100% EoL Recovery/Recycling
Models of the Circular Economy:
Circular ‘Core’ within a Linear Framework

Figure 1: Stylized Version of Characteristic Circular Economy Model Focused on Manufacturing & Consumer Market ‘Core’ with Resource Producing ‘Periphery’.
Extending CE Models for Primary Resource Sectors

Figure 5: Updated Model of the Circular Economy, with Proposed Upstream/Downstream Linkages & Circular Practices Applied in the Upstream Primary Resource Sector
% Change in Material Demand for Select Solar/Wind Materials

[Moderate vs High Technology Turnover, Relative to Reference Scenario]
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?
Recommendations for Broadening Circular Trade Opportunities

• **Improve understanding of the emerging demand for trade in circular solutions** by clarifying definitions and classifications for circular trade along key value chains by market / region.

• **Identify regulatory and technical barriers for growing circular trade**, how circularity fits within the environmental or other provisions of existing trade agreements, as well as new policies and programs (such as digital product passports) that can help to overcome these concerns.

• **Build partnerships to facilitate trade while creating supporting regional ecosystems for circular innovation**, to attract investment and grow economies of scale.

• **Continue to track nascent clusters of circular business solutions** and ensure alignment and clarity of standards, taxonomies, certifications, and traceability schemes.
Figure 1. A framework for inclusive circular trade

### Target outcomes
- SDG 8: Decent work and economic growth
- SDG 10: Reduced inequalities
- SDG 12: Responsible consumption and production
- SDG 17: Partnerships for the goals

### Areas for collective action

#### Definitions and classifications
1. Work towards a shared set of definitions for circular goods.
2. Ensure circular economy-relevant information is captured when goods or services cross borders, in a way that is globally interoperable.

#### Technical barriers to trade
1. Map circular economy standards with implications for circular economy trade, and move towards greater alignment.
2. Seek mutual recognition agreements (MRAs) to align conformity assessments.

#### Trade facilitation
1. Digitize the Basel Convention Prior Informed Consent (PIC) procedure for low-income countries.
2. Establish a working group to enhance PIC interoperability.
3. Pilot cross-border transparency and traceability for circular economy trade flows.

#### Capacity-building
1. Embed circular economy in existing multilateral capacity-building programmes.
2. Establish a global ‘repairation’ fund for circular economy.
3. Create a dedicated WTO initiative for circular economy awareness-raising.

#### Trade and economic cooperation agreements
1. Embed circularity across the full spectrum of agreements.
2. Initiate discussion on the impact of ‘linear’ and circular subsidies.
3. Set up well-resourced and long-term initiatives to tackle illegal waste trade.

### Principles for action

#### Transparency and traceability
Enhanced transparency and traceability is essential to enable circular trade that contributes positively to sustainability and human development, while discouraging trade that does not.

#### Subsidiarity
Decisions should be taken as close to affected people as possible to ensure effective solutions are developed. International policies should be developed only when they can be more effective than national policies.

#### Non-discrimination
Ensure that circular trade improvements meet the WTO principle of non-discrimination while providing enough support for countries facing the greatest challenges and impacts.

#### International collaboration
An inclusive circular transition will require a strengthening of international cooperation systems for both settling trade disputes and ensuring a fair and inclusive transition to more circular value chains.

Recent Circular Economy Research

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