Welcome to the 2020 JISEA Annual (Virtual) Meeting!

Circular Economy of Materials and Global Supply Chains

30 July 2020

Introduction: Jill Engel-Cox, JISEA Director
Moderator: Travis Lowder, JISEA

www.jisea.org
Some Housekeeping Items

TWO OPTIONS FOR AUDIO
SELECT SETTINGS WHEEL

1
Listen through your computer.
Please select the “Computer” option and review your Microphone and Speakers selection.

2
Listen through by telephone.
Please select the “Phone” option and a phone number and access code will display.

Unless presenting, please mute your audio device.
GoToMeeting: Attendee Participation

- Open and close your control panel.
- Join audio:
  - Choose **Computer** to use VoIP
  - Choose **Telephone** and dial using the information provided
- Submit questions and comments via the Chat panel (note if you don’t want to ask verbally)
- We will call on and unmute you to ask question verbally with video on
- Be sure to answer the polling question!
Overall Agenda: All Sessions 8:30-9:45 am MT

- Technical “Poster” Session and JISEA Intern Experience
- Energy for Future Food Systems
- Keynote Discussion: Rural Economies & Social Systems
- Circular Economy of Materials and Global Supply Chains

Aug 3-6: Big Data and Business Systems
- Machine Learning and Artificial Intelligence for Energy Solutions
- Financial Risks and Opportunities of Decarbonization
- Keynote Discussion: Corporate Decision Making for Systems Innovation & Disruption
- Topic “Tables”: Open Discussion Breakouts with Experts

All sessions about 45 minutes presentation and 30 minutes open questions & discussion
Circular Economy of Materials and Global Supply Chains

Sarah Ryker (United States Geological Survey)
Roderick Eggert (Colorado School of Mines)
Fazleena Badurdeen (University of Kentucky)
Moderator: Travis Lowder (JISEA/NREL)
What is the Circular Economy

CE is an industrial system that is restorative or regenerative by intention and design. It replaces the “end-of-life” concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models.

*Ellen MacArthur Foundation*
Circular Economy for Energy Materials

Goal
Focuses on research that establishes the foundational knowledge and technology for design, reduce, reuse, or recycle to create a circular economy for energy-relevant and energy-intensive materials, processes, and technologies.

Opportunities: Analysis and Modeling, Materials Processing, Devices and Systems, Reliability and Lifetime
Projected Waste from Renewable Technologies

Lithium-ion car batteries
- Waste volume: 600,000 metric tons by 2025 globally
- Material value: Upward of $2,000 worth of metals in a 438-kg battery
- Challenges: Hazardous nature of material, Quality of recycled material, Variability of content
- Select recycling processes: High-temperature metallurgy, Low-temperature extraction, Hydrothermal cathode refreshing
- Reuse alternative: Stationary energy storage

Wind turbine blades
- Waste volume: 300,000 metric tons by 2038 in Europe
- Material value: Not assessed
- Challenges: Mass size and weight, Difficulty of recycling thermoset polymers, Low value of material
- Select recycling processes: Pyrolysis to recover fibers, Mechanical degradation plus addition of adhesive to make construction panels, Fuel for cement production
- Reuse alternatives: Reuse at wind farms in other geographies, Artificial reef, seating, playgrounds

Photovoltaics
- Waste volume: 78 million metric tons by 2050 globally
- Material value: $3-$13 worth of metals per panel
- Challenges: Presence of heavy metals, Poor quality of recovered silicon
- Select recycling process: Pyrolysis to recover silicon followed by acid/electrolysis process to recover copper and silver
- Reuse alternative: Reuse of panels rejected by high-efficiency energy plants

Credit: C&EN/Shutterstock
Demand for Critical Materials Outpacing Supply

Assuming 5% annual growth in mine productions
Source: Mayyas, Steward, and Mann 2018
Benefits of a Circular Economy

- Waste reduction
- Increase supply to meet demand
- Promote efficiency
- Security of critical materials
- Promote humane practices
- Sustainability, decarbonization
Principles for Renewable Energy Circular Economy

• **Design** is critical to ensuring circularity at all nodes in the value chain

• **Reliability** of materials is critical to ensuring circular economy adoption and benefits
Materials Tracking

• Blockchain
  • Tracr
  • Cobalt Blockchain
• Supplier engagement
  • Apple
• Materials flow analysis
  • USGS
  • CEMAC

“If you can’t measure it, you can’t improve it.” – Peter Drucker
JISEA’s Work in Circular Economy and Supply Chains

• CEMAC
  – *Benchmarks of Global Clean Energy Manufacturing*

• Battery recycling analysis
  – *The Case for Recycling*

• PV recycling analysis
  – *Solar PV Recycling: Challenges and Approaches*

• Mining sector analysis
  – *Integrating Clean Energy in Mining Operations*
The Renewable Opportunity in Mining Consortium

The Renewable Opportunity in Mining Program aims to provide capacity building, technical analysis, and decision support for mining companies and related stakeholders to increase adoption of renewable energy technologies.

PROGRAM ACTIVITIES

- **Best Practices:** Develop model contract structures to better align incentives between mining and RE industry
- **Technology Analysis:** Assessment of renewable technologies and integration with various mine types, regions, and processes
- **Strategy Development:** Key global regulatory, economic, societal, and societal trends affecting corporate strategy on renewables deployment

Currently seeking sponsors! Contact travis.lowder@nrel.gov for information on how to join.
Thank you

NREL/PR-6A50-77468

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