JISEA
Joint Institute for Strategic Energy Analysis

Welcome to the 2020 JISEA Annual (Virtual) Meeting!

Circular Economy of Materials and Global Supply Chains

30 July 2020

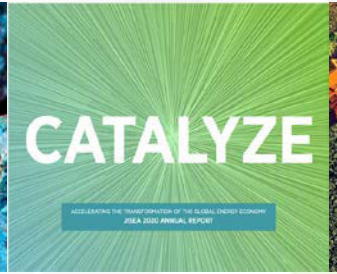
Introduction: Jill Engel-Cox, JISEA Director

Moderator: Travis Lowder, JISEA

@JISEA1

www.jisea.org



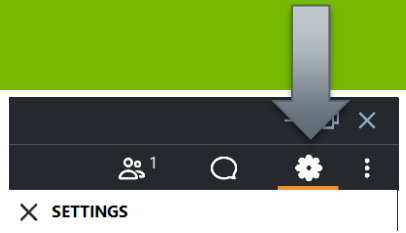



NREL NATIONAL RENEWABLE ENERGY LABORATORY · COLORADO SCHOOL OF MINES · Colorado State University · MIT Massachusetts Institute of Technology · STANFORD UNIVERSITY · University of Colorado Boulder

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

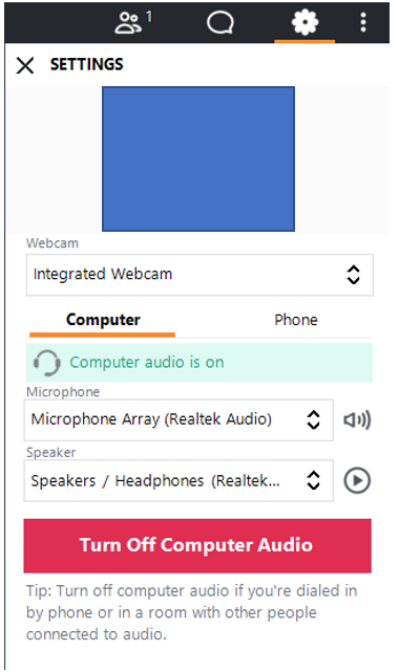
Listen through by telephone.

Please select the “Phone” option and a phone number and access code will display.

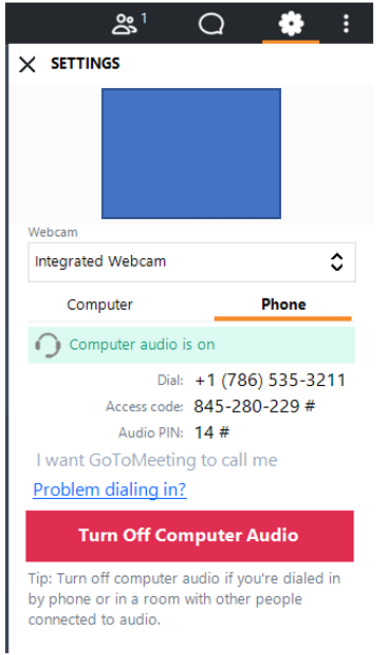
Unless presenting, please mute your audio device.

GoToMeeting: Attendee Participation

Computer Audio



Phone Audio



Your 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

July 27-30: Sustainability in a Changing World

- 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)

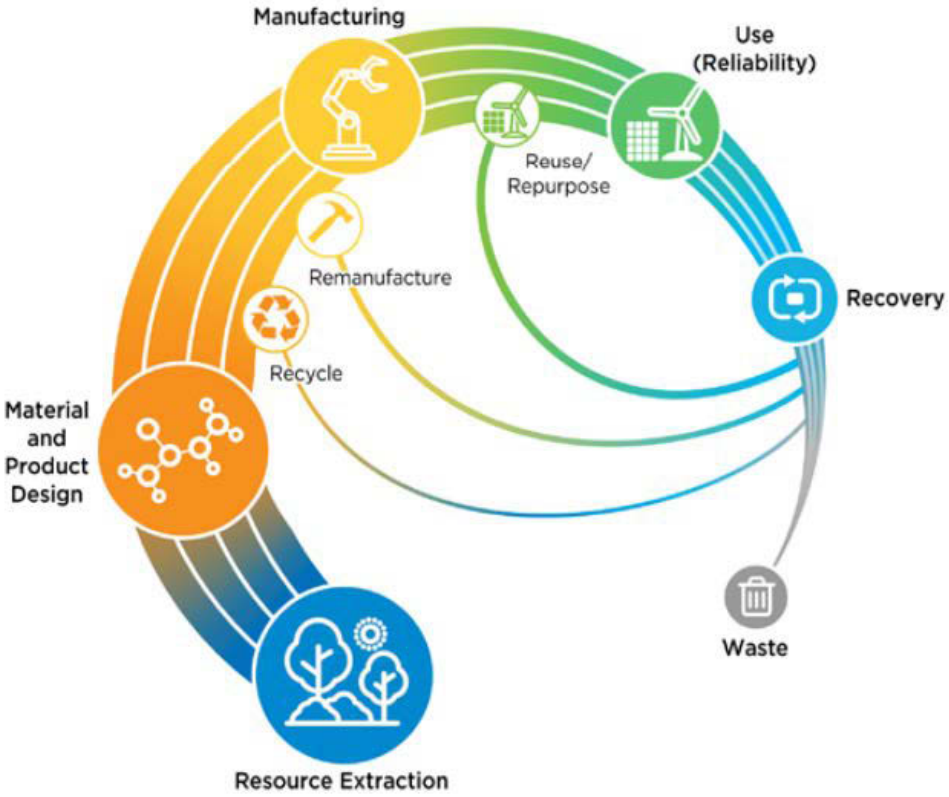
Fazleena Badurdeen (University of Kentucky)

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.

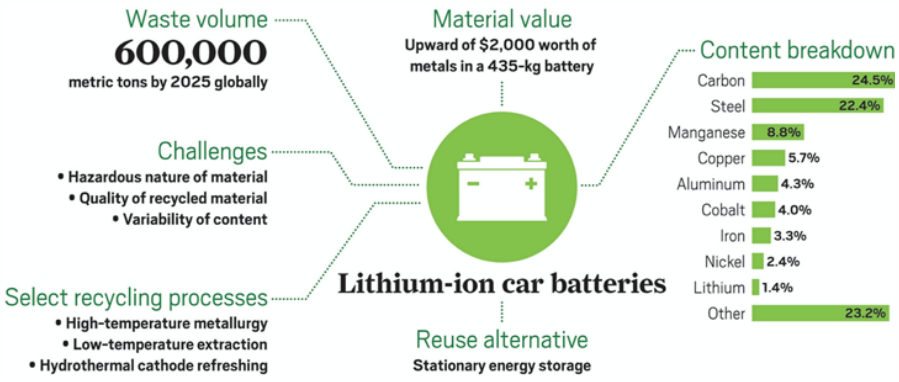
Circularity for Polymers and Composites

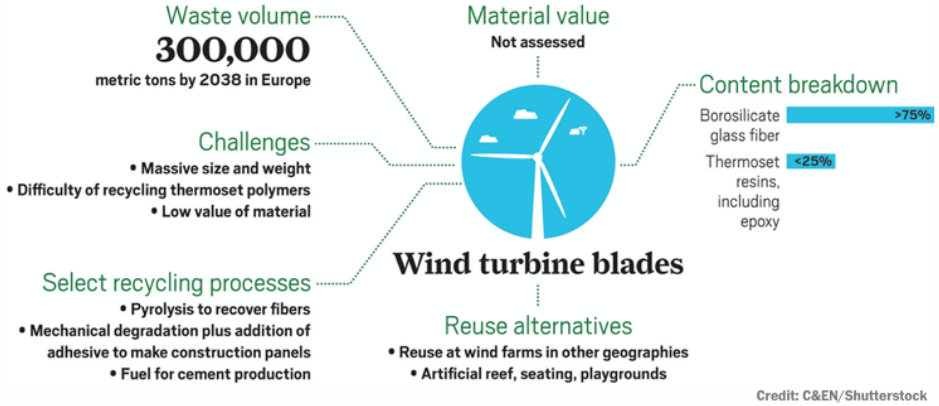
Advanced Energy Materials and Technologies

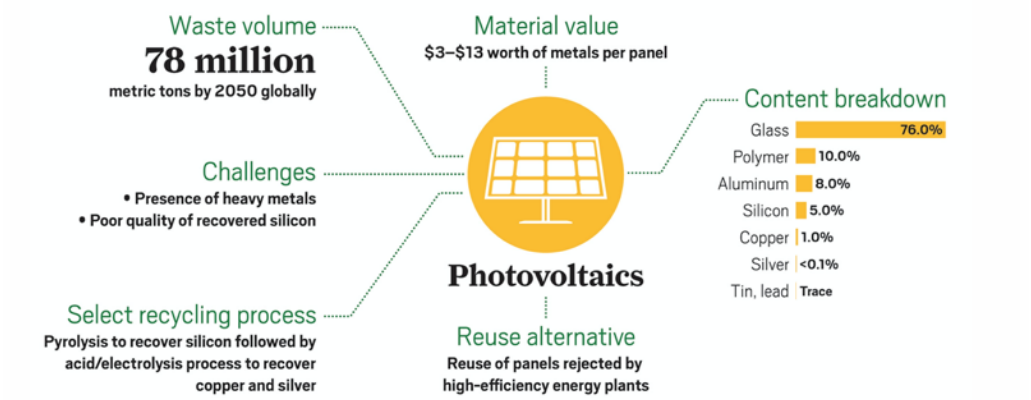
Future Adaptive Materials for Energy Systems

Opportunities: Analysis and Modeling, Materials Processing, Devices and Systems, Reliability and Lifetime

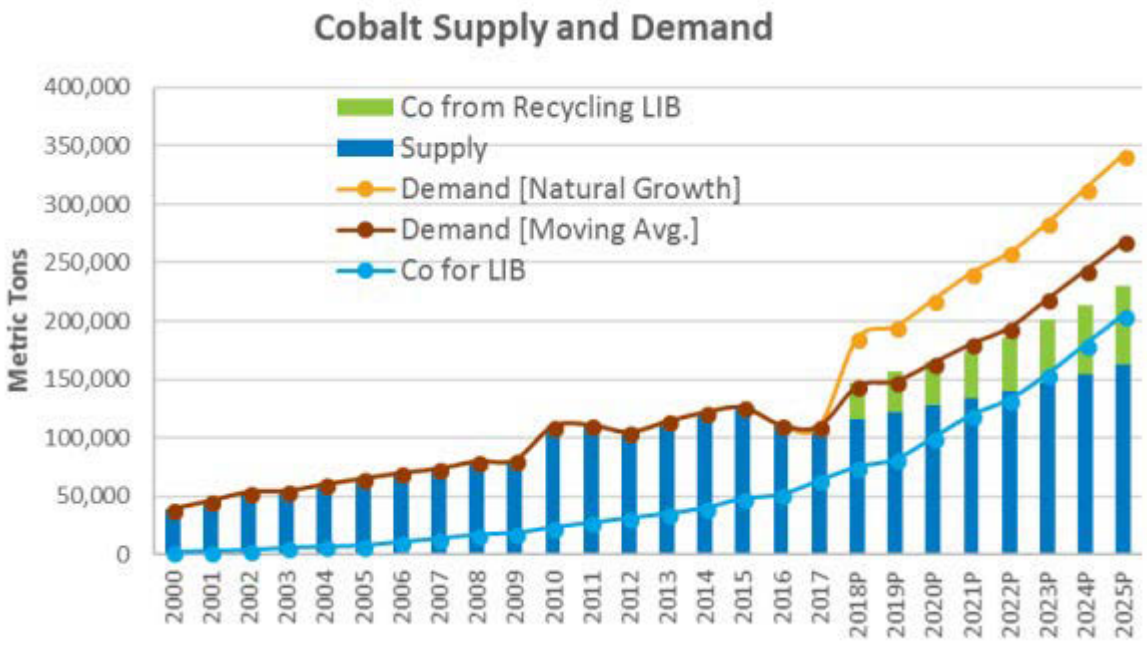
Projected Waste from Renewable Technologies







Demand for Critical Materials Outpacing Supply



Assuming 5% annual growth in mine productions

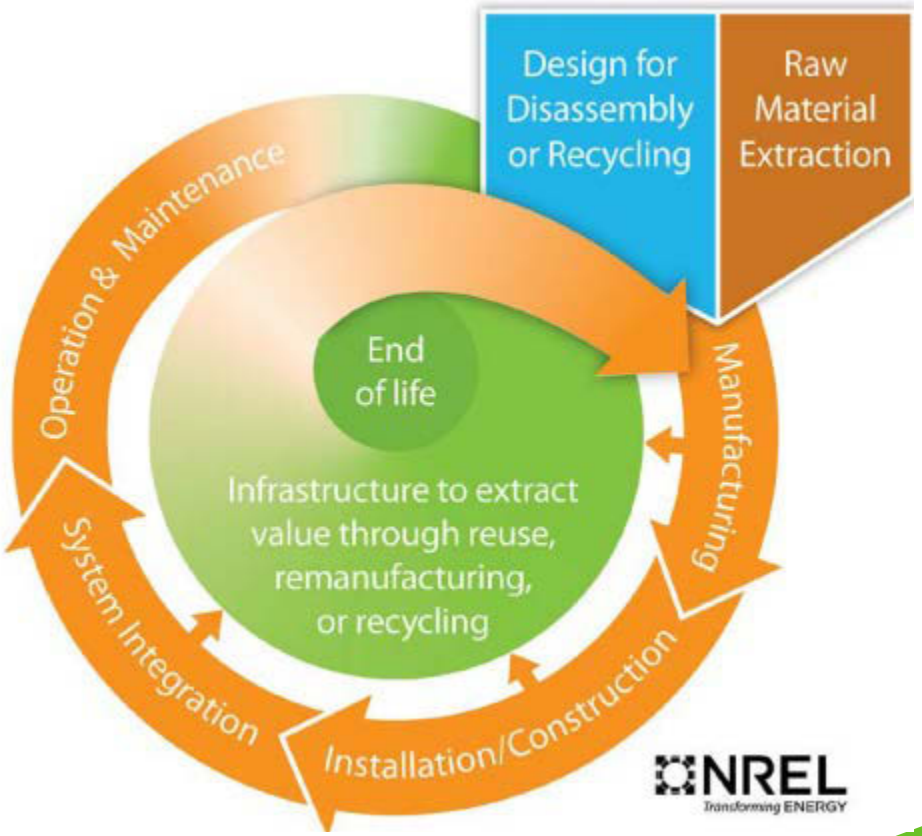
Source: Mayyas, Steward, and Mann 2018

Benefits of a Circular Economy

- Waste reduction
- Increase supply to meet demand
- Promote efficiency
- Security of critical materials
- Promote humane practices
- Sustainability, decarbonization

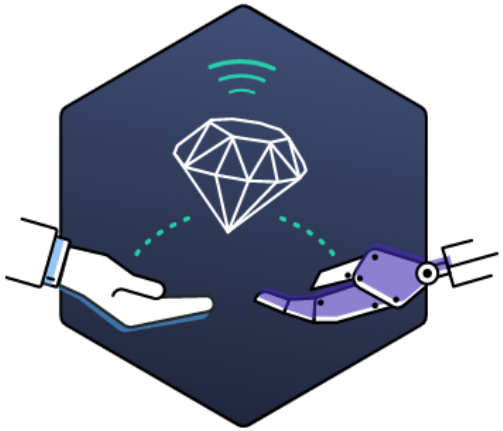
Principles for Renewable Energy Circular Economy

- **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



Apple Supplier Responsibility Standards

"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*

CEMAC Clean Energy Manufacturing Analysis Center

Operated by the Joint Institute for Strategic Energy Analysis

ReCell ADVANCED BATTERY RECYCLING

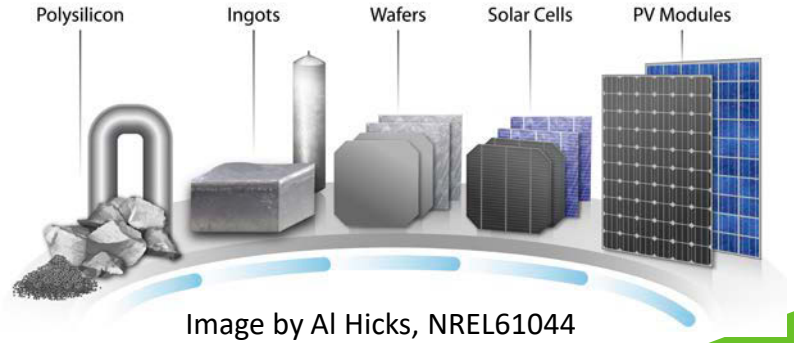


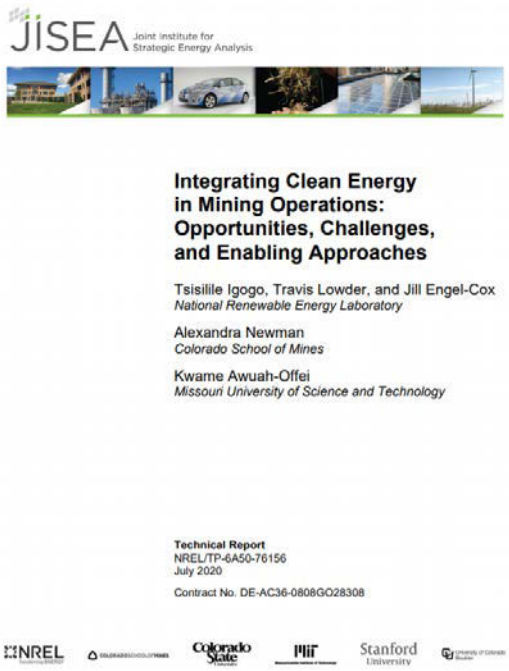
Image by Al Hicks, NREL61044

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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Integrating Clean Energy in Mining Operations: Opportunities, Challenges, and Enabling Approaches

Tsisilile Igogo, Travis Lowder, and Jill Engel-Cox
National Renewable Energy Laboratory

Alexandra Newman
Colorado School of Mines

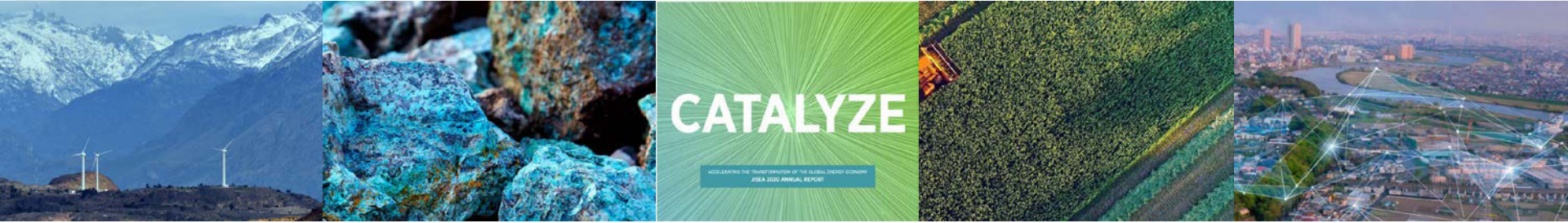
Kwame Awuah-Offei
Missouri University of Science and Technology

Technical Report
NREL/TP-6A50-76156
July 2020

Contract No. DE-AC36-0808GO28308

NREL Colorado State University MIT Stanford University

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



Thank you

NREL/PR-6A50-77468

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