Certification Approaches and their Role in Economic Transition

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Circular Economy @ NIST

Keeping atoms and molecules inside the economy, producing value, and out of unwanted sinks such as the environment (air, water, soil, etc)





Two Converging Issues with Plastic Waste



- Global trade disruption in plastic waste
- Markets increasingly limited by traditional methods of collection and sortation
- Opportunities for new mechanical pathways and new technologies (e.g. chemical processes)

Science Advances, 2018, DOI: 10.1126/sciadv.aat0131



- Increasing awareness of environmental impacts of plastic debris, from macro- to micro-scale
- Quantification challenges and data scarcity problems



NIST

World Economic Forum, Ellen MacArthur Foundation and McKinsey & Company, The New Plastics Economy – Rethinking the future of plastics (2016)

SoS 2.0 - Task



Report to Congress a study that includes:

- (1) an identification and assessment of existing mass balance methodologies, standards, and certification systems that are or may be applicable to supply chain sustainability of polymers, considering the full life cycle of the polymer, and including an examination of--
 - (A) the International Sustainability and Carbon Certification; and
 - (B) the Roundtable on Sustainable Biomaterials;
- (2) an assessment of the environmental impacts of the full lifecycle of circular polymers, including impacts on climate change; and
- (3) an assessment of any legal or regulatory barriers to developing a standard and certification system for circular polymers.

Definitions:

- (1) Circular polymers.--The term ``circular polymers'' means polymers that can be reused multiple times or converted into a new, higher-quality product.
- (2) Mass balance methodology.--The term ``mass balance methodology'' means the method of chain of custody accounting designed to track the exact total amount of certain content in products or materials through the production system and to ensure an appropriate allocation of this content in the finished goods based on auditable bookkeeping.

Circular Polymers





A portfolio of solutions

- Reduction
- Mechanical and chemical reprocessing

Simplify or diversify materials streams?

- \uparrow Monomaterials, \downarrow contamination
- Greenfield innovation vs. prob. solving

The data problems abound

- Traceable, interoperable models/cert.
- Workforce development/transformation
- An equity Gordian knot

Industry, other countries, and many states are taking action before the US Federal Government





Responsibly Sourced Palm Oil







RSPO, "Roundtable on Sustainable Palm Oil," 2021. [Online]. Available: https://www.rspo.org/impact. Certification tools can be designed and used to drive/transition to desired outcomes (priorities)

Mass Balance for Polymers



In one word, how would you describe Mass Balance Accounting for Polymers?



Chemical and mechanical recycling should not compete for the same fraction of the waste stream

Fuels and other 'non-recoverable' products (energy) are problematic – progressive policies proposed

Multiple competing platforms, expensive training and certification qualifications disadvantage small and medium business

Transparency, harmonization and access are key to build trust and promote adoption



Recommendations



1. Clarify goals/priorities?

- Diversion of plastic solids from waste and pollution streams
- Improving environmental impact of the industry/modern society
- Displacing virgin feedstocks
- 2. Adopt a national strategy
- **3.** Framework should support both mechanical and chemical pathways don't let them compete for the same materials
- 4. Open, transparent, interoperable or reciprocal certification methods available to the full supply chain
 - SMEs can't sustain multiple certificates
- 5. FAIR Data!
- 6. Common language
- 7. Invest in an R&D program
 - Push innovation and evolution of the 'life cycle approach'
 - Integrate across all aspects of the supply chain
 - Science/design, engineering, manufacturing, education, communication, etc.



Research Areas: Plastics and Polymers



'Materials' Science

- Molecular & polymer process design for re-entry at 'EOL'
- Modern standards and models
- Biotechnology tools (many aspects)



Environmental Assessment

- Benchmarking measurement
- Reference method development
- Existing and new reference materials



Decision Tools

- LCA for plastics assessment (with UCSB)
- Intercomparison studies for existing tools (with ANL)
- Interface with EPA's WARM?



Data

- Resource Registry
- Database updates
- Post-industrial marketplace frameworks (with ASTM)

Commonly Discussed Policy Options

1 Equitable Access & Deposit-Return

- Collection should match domestic garbage removal infrastructure
- D-R proven effective at state levels
- D-R applicable to more than bottles

3 Recycled Content Requirements

- Key to this report How do you trust the reported value?
- Blend policies work to increase segregated/IP market

2 Extended Producer Responsibility

- Federal state laws are difficult to uniformly implement
- Use \$ for infrastructure and innovation

4 Labeling, Taxes, Fees and Bans

- Labeling failures are symptoms of a weak/porous *domestic infrastructure*
- Know the consequences

Thank You!

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NIST CE Webpage: <u>https://www.nist.gov/circular-economy</u> Animated CE Short: <u>https://www.youtube.com/c/NIST/videos</u>



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