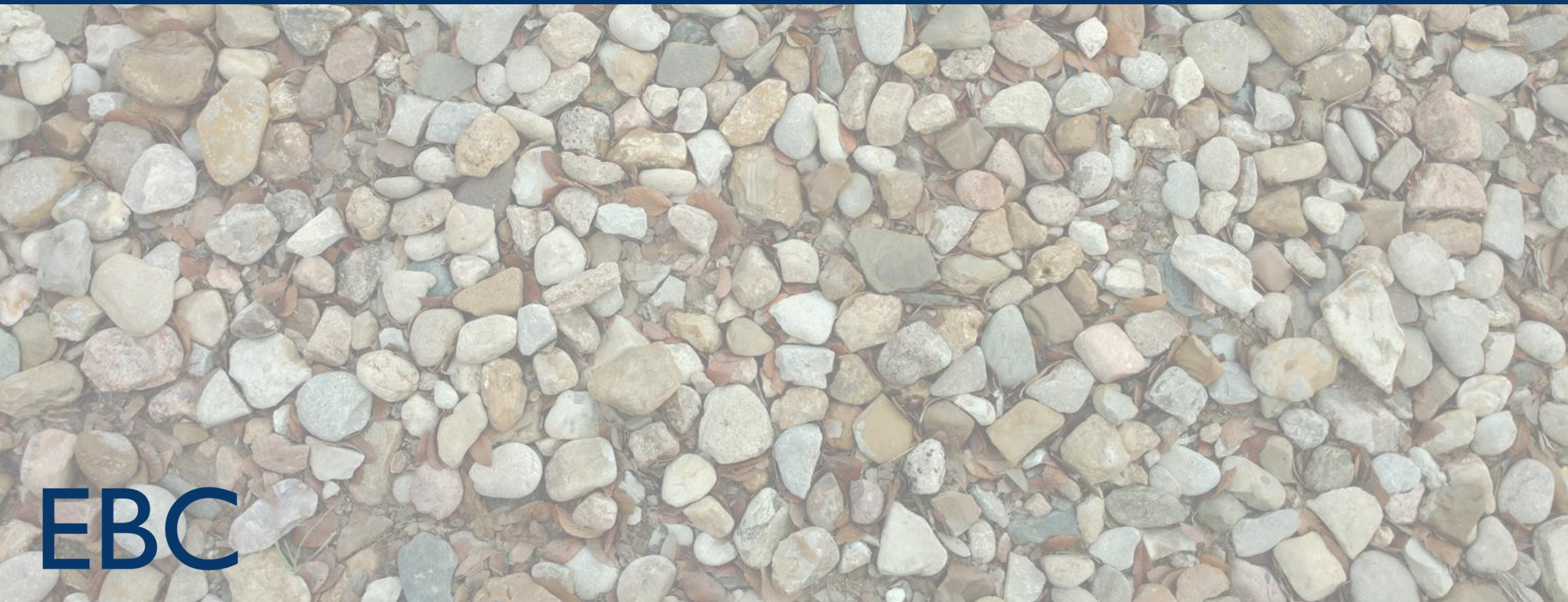
EBC Solid Waste Management Webinar

Big Battles in The World of Recycling



EBC

Welcome

Ann Gisinger

Executive Director & President

Environmental Business Council

EBC

Environmental Business Council of New England

Energy Environment Economy

Thank you to our Sponsors

Epsilon Associates Inc.

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CommonWealth Resource Management Corporation

EBC

Program Partners

MassRecycle

SWANA Southern New England

SWANA Northern New England

National Waste & Recycling Association

Northeast Resource Recovery Association

EBC

Introduction

Stephen Sakakeeny

Program Co-Chair & Moderator

Principal

SAK Environmental, LLC

EBC

Environmental Business Council of New England

Energy Environment Economy

A Piece of the Big Picture

- MA Waste Ban Data CY2019
- Waste-to-Energy Facilities - 54% (2.99M tons) of total MSW disposed annually
- Average rate of “failed loads” = 2.4% (5,650 loads)
- Paper/cardboard = 84%
- Commercial organics = 13.5%
- Not The Whole Story

Source: MassDEP Quarterly Comparative Analysis Reports (QCAR) CY2019

Waste Characterization & The Full Potential of Recycling

John Culbertson

Vice President

MSW Consultants, LLC

EBC

Environmental Business Council of New England

Energy Environment Economy


Waste Characterization & the Full Potential of Recycling
Insights from the latest trends and advances in monitoring and measuring the waste, recycling and organics streams
MSW CONSULTANTS
EBC
Big Battles in the World of Recycling
September 32, 2021
800.679.9220 x 11 | mswconsultants.com

1


Who We Are
MSW CONSULTANTS
• Material Stream Characterization Leaders
• Recycling Optimization Specialists
• Data-driven Results Providers
• Strong Operational Capabilities
• Solid Waste User Fee and Rate Experts
800.679.9220 x 11 | mswconsultants.com

2

Topic 1

Disposed Waste Composition Measurement

3

Why Measure Waste Composition?

- Evaluate the effectiveness of current diversion programs
- Identify constituents to be targeted in future diversion programs
- Assess waste as a feedstock
  - Energy content
  - Moisture level
  - Particle size
  - Infeed variability (seasonal, load-by-load)

4

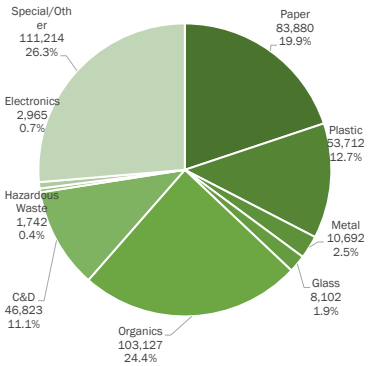
New England Waste Composition Studies

- 2019 **Massachusetts** Combustor Class II Recycling Program Waste Characterization Studies (MassDEP)
- 2018 **Vermont** Waste Characterization (DEC)
- 2015 **Connecticut** Statewide Waste Characterization Study (DEEP)
- 2015 **Rhode Island** Solid Waste Characterization Study (RIRRC)
- 2011 **Maine** Residential Waste Characterization Study (University of Maine)

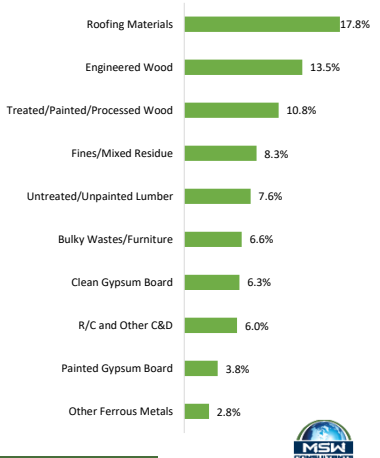
5

What's in Your Waste?

Municipal Solid Waste



Construction & Demolition Debris



Source: 2018 Vermont Waste Characterization

6

Observations

- Academic vs Practical Composition Analysis
- Determining Protocol to Meet Research Objectives
- Increasing Relevance for Old and New Stakeholders
  - State, County and Local Governments
  - Equipment Manufacturers
  - New Technology Developers
  - Corporate Sustainability Organizations
  - Expanded Producer Responsibility (EPR) Organizations

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Topic 2

The Value of Optimized Recycling

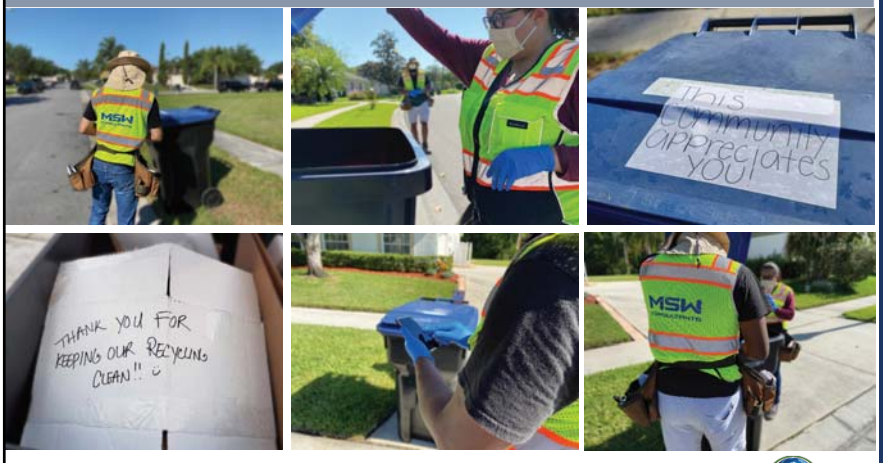
8

A New Mindset for Sustainable Curbside Recycling Programs

- Curbside recycling collection programs **ARE NOT** a function of "waste" management
- They **ARE** providers of a specialized feedstock for U.S. manufacturers of products and packaging in a circular economy

9

Direct Feedback Programs



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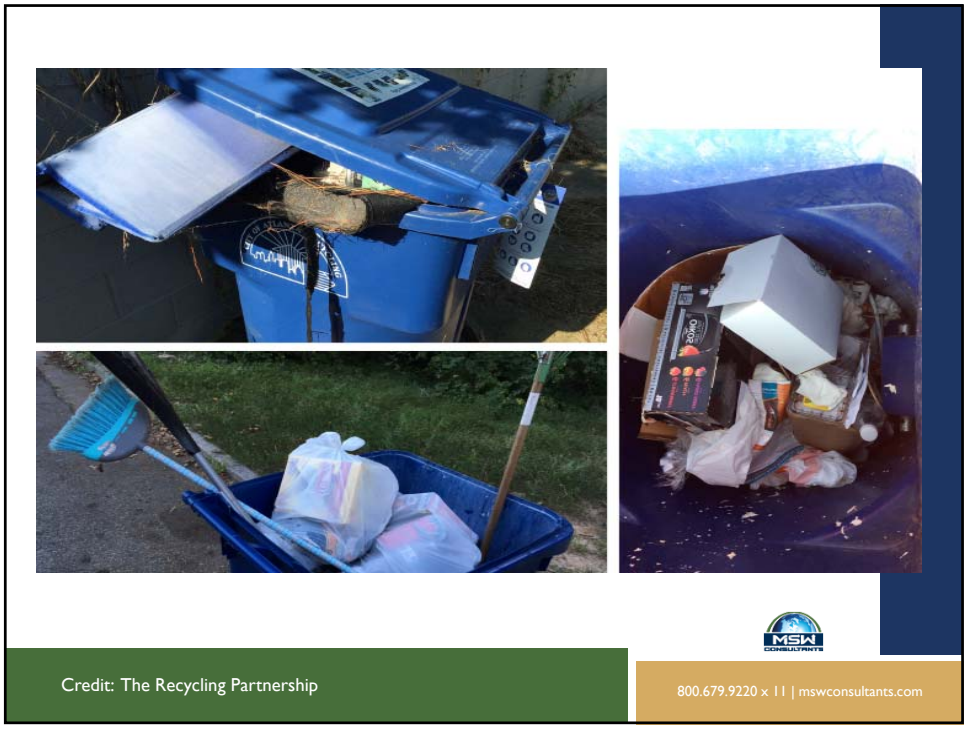
Credit: The Recycling Partnership
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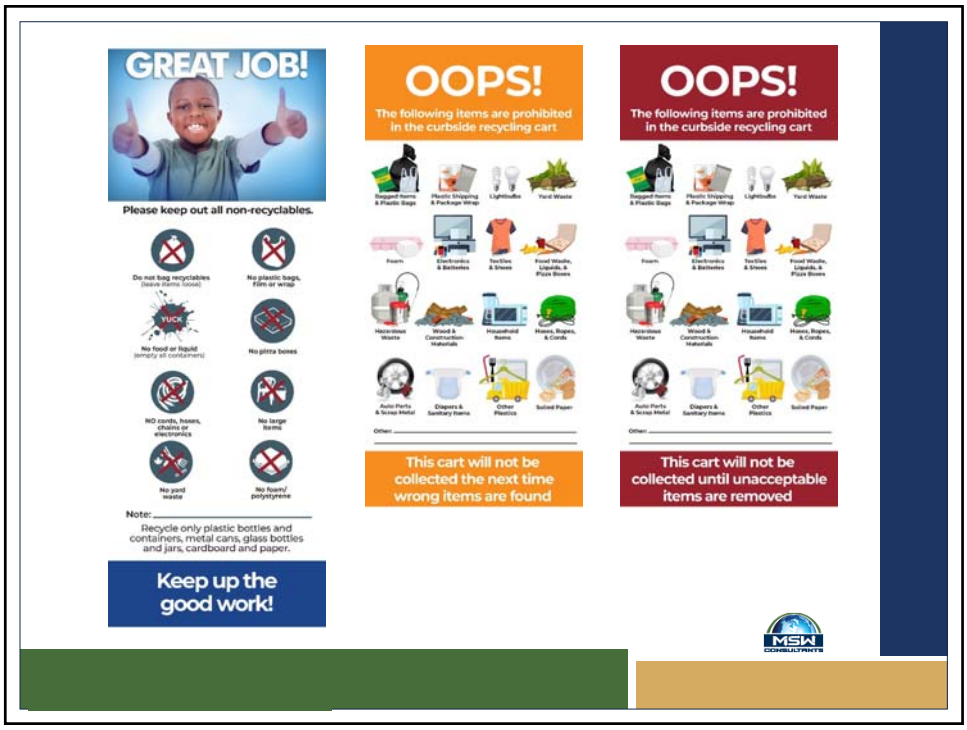
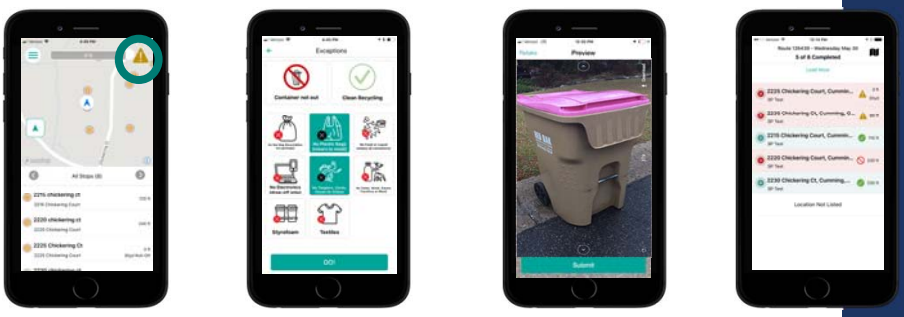

GREAT JOB!
Please keep out all non-recyclables.
Do not bag recyclables
No plastic bags, film or wrap
No food or liquid
No pizza boxes
No cords, hoses, chains or electronics
No large items
No yard waste
No foam/ polystyrene
Note:
Recycle only plastic bottles and containers, metal cans, glass bottles and jars, cardboard and paper.
Keep up the good work!
OOPS!
The following items are prohibited in the curbside recycling cart
This cart will not be collected the next time wrong items are found
OOPS!
The following items are prohibited in the curbside recycling cart
This cart will not be collected until unacceptable items are removed

12

Apps for Direct Feedback Programs



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Monitoring Recyclable Material Value and Contamination

Thoughts about Fair and Transparent Recyclables Processing

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Modern Material Recovery Facilities

Photo credit: AMP Robotics

Conclusion: Excellent at removing contaminants and sorting out mixed recyclables from multiple suppliers!

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- However…MRFs are NOT set up to accurately measure the composition and contamination of inbound materials
  - Yet this is how most processing contracts are written

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Inbound Recyclables Composition

Visual Grading

Weight-based Composition Measurement

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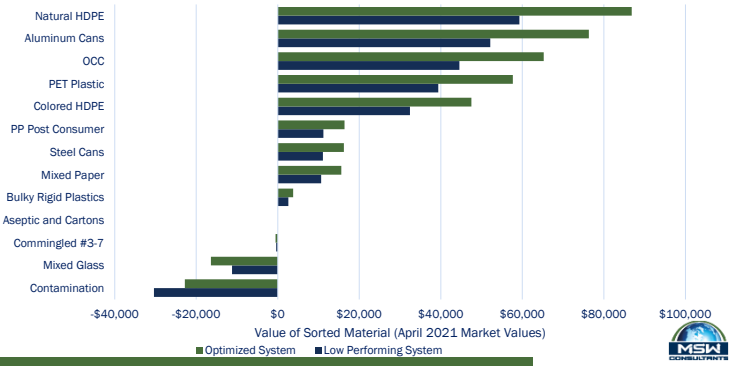
For a City with 15,000 Households…

Low Performing Recycling System:
- 300 lbs per household
- 30% contamination

VS.

Optimized Recycling System:
- 375 lbs per household
- 18% contamination



Commodity Value: From $220,000 to $345,000

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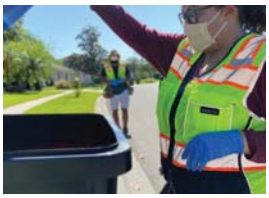
Sustainable Recycling Programs of the Future will have a sufficient, designated budget for the following elements:

Ongoing Public Education



Direct Feedback Programs

Routine Inbound Composition Monitoring at the MRF

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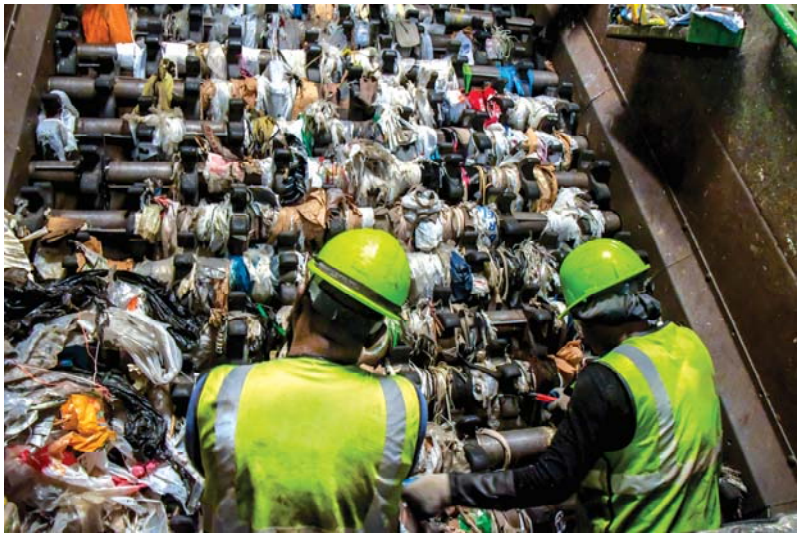

Credit: The Recycling Partnership

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Credit: The Recycling Partnership

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Thank you!

John Culbertson, Vice President
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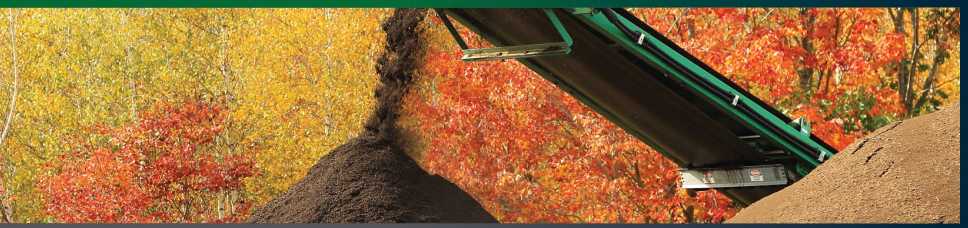
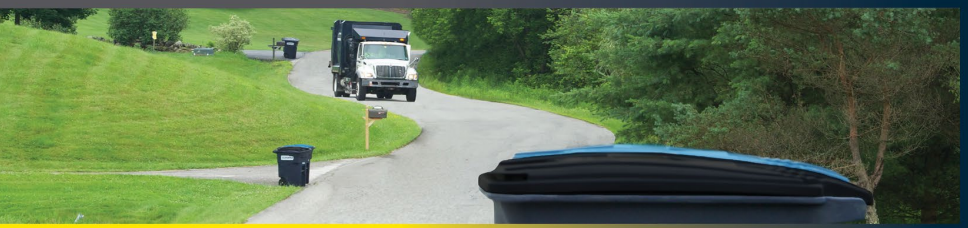
Beyond National Sword Recycling Update

Erin Banfield

Senior Business Manager
Casella

EBC
Environmental Business Council of New England
Energy Environment Economy



Beyond National Sword Recycling Update

EBC Solid Waste Management Webinar
Big Battles in The World of Recycling

Erin Banfield

September 23, 2021

casella

ESTABLISHED 1975

RECYCLING • SOLUTIONS • ORGANICS • COLLECTION • ENERGY • LANDFILLS

Casella Company Overview:

- Founded in 1975 with a single truck
- Approximately 2,800 employees serving over 200,000 customers and 500,000 households across the Northeast
- Traded on NASDAQ as CWST
- $750M in annual revenue
- Operations in CT, MA, ME, NH, NY, PA, and VT
- Vertically integrated collection, transfer, disposal and recycling operations
- Recover over 800,000 tons of recycling and over 450,000 tons of organics for beneficial use each year = More than 1.2 million tons of recyclables and organics per year

Casella Recycling

- 17 Recycling Operations
- Single Stream, Commercial, Source Separated processing
- Process and markets over 800,000 tons/yr
- Boston, MA MRF – 3rd largest in the U.S.

National Sword – Almost 3-years later…

- New Industry acceptable outbound quality spec of 0.5% of “carried waste”
- Previous Industry standard 2%
- Major MRF Impacts
- MRF Inbound Contamination Rate averages about 20%

Adding Technology

- Focus has turned to *Quality*
- Casella invested 9M in Recycling (2019)
- Polishing/Ballistic Screens
  - Extract further contaminates
- OCC Screening Retrofits
- Optical sorting for further upgrades

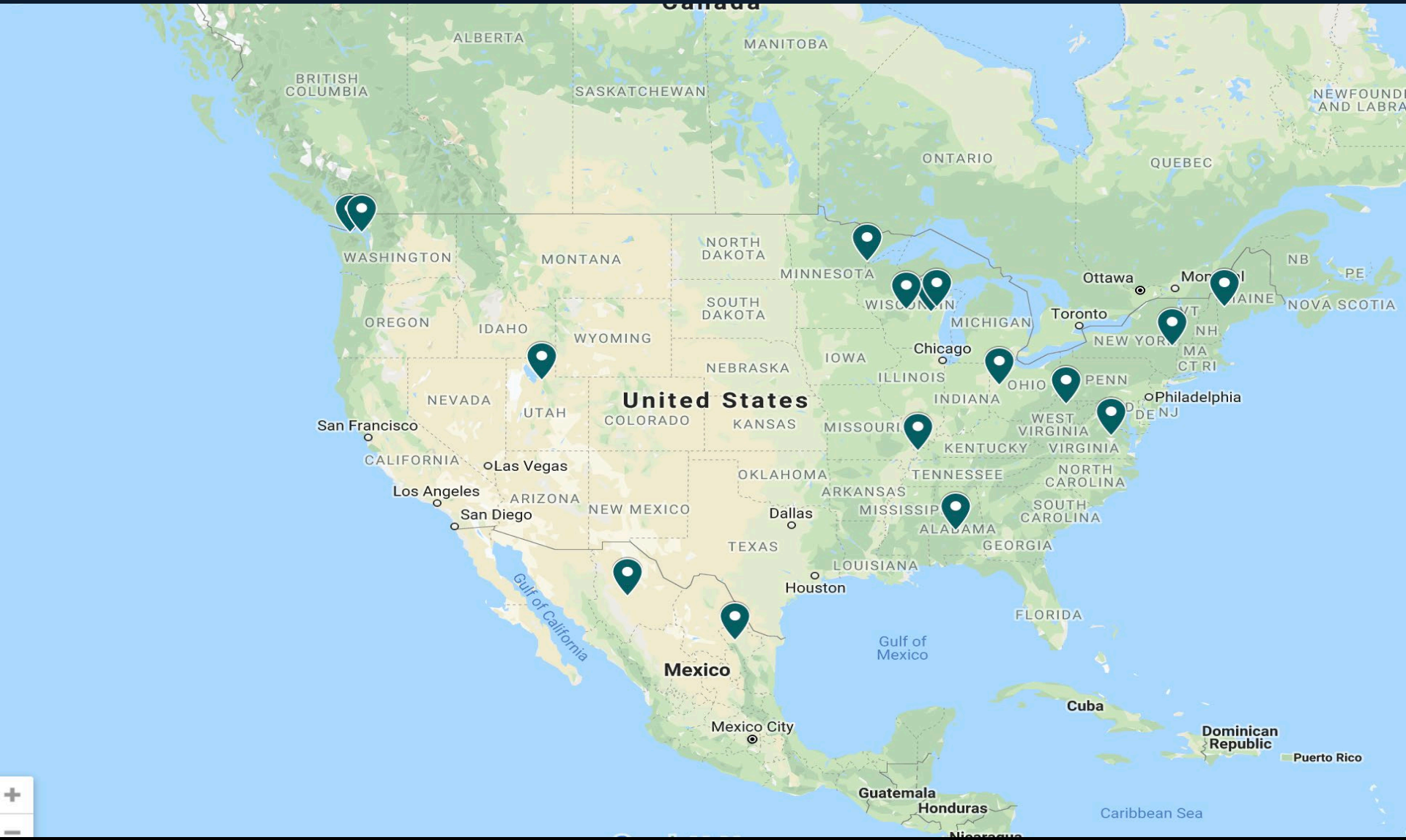
COVID Impacts

- Commercial tons (supply) decreased
  - Created increase in demand
- Residential tons increased- up to 30%
- Pricing Impacts
  - Mixed Paper
  - OCC
  - PET
  - HDPE
  - Glass

Importance of Continued Recycling

- Demand still increasing- additional capacity
  - Essential Household products - shortage
  - All produced from Recovered paper and plastics.
- Residential materials such as Mix Paper, Cardboard, Plastics
- **Products are vital to get to our front-line workers**

Upcoming Domestic Mill Growth



To learn more, please visit:

casella.com

RESOURCE SOLUTIONS

RECYCLING | COLLECTION | ORGANICS | ENERGY | LANDFILLS

Beyond the Blue Bin: Integrating Anti-Racism & Intersectional Environmentalism into Waste Reduction Messaging

Lani St. Hill

Outreach Coordinator for Waste Reduction and Recyling

North Carolina State University

EBC

Environmental Business Council of New England

Energy Environment Economy

BEYOND THE BLUE BIN

INTEGRATING ANTI-RACISM & INTERSECTIONAL ENVIRONMENTALISM INTO WASTE REDUCTION MESSAGING

NC STATE

- 36,000+ students
- 9,000+ faculty/staff
- 700+ buildings
- 2,100+ acres
- Wolfpack / ACC

Waste Reduction & Recycling

- campus waste hauler
- closed-loop on food waste
- 54% waste diversion
- robust zero waste & sustainability programs

recycling.ncsu.edu

"We must acknowledge the history of the spaces and places we occupy to both understand and unlearn the many ways that we have been socialized."

NC STATE UNIVERSITY LAND ACKNOWLEDGMENT,
AUTHORED BY LYNN-LOCKLEAR FISHER (LUMBEE)


recycling.ncsu.edu

STEP 1:

ACKNOWLEDGEMENT

LISTEN. LEARN. REPEAT.

COMMUNICATE

SOCIAL MEDIA

SHARE / FOLLOW / COMMENT/ LIKE

BE INVOLVED

ATTEND EVENTS
SUPPORT COMMUNITIES
SUPPORT THE WORK

recycling.ncsu.edu

STEP 2:

BUILD KNOWLEDGE


recycling.ncsu.edu

Personal Waste Audits

LANDFILL 43.8%

RECYCLING 31.7%

COMPOST 24.4%

ACCESS

PRIVILEGE

WORLDVIEWS

CONSUMPTION HABITS

POLICIES & SYSTEMS

recycling.ncsu.edu

REFUSE SINGLE-USE PLASTICS

EXTRACTION & MANUFACTURING

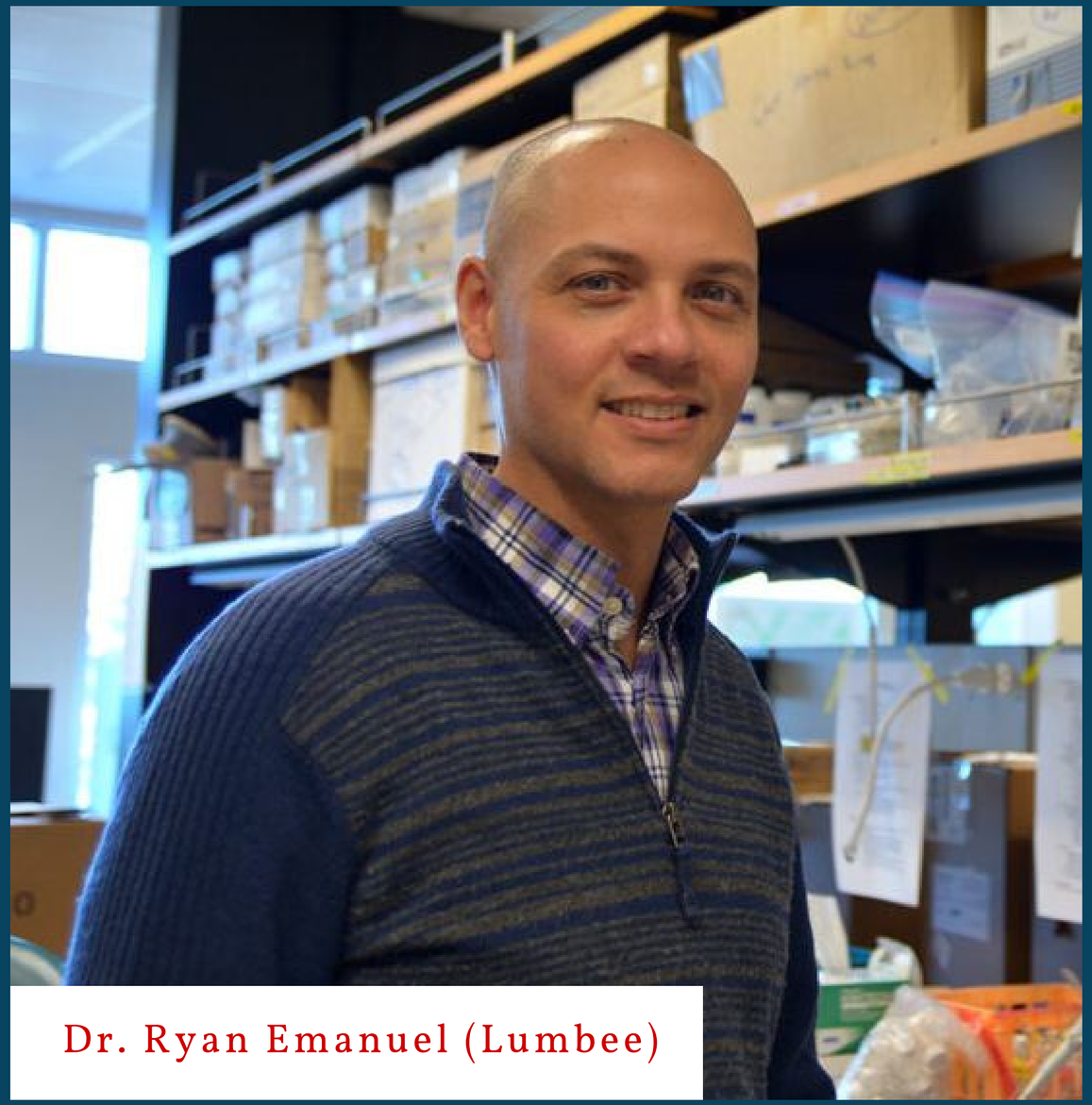
EMINENT DOMAIN
HEALTH HAZARDS
FAIR LABOR

RECYCLING & ACCOUNTABILITY

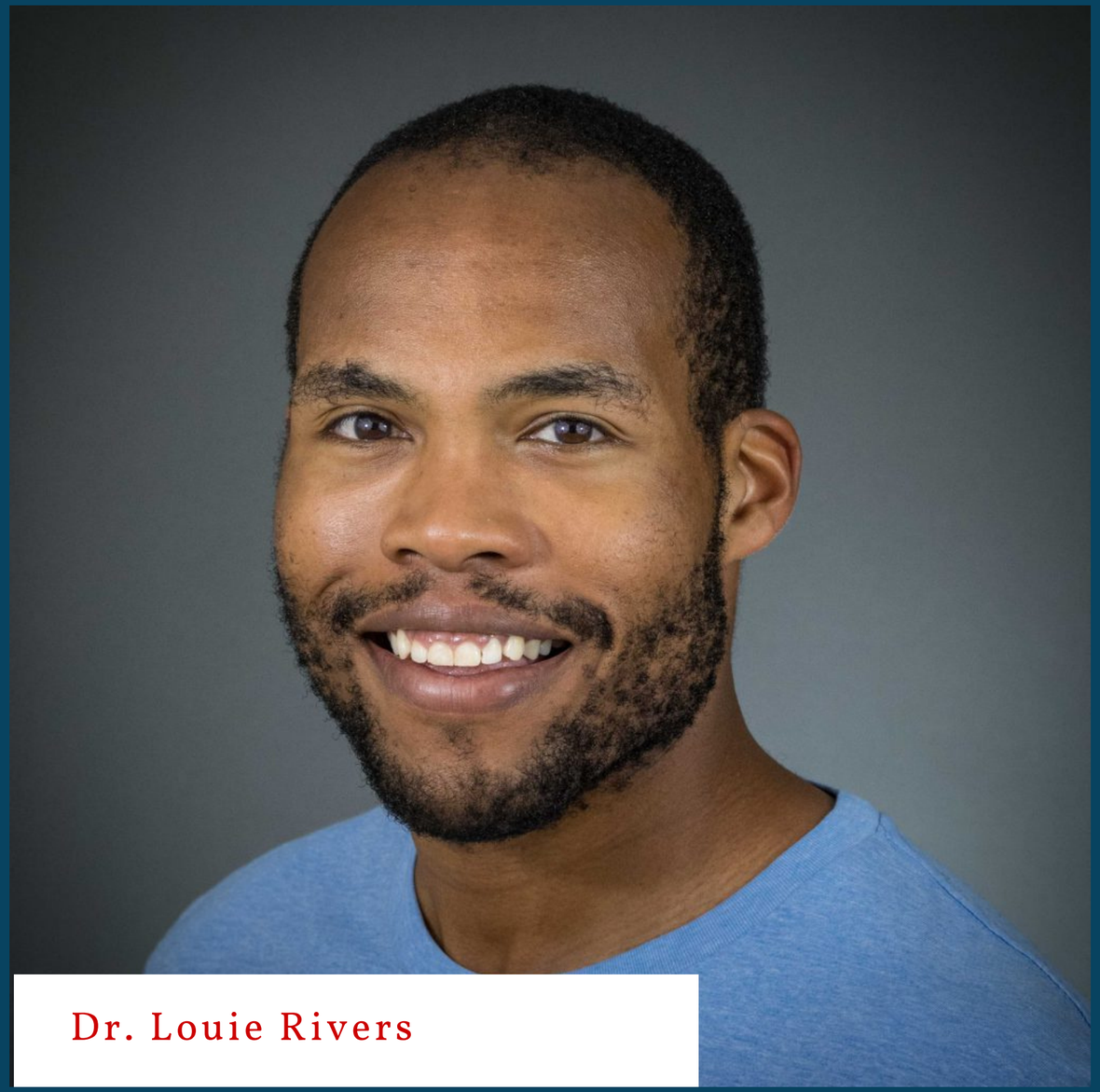
LACK OF ACCESS
INABILITY TO PROCESS
PRODUCER RESPONSIBILITY

DISPOSAL & DISPARITY

BURDEN
HEALTH HAZARDS
REDLINING



Dr. Ryan Emanuel (Lumbee)



Dr. Louie Rivers

recycling.ncsu.edu

North Carolina PCB Protests, 1982

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DATA-DRIVEN

PERSONAL EXPERIENCES

EXPERTS & RESEARCH

LOCAL KNOWLEDGE

STEP 3:

ENGAGEMENT

BUILDING ENGAGEMENT

Social Media
@NCStateRecycles

Student Interns &
Organizations

Volunteer Programs

SOCIAL MEDIA

-Share & Promote

-Meet Your Students Where They Live

-Informal Connections

i.e. *Waste Education Wednesdays*

-Evergreen

@NCStateRecycles

INTERNSHIPS

-Post Your Positions

-Professional Experience

-Model What You Want to See

STUDENT/ COMMUNITY ORGANIZATIONS

-Mentor / Advisor

-Community Resource

-Collaborate with Community Organizations

-Use Your Position to Support Others

-Talk to Everyone!

Diversity & Inclusion adVenture Experience (DIVE)

City of Raleigh Yourh Council

Hmong Student Association

NC State Cricket Club

recycling.ncsu.edu

STEP 4:

ADVOCACY

*INTERSECTIONAL ENVIRONMENTALISM**

recognizing how colonization, white supremacy, and racism have created institutions and practices of today that target the environment & vulnerable communities

building knowledge within that space to educate & inspire others to create change

INTERSECTIONAL ENVIRONMENTALISM draws from the work of the Combahee River Collective of the 1970s & later, Prof. Kimberlé Crenshaw

4 LEVELS OF ACTION

WILL GRANT (DRAWDOWN)

01 INDIVIDUAL

02 FRIENDS & FAMILY

03 SCHOOL / WORK

04 POLICY

Acknowledge

Connect with what matters

Be authentic

Build Knowledge

Dig deeper into what you are already doing to showcase the connection

Engagement

Support community dreams and solutions

Advocacy

Showcase/Support your community


C. RICHARD VAUGHN TOWERS
WOLFPACK CLUB
NC STATE UNIVERSITY
recycling.ncsu.edu

THANK YOU

Lani St. Hill (she/her)
Outreach Coordinator
NC State Waste Reduction & Recycling

mesthill@ncsu.edu

@NCStateRecycles

Instagram, Facebook, TikTok, Twitter, YouTube, Pinterest

Plastics Recycling:
What Happens After Collection

George Aronson

Principal

CommonWealth Resource Management Corporation

EBC

Environmental Business Council of New England

Energy Environment Economy

Environmental Business Council of New England, Inc.

Plastics recycling: what happens after collection



EBCNE Webinar on Solid Waste Management:
Big Battles in the World of Recycling

23 September 2021

CommonWealth
Resource Management Corporation

EBCNE Zoom Webinar on Solid Waste Management
Big Battles in the World of Recycling
23 September 2021

Appeared in the Boston Globe on 8 August 2021.
Used by permission of the cartoonist.
Thank you Alex!

There's a lot more to recycling than collection!

1. **What are plastics?**
2. **What is plastics recycling? When we collect plastics, what can we do with them?**
3. **What are pyrolysis and gasification? Are they recycling?**

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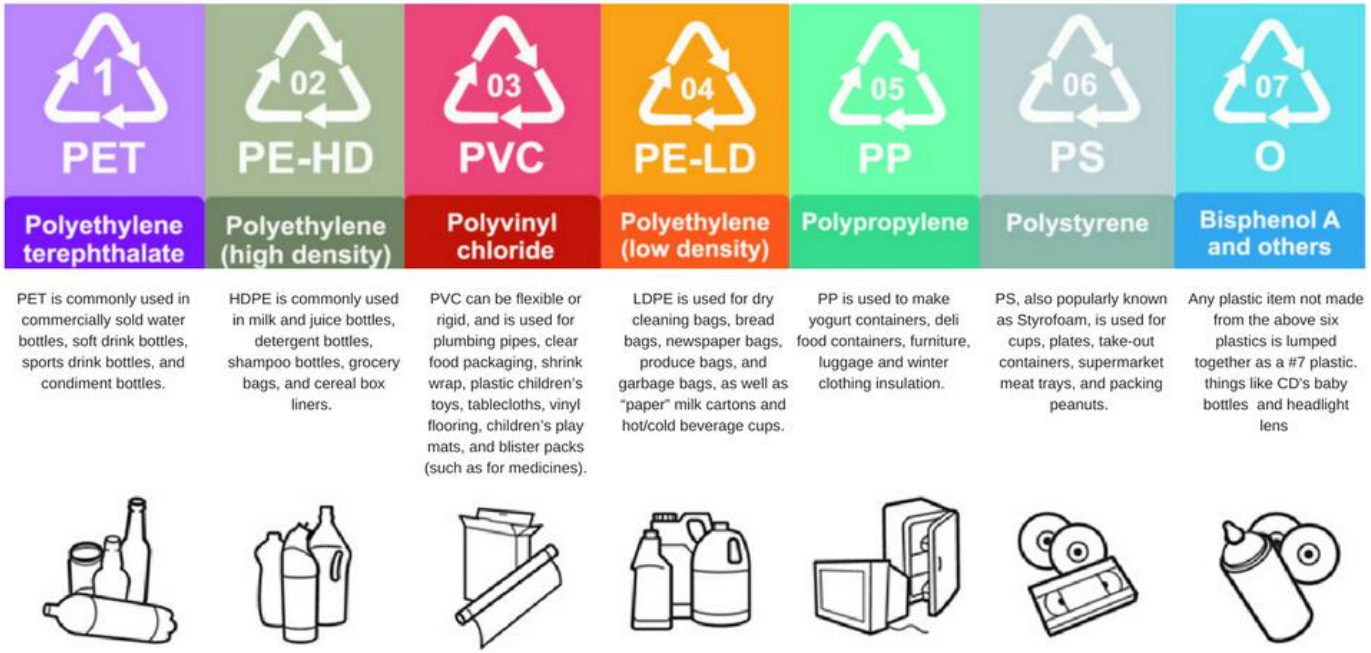
Plastics #1 - #7: the popular view



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Plastics: an elemental view. How many molecules are there in a bowling ball? In a tire?

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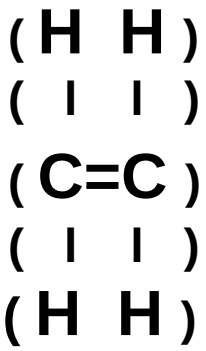
Resource Management Corporation

Plastics: an organic chemist's view

Atoms — **Carbon (C)**, **Hydrogen (H)**, **Oxygen (O)**, **Chlorine (Cl)**

Monomer



Example shown is ethylene monomer – C_2H_4

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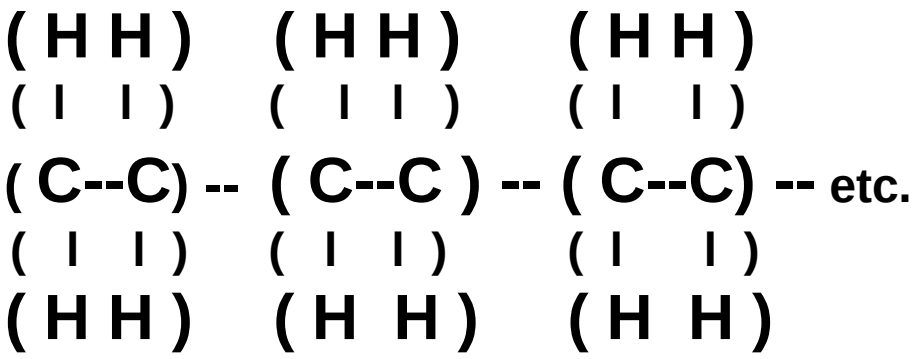
Plastics: an organic chemist's view

Atoms **Carbon (C)** **Oxygen (O)**
Hydrogen (H) **Chlorine (Cl)**

Polymers
(many monomers)



*Example shown is **poly**ethylene polymer – $(C_2H_4)n$*

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Resource Management Corporation

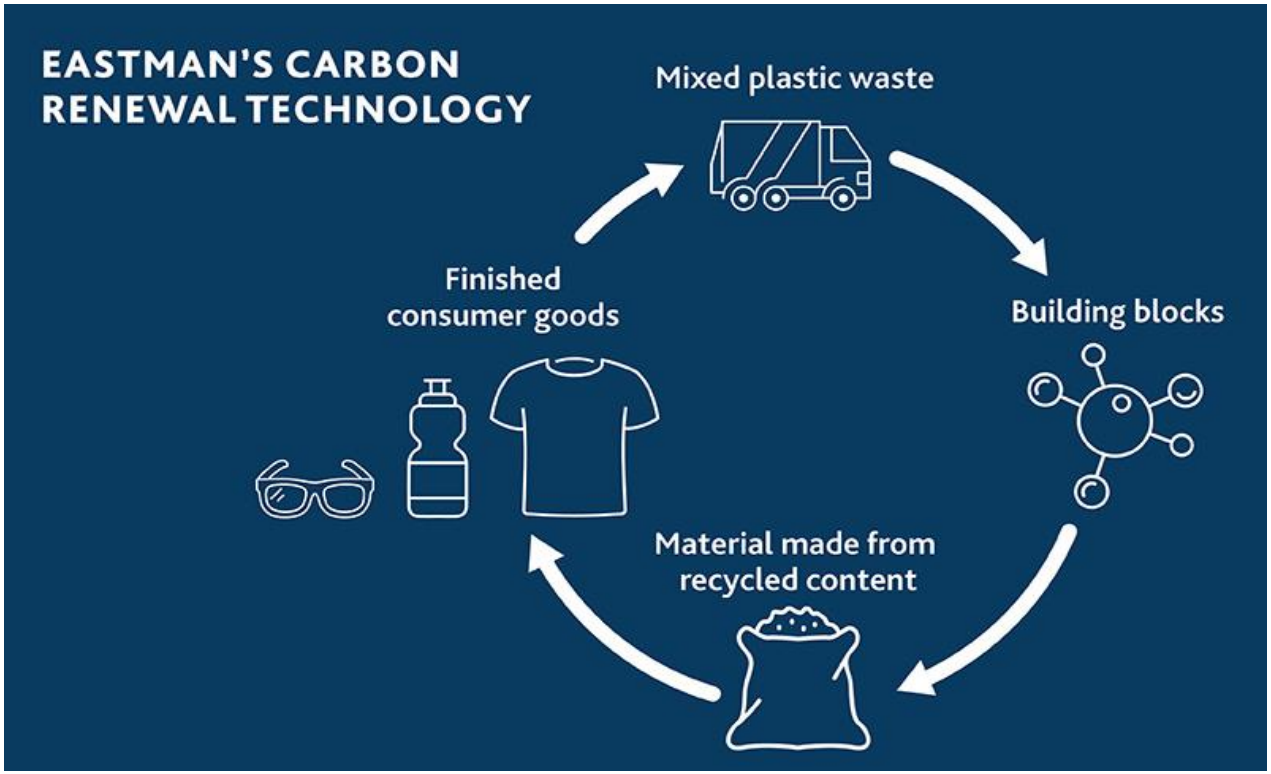
Plastics #1-#7: an engineer's view

Type	Monomer	Melt/freeze T	Properties
#1 PET	$C_{10}H_8O_4$	500 deg F	Strong but heat-sensitive
#2 HDPE	C_2H_4	270 deg F	Strong, light and stable
#3 PVC	C_2H_3Cl	212+ deg F	Rigid, can be flexible with additives, very heat-sensitive
#4 LDPE	C_2H_4	230 deg F	Thin/flexible version of HDPE
#5 PP	C_3H_6	320 deg F	Strong and stable
#6 PS	C_8H_8	800 deg F	Heat resistant; concerns with additive leaching
#7 Misc.	Many !	Wide range	Wide range of properties

What are the methods for plastics recycling?

- **Mechanical recycling** (shred soda bottles for carpet filler – *no change to the monomers*)
- **Thermal recycling** (sort, clean, heat, soften/melt, compress/pelletize, mold/stretch and harden/freeze – *minimal changes to the monomers*)
- **Molecular, chemical or solvent recycling** (pyrolysis and other processes to change the monomers through unlimited cycles)

Plastics monomer recycling



- *Infinite cycling*
- *Flexibility*
- *Capex and scale*
- *Energy and resources*

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Post-consumer plastics recycling: US markets

Local options

- Traders/processors – supply chain
- End-users – small-scale extrusion and molding products
- In New England, plastics waste supply exceeds demand

Regional facilities – large wasteshed areas

- Fayetteville, NC (Clear Path) –140,000 tpy PET
- Troy, AL (KW Plastics) – 500,000 tpy HDPE/PP
- Winchester, VA (Trex) – LDPE/HDPE film

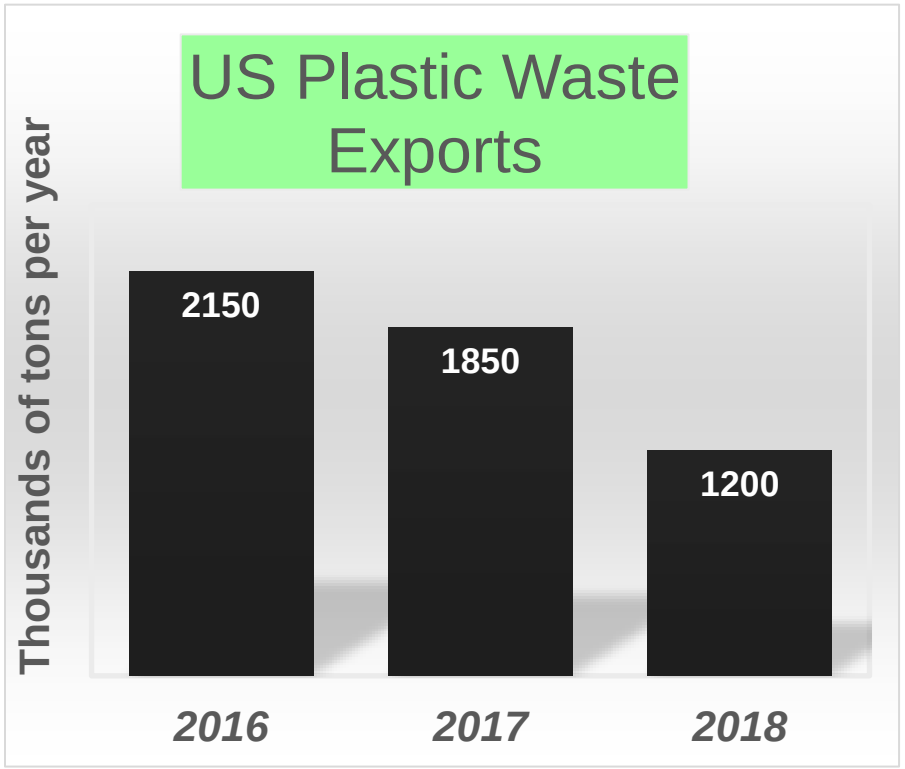
Exports

Post-consumer plastic global markets, 2017-2021

2013	China's "**Green Fence**" limits all scrap contamination, including plastics
2018	China's "**National Sword"** bans mixed plastic waste imports, limits contamination to 0.5%
2018	Other Asian countries limit imports Chinese plastics companies enter US market
2019	MRFs **stockpile plastics, reduce collection** China and US announce **tariff increases**
2020	**Pandemic** reduces economic activity
2021	**Big freeze in Texas** disrupts resin production
Ongoing	Concerns with ocean waste, climate change

Plastics recycling: export markets, 2017-2018

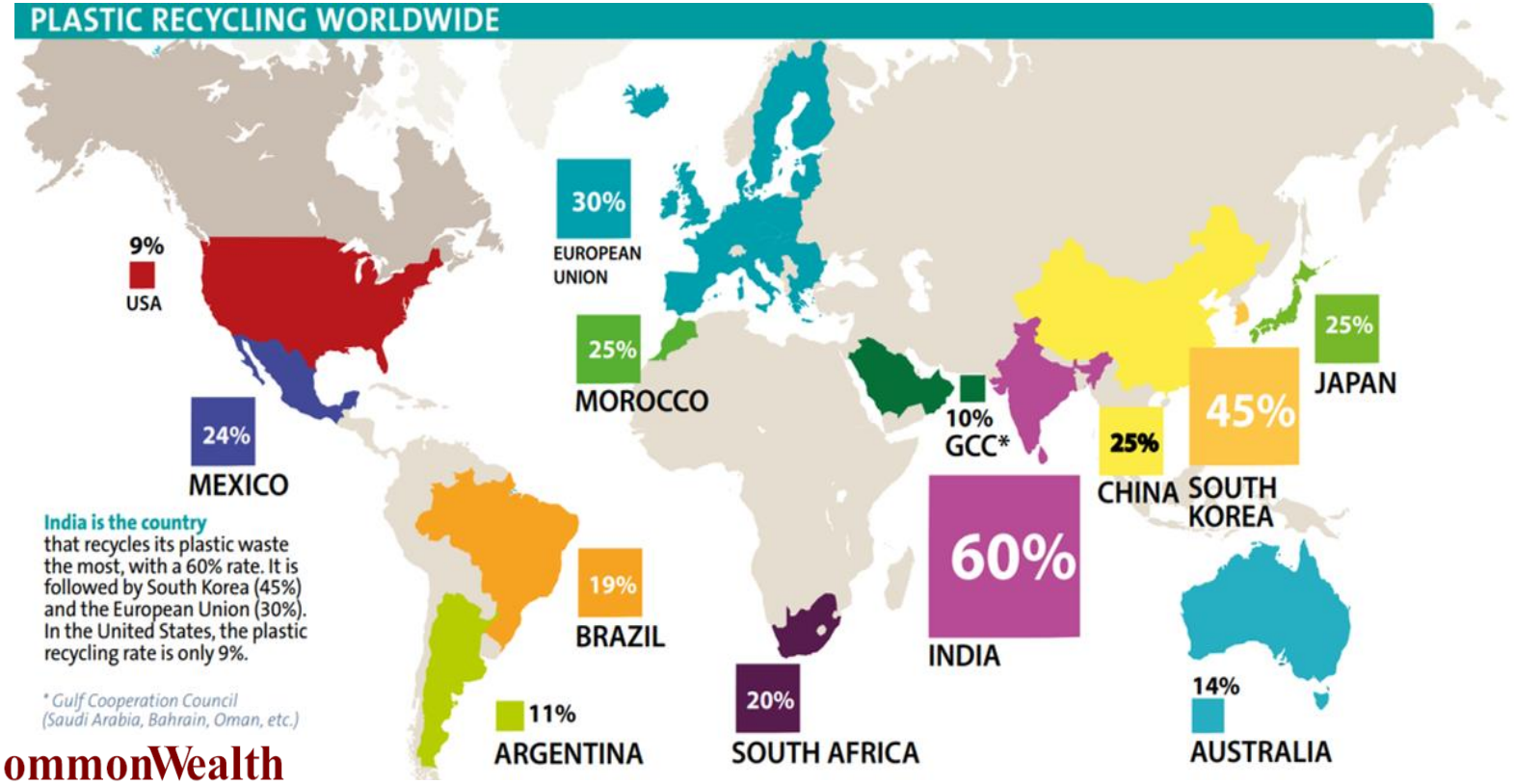
China bans mixed plastic imports on January 1, 2018
limits contamination to 0.5% as of March 1, 2018



	2017	2018
China	611	60
Hong Kong	407	132
Vietnam	148	84
India	148	144
Malaysia	130	228
Mexico	56	48
Indonesia	37	36
Taiwan	37	60
Thailand	37	120
Other	93	132
	1850	1200

Data in thousands of tons per year

Plastics recycling around the world



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New restrictions on waste exports in trade

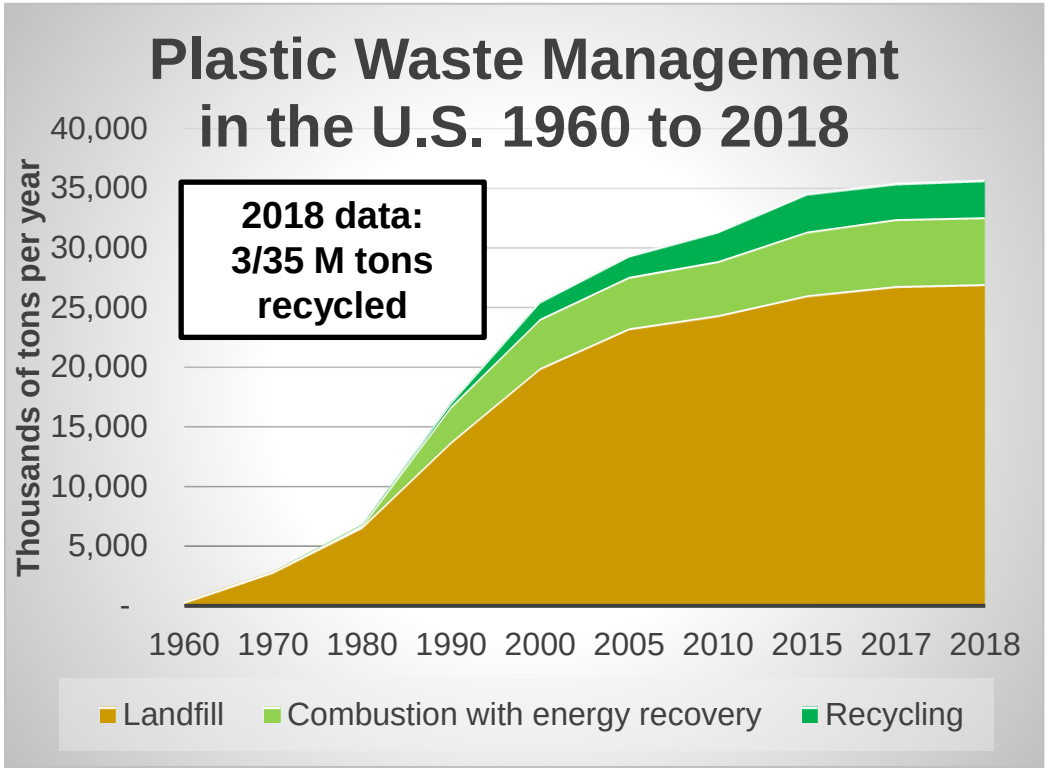
- Control trading of overly-contaminated scrap
- Reduce impacts on oceans

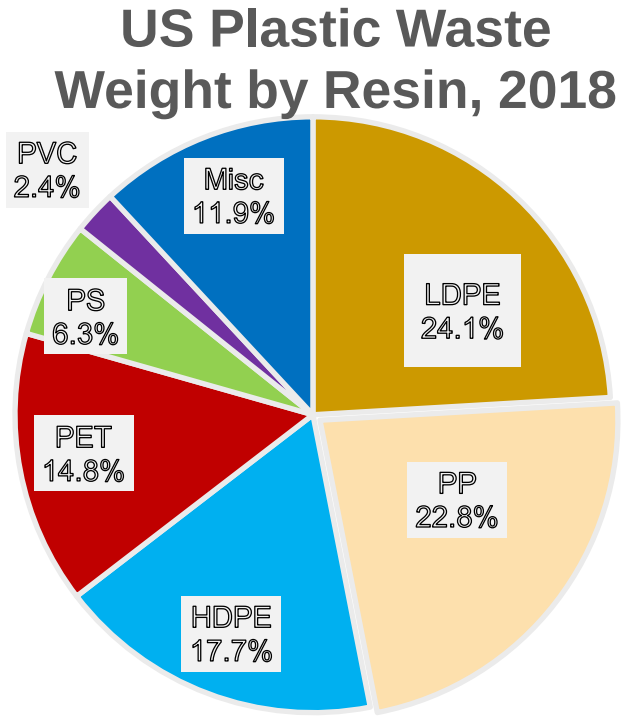
Basel Convention, 2021

- Plastic waste exports require notice and consent
- 187 countries sign; the US has not yet signed
- US waste plastic exports are now limited to
  - Pre-sorted clean uncontaminated materials; or
  - Bilateral agreements with notice and consent (Canada, Mexico, OECD)

Circular Economy Resolutions for UN Conference on the Environment, Nairobi, Kenya 2022

Plastic waste: US tons and resins





USEPA data. Exports not shown

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Resource Management Corporation

In crisis there is opportunity!

- **Crisis: imbalance of waste plastic supply/demand**
- **Public sector response:** reduce plastics waste
- **Industry response:** add plastics recycling capacity
  - Increased interest in ESG investments
  - New corporate carbon footprint reduction goals
  - Domestic sources improve supply chains
  - Recycled resins depend less on oil markets

Evolving hierarchy for plastics recycling

A. Reduce plastics waste
B. Return plastic waste to commerce
C. Avoid/reduce fossil fuel use/emissions
D. Dispose of the irreducible minimum

Evaluation criteria

- Energy use and emissions from processing
- Energy use and emissions from transport
- Carbon footprint over the use/recovery life-cycle

Reduce plastics waste. Minimize energy use and emissions from transport

U.S. Plastics Pact Unveils National Strategy to Achieve 2025 Circular Economy Goals. *June 15th, 2021*

1. Eliminate problematic or unnecessary packaging.
2. Make all plastic packaging reusable, recyclable, or compostable.
3. Recycle or compost 50% of plastic packaging.
4. Achieve average for plastic packaging of 30% recycled or responsibly-sourced bio-based content

https://usplasticspact.org/

New large-scale plastics recycling facilities

PureCycle (Proctor & Gamble): replace PET/HDPE with PP

- 50,000 tpy new capacity, Ironton, OH by 2022
- 500,000 tpy new capacity by 2025

Envision Plastics:

- Diversion of ocean-bound plastics to produce resins
- Production of food-grade post-consumer HDPE at former MRF in Reidsville, NC

New large-scale plastics recycling facilities

Eastman Renew: carbon renewal technology

- Allows full recycling of C-H monomers, 1-2 and 4-7
- Can recycle infinite times with no loss of quality
- 100,000 tpy new capacity, Kingsport, TN, by 2022

Brightmark: pyrolysis/gasification of 1s through 7s

- 100,000 tpy new capacity, Ashley, IN, in start-up
- 400,000 tpy new capacity in Macon, GA by 2025

Pyrolysis process: decompose polymers to gases and monomers with

- **Controlled heat and pressure**
- **No oxygen (prevent burning)**
- **Catalysts**
- **Distillation and post-processing**

Products include

- Plastic monomers
- Liquid fuels (synthetic diesel, jet fuel, heating oil)
- Biochar and solid residues

Other pyrolysis/gasification processes

Alternative feedstocks

- **Biosolids (carbohydates) with PFAS destruction**
- **Mixed plastics and products (hydrocarbons) pre-processed to a physical spec**

Other products

- Electricity (steam turbines and IC engines)
- Renewable pipeline gas

Small-scale skid-mounted facilities

- Reduce energy for transport

Waste plastics to diesel by pyrolysis,
Jiangsu Province, Republic of China

1. Feedstock pre-processing

2. Conversion in a reactor vessel with mixing, heat and a catalyst

All photos by G Aronson

3. Product distillation and refinement

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Small-scale pyrolysis/gasification facility development in the Northeast:

1. **Sustane Technologies, Chester, NS – in start-up**
2. **Warwick, RI – pre-construction development**
3. **Aries CleanTech, Taunton MA – in MEPA permitting process**
4. **Trashology: pilot test facility, Concord, MA**
5. **Nantucket RFEI process – planning and procurement process**

MassDEP guidance on pyrolysis/gasification

Letter to City of Taunton, July 2019

Technology	Status of 1990 permit moratorium
New MSW combustion capacity	Applies
Use syngas from pyrolysis or gasification to make electricity	Limited to 350,000 tpy MSW statewide capacity
Transportation liquid fuels (synthetic diesel, jet fuel)	Exempt
Other fuels that might be combusted (synthetic home heating oil, pipeline natural gas)	Not addressed yet

MassDEP guidance on pyrolysis/gasification

Letter on Aries CleanTech project in Taunton, July 2019

Projects will require upfront recycling programs with measurable and enforceable performance standards

- Implies that source separation/recycling is preferred to pyrolysis
- Standards will depend on technology
- No precedents yet

Where should local pyrolysis/gasification be in the hierarchy ?

- Monomer cycling vs. fuel/energy production
- Net carbon footprint of local vs. remote recycling?
- Fate of exported material not known with certainty

De-carbonization vs. *de-fossilization*

- Mass. de-carbonization roadmaps have a continuing role for synthesized liquid fuels
- Cost, quantities and sources are ”major uncertainties requiring further in-depth study”
- Pyrolysis/gasification of plastics could fill role as an alternative to bad-politics biomass

Summary

- Consider monomers
- Export limits led to supply/demand imbalance
- New actions to address waste plastics
  - Public action to reduce waste plastic supply
  - Private action to add recycling capacity
- Emerging pyrolysis technology regionally and locally for monomer recycling, liquid fuels and electricity

Evolving hierarchy for plastics recycling

A. Reduce plastics waste
B. Return plastic waste to commerce and
C. Avoid/reduce fossil fuel use and emissions
D. Dispose of the irreducible minimum

Evaluation criteria

- Energy use and emissions from processing
- Energy use and emissions from transport
- Carbon footprint over the use/recovery life-cycle

Thank you for listening.

SUPPORT THE EBCNE !!!

EBC
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