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S. HRG. 116–255

RESPONDING TO THE CHALLENGES FACING RECYCLING IN THE UNITED STATES

HEARING

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

UNITED STATES SENATE

ONE HUNDRED SIXTEENTH CONGRESS

SECOND SESSION

JUNE 17, 2020

Printed for the use of the Committee on Environment and Public Works



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COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ONE HUNDRED SIXTEENTH CONGRESS

SECOND SESSION

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C O N T E N T S

Page

JUNE 17, 2020

OPENING STATEMENTS

Barrasso, Hon. John, U.S. Senator from the State of Wyoming 2
Carper, Hon. Thomas R., U.S. Senator from the State of Delaware 4

WITNESSES

Udall, Hon. Tom, U.S. Senator from the State of New Mexico 7
Prepared statement 18
Croke, Bridget, Managing Director, Closed Loop Partners 23
Prepared statement 26
Responses to additional questions from:
Senator Sullivan 173
Senator Carper 175
Senator Merkley 178
Senator Markey 179
Stasz, Meghan, Vice President of Packaging and Sustainability, Consumer Brands Association 181
Prepared statement 183
Responses to additional questions from:
Senator Sullivan 189
Senator Carper 192
Senator Merkley 194
Senator Markey 195
Butler, Nina Bellucci, Chief Executive Officer, MORE Recycling 197
Prepared statement 200
Responses to additional questions from:
Senator Sullivan 217
Senator Carper 224
Senator Sanders 230
Senator Merkley 233
Senator Markey 234

RESPONDING TO THE CHALLENGES FACING RECYCLING IN THE UNITED STATES

WEDNESDAY, JUNE 17, 2020

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, DC.

The Committee met, pursuant to notice, at 10:07 a.m. in room 106, Dirksen Senate Office Building, Hon. John Barrasso (Chairman of the Committee) presiding.

Present: Senators Barrasso, Carper, Inhofe, Braun, Rounds, Boozman, Ernst, Cardin, Whitehouse, Merkley, and Gillibrand.

Senator BARRASSO. Before we start the hearing today, I wanted to just say it is Beth Lange's last hearing.

She has been with the Committee since 2017. For the last 2 years, she made sure our hearings and our markups ran smoothly and on time. We appreciate all the work for the Committee, and we wish her very well in her new job with the Department of Agriculture and their Legislative Affairs Team.

During that time, she was able to have a baby named Jack, a lovely young lad. Some of us were hoping that it would be John instead of Jack, but we understand.

Off to the Department of Agriculture with you.

[Laughter.]

Senator BARRASSO. Anyway, Leah Schaefer is taking over and will do a great job with Beth.

Thank you so much for your service to the Committee, and we are going to miss you. Thank you.

Senator CARPER. Could I just add our thanks and our congratulations as well?

You have one child, just one child?

Ms. LANGE. Just one.

Senator CARPER. Have you had enough of Jack? Do you think there might be another one somewhere down the road?

Senator BARRASSO. A girl named Jill, maybe?

[Laughter.]

Senator CARPER. That would be good.

USDA?

Ms. LANGE. Yes.

Senator CARPER. All right. In the Bible, Matthew 25, it says, "When I was hungry, did you feed me?" and going to the USDA, thank you for feeding us, and thank you for your great work here. It has been a joy. Thank you.

OPENING STATEMENT OF HON. JOHN BARRASSO, U.S. SENATOR FROM THE STATE OF WYOMING

Senator BARRASSO. With that, we call this hearing to order today.

Today we are going to consider the recent challenges facing recycling programs in the United States and the potential solutions to these challenges.

I will tell you, in the big story today in the Casper newspaper is, today—I see Senator Udall—today, we are opening the recycling facilities that we have all around Casper that have been closed as a result of the coronavirus crisis that is affecting us that have been closed as a result for a number of months. So, we are going to look specifically today at consumer goods, including paper, plastics, metals, and glass.

I would point out, in reading this article today in the Casper Star Tribune, they said that we are not able to, again, recycle glass. We will be recycling paper, plastics, and others, but not glass.

It is interesting as we deal with this topic of recycling what you can and can't, including no longer can, and what we should in the future. I believe we have a shared responsibility to keep recyclable materials and other waste out of the environment.

In the United States, State and local laws, not Federal laws, govern recycling. That means that towns, cities, and counties manage recycling programs. Local recycling programs can consist of curbside recycling, which takes place alongside weekly trash collections.

These programs can also include drop off recycling, which is what we have in Casper, Wyoming, which involves Americans taking their recyclable goods to one or more collection sites.

I will tell you, other members, that when I take them there, and as my wife has me dutifully sectioning things out, and we take the clear plastics and the plastics with color in them, and then the magazines, and then the newspapers, and the inserts and put them all in the different bins, that one day, I was there, and what looked like a big trash truck pulled up and lined up with each of the dumpsters, and dumped them all into the same locations.

So I guess the only reason I am actually moving them is because my wife says it is important that I do separate them out before I take them, but that is the way we collect them but then when they take them beyond.

There are lots of interesting points to be dealt with as we learn more and more about how and what we can recycle.

Local governments typically fund recycling programs through the sale of recyclable materials and user fees. While we are opening our recycling centers again in Wyoming, what we know is that it now has a cost to do it. It doesn't pay for itself, especially with the distances that we are from other communities.

For decades, communities in the United States sold much, if not all of the recyclable materials for export to China. Chinese manufacturers were hungry for raw materials. Large cargo ships, which would otherwise return empty to China, often made it less expensive to export recyclable materials than transport the materials locally.

But in 2018, China all but ended imports of mixed paper and mixed plastic. As a result, the value of the materials collapsed. In response, local governments have had to decide whether to raise users' fees or end, suspend, or scale back their recycling programs.

And what we are seeing in Wyoming today is that, there had been a debate at city council, should we end this program. It is an important program. What other public services will not be granted because of the money that is going to be used at the cost to recycle, a program that used to pay for itself?

When local governments end or suspend recycling, recyclables often end up in landfills, so this is something that no one wants to see.

Another challenge facing recycling programs is the issue of contamination. Contamination occurs when consumers mix recyclable materials with material that can't be recycled, or material that can't be recycled locally. Contamination lowers the value of recyclable materials and can drain revenue from local recycling programs.

When China imported much of our recyclable waste, we didn't have to worry much about that in terms of the contamination. China and other countries sorted our waste for us. Now that these countries have imposed import restrictions, we have been forced to confront contamination head on.

State and local governments believe that if they can reduce contamination, they can find or develop new markets for their recyclable materials. Local recycling programs are responding in several ways. Some have launched campaigns to educate consumers about what can and cannot be recycled. Others have switched from single streams of recycling to dual or multiple stream recycling. Others have invested in new technologies that can sort materials with greater sophistication.

The private sector has also taken additional steps to boost recycling capacity here in the United States. Consumer product companies have pledged to use more recyclable materials in their products and in their packaging.

Companies are making investments in what is known as advanced recycling. Advanced recycling is a group of technologies that use heat or chemicals to break down certain plastics and other materials.

With traditional or mechanical recycling, plastics can only be recycled a few times and generally for lower quality goods. Advanced recycling allows plastics to be reused indefinitely. They also allow plastics to be used for other high quality products. Advanced recycling won't replace traditional or mechanical recycling, but it can reduce the need to produce new materials.

The COVID-19 pandemic has presented a new set of challenges. It has disrupted curbside recycling in many communities. Nine out of 10 States that have bottle and can redemption programs, have, to this point, suspended these programs because of the pandemic.

It has also contributed to the collapse in crude oil prices, which reduces the value of many of the recyclable materials.

Finally, COVID-19 has called into question taxes and bans on single use plastics. In its reopening guidelines, the Centers for Disease Control and Prevention has encouraged restaurants to use disposable food service items, such as utensils and dishes. We are

talking about plastic spoons, plastic forks, plastic knives, plastic plates, as recommendations from the Centers for Disease Control and Prevention.

California, Maine, Massachusetts, New Hampshire, New York, and Oregon, as well as a number of municipalities have delayed or suspended their bans and taxes on single use plastic shopping bags. Some State and city governments, along with nationwide retail chains, have now even prohibited reusable bags. The pandemic has reminded us that the critical role that single use plastics do play in protecting public health.

To help us navigate these challenges, we have a panel of three experts who will help identify potential solutions for communities and companies alike.

Senator Udall is also here, and he cares deeply about recycling, and is here to share his thoughts with the Committee.

Before turning to Senator Udall, however, let me now turn to Ranking Member Carper for his opening statement.

OPENING STATEMENT OF HON. THOMAS R. CARPER, U.S. SENATOR FROM THE STATE OF DELAWARE

Senator CARPER. Thanks, Mr. Chairman. Thank you so much for scheduling this hearing.

This is a hearing that Senator Udall, Sheldon and I, and others have sought for some time, and I am just delighted we could be here and warmly welcome our friend Tom Udall.

I would like to also welcome Bridget Croke, and I would like to welcome Meghan and Nina. I think Meghan and Nina are here, but are just going to be joining us from afar, but we are delighted that you are going to be part of this presentation today.

As some of my colleagues know, recycling has been a lifelong passion of mine. When I was 22, I was a young naval flight officer flying out of the naval air station in Moffett Field in California, lived in Palo Alto when we were not overseas, and I wanted to recycle.

I found a place where you could actually take stuff in my Volkswagen Karmann Ghia, and go recycle. I would go there about every month, and I have never stopped.

In the last year or two alone, I have recycled a Ford Exploder, I called it an exploder, a Ford Explorer; I have recycled paint thinners, electronics, televisions, a bundle of outdoor tree lights, a dehumidifier, and a whole lot more.

My wife thinks I am crazy, but I am a big recycler.

Today is her birthday, and I don't have any intention to ever recycle my wife. I will hold on to her as long as I have held onto my 2001 Chrysler Town and Country Minivan, and then a little bit longer, if she will put up with me.

But anyway, recycling is a win-win-win solution. It saves our environment, grows our economy, creates jobs, as the Chairman has said.

For a small State like Delaware, recycling is particularly important because, to be honest with you, we just don't have a lot of room for landfills. We are about 50 miles wide, about 100 miles north to south. So we just don't have the extra room to store garbage and trash.

As co-chairs of the Senate Recycling Caucus, Senator John Boozman, who is sitting right here with us, he and I have collaborated, as he knows, on a number of efforts this Congress, with the help of our staffs. We are grateful for that, and we have held stakeholder briefings, passed a resolution to recognize America Recycles Day, and asked Senate leadership to consider the recycling industry in future COVID-19 legislation.

We are also working on legislation that would gather much needed data about our recycling system and explore the opportunity for the U.S. to implement a national composting strategy.

While I am proud of the work that Senator Boozman and I have done in recent years with the help of our staffs, I also know that we have more work to do, a lot more work to do. With a national recycling rate of just 35 percent, recycling is not a silver bullet solution to our waste management problems. We must also incorporate solutions that address reducing and reusing materials.

That is why our friend and colleague Tom Udall is here with us today, to highlight both the challenges that single use plastics present to our society, and potential solutions to those challenges.

As we discuss recycling challenges facing the U.S., and the Chairman has already mentioned a couple of them, we also need to focus on the challenges that plastics present to our recycling system, namely single use plastics.

Since the mass production of plastics began in the 1950s, we have produced more than 8 million metric tons of plastics, half of which have been produced over the last 13 years alone.

Of all the plastics ever produced, only 9 percent—only 9 percent—have ever been recycled.

If we continue down this path, the World Economic Forum predicts that we are on track to have plastic pollution outweigh fish in our world's oceans by 2050. Let me say that again, the World Economic Forum predicts that we are on track to have plastic pollutions outweigh fish in our world's oceans by 2050.

The Great Pacific Garbage Patch is a harbinger of this crisis. That mass of marine debris floating in our oceans is more than 300 times the size of my State.

But we don't have to voyage to the South Pacific to witness the world's recycling crisis. That crisis is burgeoning right here in the U.S., oftentimes in our own backyards.

My wife and I live in Wilmington, Delaware. It is located not far from the I–95 corridor. When I head for DC on sessions days, if I am not on the train, I oftentimes take an on ramp near our home onto I–95 South, then head for our Nation's Capital on 95.

Usually, a crew from DelDOT picks up litter along that on ramp that I traveled on this morning, as well as along other on ramps onto I–95.

People throw their trash out of their vehicles when they get on the on ramps of I–95. They just say, well, this is my last chance, I am going to get rid of this, and that is what they do.

Usually, there is a crew from DelDOT that picks up litter along the on ramps as well as other on ramps onto 95. During the pandemic, however, those pickups have occurred less and less frequently, leaving an unsightly mess that is, in a word, infuriating.

The past month, the mowing crews have stopped showing up, too, until the grass grew to a height of 1 foot. My wife would drive by there and look at it and just become furious, until last week, that is. When the mowing crew showed up last week, they not only cut the grass, they shredded aluminum cans, they shredded plastic bottles, Styrofoam, trash bags, diapers, and more. As if it didn't look bad enough before, you can imagine what it looked like after that.

I decided to do something about it, and thinking about my wife's birthday, this is what I did. This past weekend, I found an old DelDOT Adopt-a-Highway yellow fluorescent vest in our garage. I put it on.

I grabbed a couple of large 45 gallon trash bags, climbed into my like new 2001 Chrysler Town and Country minivan, headed for a place to park not far from that on ramp, and went to work. Two hours later, the right hand side of the on ramp had been cleaned up. I loaded the bulging bags onto the back of my minivan and vowed to return the next weekend to finish the job.

I tell you that story for this reason: As I drove home, I couldn't help but think about how concerned many of us in our neighborhood and in our State and around our country, how concerned we are about a great garbage patch in the sea on the other side of the world, even though we have a sea of garbage just a mile or so from, in this case, our own backyards.

I couldn't help but think about how recycling just one of those Coors aluminum cans I picked up would have yielded enough energy to run a TV for 3 hours. Let me just say, if you are wondering what people who threw out trash are drinking, they are drinking Coors beer. I picked up I can't tell you how many other aluminum cans.

Litter like that I have just described is not just an eyesore; it is wasteful. It is harmful to our environment. By not recycling properly, we miss an opportunity to do something good for our planet and its inhabitants.

The amount of waste winding up on the side of the roads in our States and other States is, sadly, not unique to Delaware. In a lot of places in America, it is about to get worse.

Prior to 2018, as the Chairman has said, the U.S. shipped enormous quantities of scrap recyclable materials to China. That came to a halt when China imposed new restrictions on certain imported materials coming in from other countries, including the U.S.

As we grapple with the fallout of China's policies and the impacts of the coronavirus pandemic, the price consumers will have to pay for curbside recycling service is likely to rise, not fall. That means many consumers will be forced to make a choice, a Hobson's choice, either pay for recycling services, or put their money toward other basic needs.

No American should have to debate whether they can afford to recycle, especially amid a pandemic that has caused great economic hardship, and whose effects are exacerbated by air pollution.

When municipalities are no longer able to afford recycling, the Chairman has referred to this, the collected recyclables are oftentimes incinerated or pile dup in landfills, leaking air toxins into the air we breathe. Burning plastic or allowing plastic to melt in land-

fills not only contributes to climate change, but also pollutes the air we breathe.

We can't afford to breathe toxic air even in the best of times, and we sure can't afford to breathe it during a respiratory pandemic.

If you happen to be African American, the news is even worse. Black Americans are three times as likely to die of asthma related illnesses and are dying from coronavirus at three times the rate of white Americans, three times. None of us who profess to believe in the Golden Rule, and I think we all do, should turn a blind eye to a public health disparity of this magnitude.

In closing, neither can we afford to turn a blind eye to those that will be most affected by the global uptick in virgin plastic production and our country's lack of recycling collection: Low income communities, indigenous communities, and communities of color that cannot afford to handle more waste, our waste.

As we examine the challenges facing America's recycling efforts today, I hope we will begin a new discussion, a robust discussion, not just focusing on those challenges, but on the opportunities they bring with them to make Planet Earth a better home for all of us, and for God's creation, all of us who occupy it together.

Thank you, Mr. Chairman.

Senator BARRASSO. Thank you very much, Senator Carper.

Before we turn to our three witnesses, we would like to hear from Senator Udall. Senator Udall has a significant interest in recycling, and has helped the Senate advance the Save Our Seas 2.0 Bill earlier this year.

Welcome back to the Committee, Senator Udall. For many years you were a long and productive member of this Committee, and we look forward to hearing from you now.

STATEMENT OF HON. TOM UDALL,
U.S. SENATOR FROM THE STATE OF NEW MEXICO

Senator UDALL. Thank you so much, Chairman Barrasso and Ranking Member Carper, and members of the Committee.

It was a real pleasure working with Senator Whitehouse on that Save Our Seas Bill, and thank you for inviting me today.

In recent years, Americans across our country have woken up to the fact that we have a plastic pollution crisis. A study released last week found that the equivalent of millions of plastic bottles rain down or are swept onto our western national parks each year in the form of tiny plastic particles.

We know plastic doesn't go away, so when it breaks down, we find it 2 miles above sea level in the Rocky Mountains in the form of rain. Seven miles below sea level in the Mariana Trench, the deepest place in the ocean, there are plastic wrappers.

It is in our own bodies. Research shows we swallow a credit card's worth of plastic every week through our air, water, and food.

For too long, we have placed the burden on millions of consumers and taxpayers through curbside recycling and the hope that, if we dutifully sort our plastic into blue bins, we will reduce pollution. It is clear that this approach has failed.

We cannot expect consumers to clean up all this plastic waste. We have lost sight of the foundation of our environmental laws and

the teachings of Economics 101: The polluter, not the consumer or the taxpayer, should pay to clean up the waste.

The place to focus is where plastic is created, at the front end of production, where millions of tons are created. But companies have no responsibility once they sell their product. More and more cheap, new plastic items are being produced that will never get recycled or reused.

The burden falls back on our municipalities to manage a suffocating amount of plastic waste, costing local taxpayers billions of dollars a year across the country.

Worse yet, most of that plastic recycling is a lie. It is actually landfilled, incinerated, and shipped overseas to developing countries.

Is there any question why our local governments are shutting down recycling programs? Why do we force taxpayers to sort, clean, and transport plastic pollution at their own cost, after companies have profited from them?

Take a look at this chart, and I hope there is a smaller copy up there with you, from 2017. Americans generated 35 million tons of plastic waste.

Only 8 percent of that waste was sorted for recycling. The vast majority was sent directly to landfills and incineration, and that 8 percent was mostly shipped overseas to developing countries. Only a tiny fraction was recycled domestically.

We can't just place the blame on other countries for polluting the oceans. If we can't recycle or manage our own plastic waste here in America, how can we expect a developing country to do so?

Here is the root of the problem: This is plastic that is not manufactured for recycling or reuse. This is plastic that manufacturers have designed for a one time use. It is the opposite of sustainable.

Companies churn out new products, I want to show these around, companies churn out new products and outsource the cleanup of their waste to taxpayers, beach and highway cleanups, and good Samaritans, none of whom can keep up with the avalanche of waste.

We need to return to the polluter pays principle and recognize who the true polluters are. My bill, the Break Free from Plastic Pollution Act, does just that. We start by dramatically reducing the manufacture of those items that pollute the most and can't be recycled.

Plastic bags top the list, causing tremendous environmental harm. For other products and packaging, we reform how these items are handled after consumer use. Producers need to take responsibility for the collection, recycling, and disposal of the products they create. This will create powerful incentives to design products that are more sustainable and easier to recycle.

This is a tried and true market proven concept. We already do this for batteries, paint, and other items that are dangerous if disposed improperly.

Look closely at the soda bottle. Many U.S. States have had bottle deposits for decades. Using deposits on beverage containers greatly increases the return of those products for recycling and keeps them out of the environment.

My bill also stops sending plastic waste overseas to developing countries and requires that new products be made from recycled plastic here in America. We need economies of scale to bring down the cost of recycled plastic compared to cheap new plastic. Many companies set recycled content goals, but are unable or unwilling to do so given the limited supply and high cost.

Finally, my bill presses pause on expanding more plastic producing plants. These new, planned facilities are greenhouse gas super-polluters, and they are an environmental hazard to communities around them. If built, they are guaranteed to pump billions more tons of plastic waste into the environment.

The lack of regulation on these facilities is shocking. Many Americans simply would not believe it. It is a scandal.

This jar contains plastic pellets scooped from the riverbanks of Cox Creek, Texas, where Formosa Plastic is estimated to be discharging between 500 million and 5 billion plastic pellets each year. Around the globe, these plastic pellets are dumped, spilled, and lost to the environment at a rate of 250 thousand tons per year.

It is shocking that there is no Federal ban on dumping plastic pellets in waterways. My bill would fix that.

Colleagues, I was not the first person to become concerned with plastic pollution. There is a mass movement of people across our country who are fighting this awful situation. When people realize that the blue recycling bin is largely a lie, they are angry. They want answers.

It is a shame that we are trashing our planet, but it is not the consumer's fault. This is not the fault of a few litterbugs. It is past time for Congress and the industry to step up on solutions to this problem.

My legislation does just that.

I would like to submit a letter for the record from 470 organizations that support my bill, Mr. Chairman.

Senator BARRASSO. Without objection.

[The referenced information follows:]

Letter of Support for the Break Free from Plastic Pollution Act of 2020

U.S. Senator Tom Udall
531 Hart Senate Office Building
Washington DC, 20510

U.S. Representative Alan Lowenthal
108 Cannon House Office Building
Washington, DC 20515

Dear Senator Udall and Representative Lowenthal,

The undersigned organizations strongly support the Break Free from Plastic Pollution Act as a comprehensive bill in Congress that adequately addresses the plastic pollution crisis. This bill shows a commitment to real solutions by reducing throwaway plastics and encouraging producer responsibility while combating false solutions such as incineration or a solitary focus on recycling.

The plastic pollution crisis has grown so massive that our waste management systems are unable to handle it. Without reducing plastic waste or holding producers accountable, the burden falls on local governments and taxpayers. This legislation provides the opportunity to create a circular economy of reusable products rather than throwaway plastics made from fossil fuels.

Plastics generate greenhouse gases at every phase of their life cycle: fossil fuel extraction and transport, refining and manufacturing, usage, waste management, and unmanaged plastic that permeates our land, water, and air. In 2019, it's estimated that plastic production and incineration emitted 850 million metric tons of greenhouse gas emissions, the equivalent to 189 500-megawatt coal-fired power plants operating at full capacity, and this is a conservative estimate (CIEL et al., 2019). It is clear we cannot solve the climate crisis without bold legislation aimed to mitigate plastic pollution.

Plastic pollution harms our environment and communities. Endangered wildlife eat and get caught in plastic pollution each year, suffering and dying as a result. Microplastics contaminate our air and drinking water and even the most remote places on Earth, from the Mariana Trench to the Arctic.

With the plastic industry's plan to increase production of plastic by 40 percent over the next decade comes a serious threat not only to wildlife and the climate, but also to public health and safety. Pollution from the plastic industry exposes communities to chemicals linked to cancer, birth defects, neurological damage, endocrine disruption and other serious health problems. Petrochemical facilities that create plastic and incinerators that burn plastic are often located in communities of color and low-income communities that bear the brunt of their dangerous pollution. The plastic pollution crisis is also an environmental justice crisis.

This bill builds on a growing nationwide movement anchored in local battles to fight the plastic pollution crisis. It will effectively reduce waste by phasing out certain plastic products, placing additional responsibility on manufacturers for waste management, restricting the export of plastic waste, and pausing new plastic production. The United States must be a global leader in confronting the plastic pollution crisis, and the Break Free from Plastic Pollution Act charts the way forward. Senator Udall and Representative Lowenthal, we thank you for your critical leadership on this urgent issue.

Sincerely,

350 Butte County

350 Eastside

350 Eugene

350 Fairfax

350 Marin

350 New Orleans

350 Sacramento

350 Santa Cruz

350 Silicon Valley

350 Triangle

350 Wichita

350Brooklyn

350 Kishwaukee

5 Gyres

7th Generation Advisors

Adventures in Waste

Albany Berkeley Plastic Reduction Working Group

Algalita Marine Research & Education

Alliance for a Green Economy

Alliance for Democracy (US)

Alliance of Climate and Environmental Stewards

Already Devalued and Devastated Homeowners of Parsippany

Altamaha Riverkeeper

Alter Terra

American Bird Conservancy

American Public Health Association

American Sustainable Business Council

AmPark EcoCore

Anacostia Riverkeeper

Anacostia Watershed Community Advisory Committee

Animals Are Sentient Beings, Inc.

Apalachicola Riverkeeper

Art Parts Creative Reuse Center

Association of University Centers on Disabilities

ASU

Atchafalaya Basinkeeper

Audubon Naturalist Society

Ayer Recycling Committee

Aytzim: Ecological Judaism

Azul

Azulita

Backbone Campaign

Bag Free Wichita

BAN SUP

Battle Creek Alliance

Bay Area-System Change not Climate Change

Bayou City Waterkeeper

Beaver County (PA) Marcellus Awareness Community

Beaverdam Creek Watershed Watch Group

Bergen SWAN

Berks Gas Truth

Berkshire Environmental Action Team (BEAT)

Berkshire Zero-Waste Initiative

Better Path Coalition

Better World Shopper

Beyond Plastics

Big Reuse

Black Warrior Riverkeeper

Blue Frontier

Blue Sphere Foundation

Bluecology

Boston Building Resources

Boston Clean Energy Coalition

Boulder Waterkeeper

Break Free From Plastic

Breast Cancer Action

Breathe Easy Susquehanna County

Breathe Project

Bridgewater Green Committee

Brooklyn Bridge CSA

Buckeye Environmental Network

Bucks Environmental Action

Buffalo Niagara Waterkeeper

BYO Madison

Cafeteria Culture

Cahaba Riverkeeper

California Association of Sanitation Agencies

California Environmental Justice Coalition (CEJC)

California for Progress

California Product Stewardship Council

California Young Democrats Environmental Caucus

Californians Against Waste

Californians for Western Wilderness

CALPIRG Students

Campaign for Renewable Energy

Canton Residents for a Sustainable, Equitable Future

Cape Cod Anti-Litter Coalition Inc.

Cape Fear River Watch

Carol L Lindsey, Consulting, LLC

Catawba Riverkeeper Foundation

CEA

Center for Biological Diversity

Center for Coalfield Justice

Center for Environmental Health

Center for International Environmental Law (CIEL)

Center for Sustainability at Ramapo College of New Jersey

Center for Zero Waste Design

Central California Asthma Collaborative

CEO Pipe Organs/Golden Ponds Farm

CERBAT: Center for Environmentally Responsible Building Alternatives

Chelmsford Sustainability Committee

Cherokee County Solid Waste

Chico 350/ 350 Butte County

ChicoBag / To-Go Ware

Christian Reformed Church Office of Social Justice

Christians For The Mountains

Church Women United in New York State

Circle Pines Center

Citizen's Coalition for a Safe Community.

Citizens for Water

Citizens Regeneration Lobby

City of Greenbelt

City of Winters

Clean Ocean Action

Clean Water Action

Climate Action Group of the Unitarian Society of Northampton and Florence

Climate Action Mondays

Climate Crisis Policy

Climate First: Replacing Oil and Gas (CFROG)

Climate Reality CWPA Chapter

Climate Reality Project Los Angeles Chapter

Climate Reality Project: Pittsburgh & Southwestern PA

Coachella Valley Waterkeeper

Coalition Against the Pilgrim Pipeline NJ

Colorado Medical Waste

Colorado Riverkeeper

Columbia Riverkeeper

Columbus Community Bill of Rights

Common Ground Compost LLC

Community Advocates for a Sustainable Environment

Community SPOTLIGHT

Concerned Citizens Against Industrial CAFOs

Concerned Health Professionals of New York

Concerned Ohio River Residents

Congregation of Our Lady of Charity of the Good Shepherd, U.S. Provinces

ConnPIRG Students

Conscious Container

Conservation Congress

Conservation Law Foundation

Container Recycling Institute

Cook Inletkeeper

Coosa River Basin Initiative/Upper Coosa Riverkeeper

Creation Care Action & Advocacy from the Baltimore-Washington Conference of the United Methodist Church

Cruzan Enterprises

Damascus Citizens for Sustainability

Defiance Canyon Raptor Rescue

Designs For A Better World

Do Good Soaps and Suds

Don't Gas the Meadowlands Coalition

Don't Waste Arizona

Earth Democracy Committee

Earth Ethics, Inc.

Earth Island Institute

Earthworks

East Yard Communities for Environmental Justice

Eastern Region Association of Forest and Nature Schools

EcoAction Arlington

Ecological Rights Foundation

Ecology Center

Ecosystem Strategies

Elders Action Network

Elders Climate Action

Emmanuel United Methodist Church, Laurel MD

End of Waste Foundation, Inc.

Endangered Habitats League

Endangered Species Coalition

ENGN Civic Creative Center

Environment America

Environment and Human Health, Inc.

Environment California

Environment Maine

Environmental Action Committee of West Marin

Environmental Advocates of New York

Environmental Caucus of Florida

Environmental Health Trust

Environmental Justice Center of Chestnut Hill United Church

Environmental Protection Information Center

Environmental Stewardship Advisory Board

Environmental Youth Council of St Augustine

Equitable Health Solutions, LLC

Extinction Rebellion Kentucky

Fairmont MN Peace Group

Families Advocating for Chemical and Toxics Safety (FACTS)

Family Farm Defenders

Feminists in Action

FinalStraw

Florida Public Interest Research Group

FLOW (For Love of Water)

Frac Sand Sentinel: Project Outreach

FracTracker Alliance

Franciscan Action Network

FreshWater Accountability Project

Friends Committee on Legislation of California

Friends of Merrymeeting Bay

Friends of the Earth US

Friends of the Kaw

Friends of the Wild Swan

Fund for Wild Nature

Garrettsville Board of Public Affairs

Gas Free Seneca

Genesis Farm

Geos Institute

Gila Resources Information Project

Global Alliance for Incinerator Alternatives

Good Neighbor Steering Committee

Grassroots Environmental Education

Great Egg Harbor Watershed Association

Green America

Green Party of Nassau County

Green Party of Seattle

Green Team, Unitarian Universalist Society of Greater Springfield

Greenaction for Health and Environmental Justice

Greenebank Consulting

GreenLatinos

Greenpeace USA

Guernsey County Citizens Support on Drilling Issues

Gunpowder Riverkeeper

Hands Across the Sand / Land

Hannah4Change

Haw River Assembly

Hawai'i Institute for Human Rights

Hawaii Public Health Association

Heal the Bay

Health Promotion Consultants

Healthy Gulf (formerly Gulf Restoration Network)

HealthyPlanet

Heartwood

Heirs To Our Oceans

Hesperian Health Guides

Home ReSource

Honeydew Advisors

Hull Family Foundation

iEat Green, LLC

Indivisible Georgia 04

Indivisible OC 48

Indivisible Pittsfield

Inland Ocean Coalition

Institute for Policy Studies

Interfaith Climate Action Network of the Interfaith Council of CCC

Interfaith Earthkeepers of Eugene/Springfield, OR

International Marine Mammal Project of Earth Island Institute

Island Seafoods, Inc.

Its Easy Being Green

Jackpine Savage Guide Service

JamPac (Jamesville Positive Action Committee)

Jewish Climate Action Network MA

John G. Shedd Aquarium

Just Salad

Justice Action Mobilization Network

Keep Massachusetts Beautiful

Klamath Forest Alliance

Labor Network for Sustainability

League of Conservation Voters

Lee Greener Gateway Committee

Levanah Farm

LINKCO Inc

Living Rivers

Lonely Whale

Louisiana Bucket Brigade

ManaSota-88, Inc.

Manhattan Solid Waste Advisory Board

Marcellus Outreach Butler

Marin Sanitary Service

Maryknoll Sisters Eastern Region USA

MaryPIRG

Mass Recycle

MendoRecycle

Mid-Missouri Peaceworks

Milwaukee Riverkeeper

Mission Blue / Sylvia Earle Alliance

Missouri Confluence Waterkeeper

MountainTrue

Movement for a People's Party

MSW Consultants, LLC

NAACP Berkshire Branch

National Advocacy Center of the Sisters of the Good Shepherd

National Stewardship Action Council

Natural Resources Council of Maine

Nature Coast Conservation, Inc.

NC WARN

Neighbors of the Northwest Branch of the Anacostia River

Network of Spiritual Progressives

New England Aquarium

New Jersey Highlands Coalition

New Jersey Tenants Organization

New Mexico Environmental Law Center

New Mexico Interfaith Power and Light

New Mexico Recycling Coalition

New York Climate Action Group

New York Heartwoods

New York Progressive Action Network - Enviro Committee

North American Climate, Conservation and Environment (NACCE)

North Country 350 Alliance

Northern Jaguar Project

Northwest Coalition for Responsible Investment

NY Buddhist Climate Action Network

NY4WHALES

NYC H2O

Ocean Conservation Research

Oceana

Oceanic Global

Oceanic Preservation Society

Ogeechee Riverkeeper

Ohio Valley Environmental Coalition

Olympic Climate Action

Orange County Coastkeeper

Oregon Physicians for Social Responsibility

OSPIRG

OVEC - Ohio Valley Environmental Coalition

Pasco Activists

PAUSE - People of Albany United for Safe Energy

PDA, AZ Chapter

Peace Action New York State

Peconic Baykeeper

Pelican Media

Peninsula Interfaith Climate Action

People Over Pipelines

People's Climate Movement - Capital Region

Physicians for Social Responsibility

Physicians for Social Responsibility PA

Physicians for Social Responsibility, AZ Chapter

Pinelands Preservation Alliance

Plastic Free Sharon

Plastic Oceans International

Plastic Pollution Coalition

Portland Community College

Post-Landfill Action Network

Presentation Sisters

Product Stewardship Institute

Progressive Democrats of America

Project Coyote

Protect PT (Penn-Trafford)

Public Citizen

Public Laboratory for Open Technology and Science

Puget Soundkeeper Alliance

QEW

Quic Service Bike Shop

Rachel Carson Council

Rachel's Network

Raritan Headwaters

RE Sources

Reach Out America

Reconstructionist Rabbinical Association

Recycle Across America

Resist the Pipeline

Resource Renewal Institute

RESTORE: The North Woods

Reuse International

Rio Grande International Study Center

River Guardian Foundation

Riverdale Jewish Earth Alliance

RootsAction.org

Safe Climate Campaign

San Antonio Bay Estuarine Waterkeeper

San Francisco Baykeeper

SanDiego350

Santa Barbara Standing Rock Coalition

Santa Cruz Climate Action Network

Santa Fe Conservation Trust

Save Our Shores

Save Our Sky Blue Waters

Save The Hills Alliance, Inc.

Save The River Upper St. Lawrence Riverkeeper

Save Wolves Now Network

School Without Walls at Francis Stevens DCPS

Sea Hugger

Seaside Sustainability

Seattle Aquarium

Seeding Sovereignty

Seneca Lake Guardian

Sequoia ForestKeeper®

Sierra Club

Sisters of Mercy of the Americas' Justice Team

Sisters of St. Dominic of Blauvelt, New York

Sixth Street Community Center

Slow Food DC

Snake Conservation Society

Snake River Waterkeeper

SoCal 350 Climate Action

Society of Alternative Resources

SocioEnergetics Foundation

South Asian Fund For Education, Scholarship and Training (SAFEST)

South Carolina Interfaith Power and Light

South Shore Recycling Cooperative

South Yuba River Citizens League

Southern Utah Wilderness Alliance

Spokane Riverkeeper

Spottswoode Winery, Inc.

Stop NY Fracked Gas Pipeline

Stop the Algonquin Pipeline Expansion

Story of Stuff Project

Strategy Zero Waste Solutions

Suncoast Waterkeeper

Sunrise Movement Bay Area

Sunrise Movement Howard County

Surfrider Foundation

Sustainable McDonough

Sustainable Ocean Alliance at the University of Maryland

Sustainable Sharon Coalition

Sustainable Sudbury

Sustainable Upton

Sustaining Way

Tar Sands Action Southern California

Tennessee Riverkeeper

Texas Campaign for the Environment

Texas Environmental Justice Advocacy Services (T.E.J.A.S.)

The 5 Gyres Institute

The Center for Oceanic Awareness, Research, and Education (COARE)

The Climate Mobilization Hoboken Chapter

The Climate Mobilization-Santa Barbara Chapter

The Enviro Show

The Great American Rain Barrel

The Lands Council

The Last Beach Cleanup

The Last Plastic Straw

The New School

The Rewilding Institute

The River Project

The Shame Free Zone

The Story of Stuff Project

The Wei LLC

Think Zero LLC

Town of Wellfleet Recycling Committee

Toxics Action Center

Toxics Information Project (TIP)

Transition Sebastopol

Turtle Island Restoration Network

U.S. Public Interest Research Group (PIRG)

Unexpected Wildlife Refuge

Unitarian Universalist Pennsylvania Legislative Advocacy Network (UUPLAN)

UO Climate Justice League

Upper West Side Recycling

UPSTREAM

Urban Bird Foundation

UU FaithAction NJ

Valley Watch, Inc.

Valley Improvement Projects (VIP)

Vermont Public Interest Research Group (VPIRG)

Vokashi, Inc.

Vote-Climate

Wabash Riverkeeper Network/ Banks of the Wabash, Inc.

Wasatch Clean Air Coalition

Waste Task Force

WATCH, Inc

Waterkeeper Alliance

Waterkeepers Chesapeake

Weather Medic Inc

WESPAC Foundation

West 80s Neighborhood Association

Western Watersheds Project

White Rabbit Grove RDNA

White River Waterkeeper

Wholly H2O

Wild Nature Institute

WILDCOAST

WildEarth Guardians/Rio Grande Waterkeeper

WilderUtopia

Willamette Riverkeeper

Winyah Rivers Alliance

Women Working for Oceans

Women's International League for Peace & Freedom, US

WWALS Watershed Coalition, Inc.

Yellowstone to Uintas Connection

Young Democrats of America Environmental Caucus

Zanker Recycling

Zero Waste Arlington

Zero Waste Kauai

Zero Waste Marin

Zero Waste Society

Zero Waste Washington

Senator UDALL. I thank you for your time, and I am deeply grateful for this Committee's attention and involvement.

Thank you, Mr. Chairman. I yield back.

[The prepared statement of Senator Udall follows:]

U.S. SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
HEARING: RESPONDING TO THE CHALLENGES FACING RECYCLING IN THE UNITED STATES
June 17, 2020

Testimony of U.S. Senator Tom Udall

Chairman Barrasso, Ranking Member Carper, Members of the Committee. Thank you for allowing me to appear before you today.

In recent years, Americans across our country have woken up to the fact that we have a plastic pollution crisis.

A study released last week found that the equivalent of millions of plastic bottles rain down or are swept onto our Western national parks each year in the form of tiny plastic particles.

We know plastic doesn't go away. So when it breaks down, we find it two miles above sea level in Rocky Mountain rain water.

Seven miles below sea level in the Mariana Trench – the deepest place in the ocean – there are plastic wrappers.

It's in our own bodies. Research shows we swallow a credit card's worth of plastic every week -- through our air, water and food.

For too long, we have placed the burden on millions of consumers — and taxpayers — through curbside recycling and the hope that, if we dutifully sort our plastic into blue bins, we will reduce pollution.

It is clear that this approach has failed. We cannot expect consumers to clean up all this plastic waste.

We have lost sight of the foundation of our environmental laws — and the teachings of Economics 101 — the polluter, not the consumer or taxpayer — should pay to clean up the waste.

The right place to focus is where plastic is created – at the front end of production where millions of tons are created. But companies have no responsibility once they sell their product.

More and more cheap, new plastic items are being produced that will never get reused or recycled.

The burden falls back to our municipalities to manage a suffocating amount of plastic waste -- costing local taxpayers billions of dollars a year across the country.

And worse yet, most of that plastic "recycling" is a lie. It is actually landfilled, incinerated, or shipped overseas to developing countries.

Is there any question why our local governments are shutting down recycling programs?

Why do we force taxpayers to sort, clean, and transport plastic pollution – at their own cost — after companies have profited from them?

Take a look at this chart based on EPA data from 2017, the latest data we have.



Americans generated 35 million tons of plastic waste.

Only 8 percent of that waste was sorted for recycling.

The vast majority was sent directly to landfills and incineration.

And that 8 percent was mostly shipped overseas to developing countries.

Only a tiny fraction was recycled domestically.

We can't just place the blame on other countries for polluting the oceans.

If we can't recycle or manage our own plastic waste here in America, how can we expect a developing country to?

Here's the root of the problem: This is plastic that is not manufactured for recycling or reuse.

This is waste that manufacturers have designed for a one-time use. It's the opposite of sustainable.

Companies churn out new products and out-source cleanup of their waste to taxpayers, beach and highway clean-ups, and good Samaritans . . . none of whom can keep up with this avalanche of waste.

We need to return to the "polluter pays" principle and recognize who the true polluters are.

My bill -- the Break Free From Plastic Pollution Act -- does just that.

We start by dramatically reducing manufacture of those items that pollute the most and can't be recycled.

Plastic bags top the list – causing tremendous environmental harm.

For other products and packaging, we reform how these items are handled after consumer use.

Producers need to take responsibility for the collection, recycling, and disposal of the products they create.

This will create powerful incentives to design products that are more sustainable and easier to recycle.

This is a tried and true, market-proven concept.

We already do this for batteries, paint, and other items that are dangerous if disposed improperly.

Look closely at that soda bottle. Many U.S. states have had "bottle deposits" for decades.

Using deposits on beverage containers greatly increases the return of those products for recycling and keeps them out of our environment.

My bill also stops sending plastic waste overseas to developing countries and requires that new products be made from recycled plastic here in America.

We need economies of scale to bring down the cost of recycled plastic compared to cheap new plastic.

Many companies set recycled content goals, but are unable or unwilling to do so given the limited supply and high cost.

Finally, my bill presses pause on expanding more plastic-producing plants.

These new, planned facilities are greenhouse gas super-polluters.

And they are an environmental hazard to communities around them.

If built, they are guaranteed to pump billions more tons of plastic waste into the environment.

The lack of regulation on these facilities is shocking. Many Americans simply would not believe it. It's a scandal.



This jar contains plastic pellets scooped from the river banks of Cox Creek, Texas, where Formosa Plastic is estimated to be discharging between 500 million and 5 billion pellets each year.

Around the globe, these plastic pellets are dumped, spilled, and lost to the environment at the rate of 250,000 tons per year.

It's shocking that there is NO federal ban on just dumping plastic pellets into waterways.

My bill would fix that.

Colleagues, I was not the first person to become concerned with plastic pollution.

There is a mass movement of people across our country who are fighting this awful situation.

When people realize that the blue recycling bin is largely a lie, they are angry. They want answers.

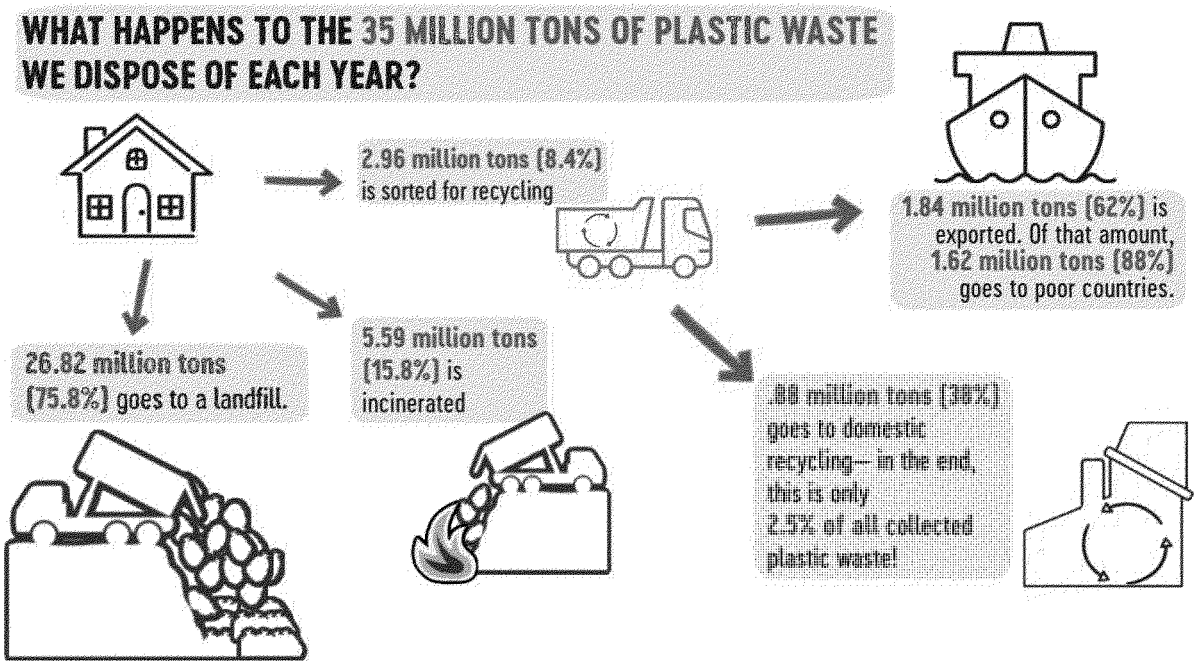
It's a shame that we are trashing our planet, but it's not the consumer's fault. This is not the fault of a few litterbugs.

It's past time for Congress and industry to step up on solutions to this problem.

My legislation does just that.

I'm deeply grateful for this Committee's attention and involvement.

From the office of Sen. Tom Udall



Based on EPA Data from 2017

Senator BARRASSO. Thank you so much, Senator Udall. It is always good to have you back at this Committee on which you served so ably for so many years.

But even after you left the Committee, you played a critical role in our agenda. In the 114th Congress, you successfully spearheaded efforts to reform our Nation's chemical law, the Toxic Substances Control Act.

Like your father, you have been a tireless champion for the environment. Your father Stewart Udall, you know him, maybe some others don't, your father, Stewart Udall, served as Secretary of the Interior to both Presidents Kennedy and President Johnson.

As you know, I think I got for you a photo of your father with Senator Kennedy in Laramie, Wyoming, at the University of Wyoming in 1963.

So we welcomed both of them to Wyoming, and I have a picture hanging on my wall of then-President Kennedy addressing the group at the University of Wyoming in 1963.

Of course, for people who aren't familiar with this, you may be watching from home, the Department of Interior's headquarters bears your father's name.

This Committee thanks you for your service to our country. Thank you for being with us today, Senator Udall.

Senator UDALL. Chairman Barrasso, thank you for those generous words. You failed to note, though, I come every summer to Wyoming to the Wind River Mountains to backpack and hike and climb mountains, which is one of my favorite places in the world.

Senator BARRASSO. We look forward to having you back again this year.

Thank you, Senator Udall.

Senator UDALL. Thank you.

Senator BARRASSO. With that, we are going to hear from our three witnesses today. We are joined by Bridget Croke, who is the Managing Director at Closed Loop Partners, and she is joining us remotely.

We also have Ms. Meghan Stasz, who is the Vice President of Packaging and Sustainability at the Consumer Brands Association, and Ms. Nina Bellucci Butler, who is the Chief Executive Officer of MORE Recycling.

I want to remind the witnesses that your full written statements and testimony will be made part of our official hearing record today, so we ask that you please try to keep your statements to 5 minutes so that we may have time for questions.

We look forward to hearing the testimony, and with that, let me start with Ms. Croke.

STATEMENT OF BRIDGET CROKE, MANAGING DIRECTOR, CLOSED LOOP PARTNERS

Ms. CROKE. Thank you, Chairman Barrasso, Ranking Member Carper, and Committee members.

I will also mention that I also really love the Wind River Range.

I am thrilled to have the opportunity to share my and my company's perspective with you, albeit remotely, and to see this topic discussed by national leaders.

Senator BARRASSO. Can you tell us where you are? I think you are in Vermont today, is that correct?

Ms. CROKE. I am in Vermont. We are headquartered in New York, but right now, we are all remote, and are not traveling, so apologies for not being there in person, but thrilled to be a part of this.

Senator BARRASSO. Thank you.

Ms. CROKE. As I mentioned, my name is Bridget Croke, and I am a Managing Director at Closed Loop Partners. We are an investment and innovation firm that has brought together private industry like Walmart, Procter & Gamble, Unilever, Nestle, and others, industry groups like the American Beverage Association, and investors including major banks, pension funds, family offices, along with environmental foundations to invest in the infrastructure and innovative solutions needed to minimize waste and ensure recycled materials become the manufacturing feedstock for future products and packaging, while hopefully creating good jobs and minimizing taxpayer dollars spent to manage waste.

Over the last 5 years, Closed Loop Partners has deployed nearly $70 million in investment capital in over 50 communities and businesses across the United States, from Arizona, to Iowa, to Tennessee, and we have leveraged an additional $270 million in co-investment funds from public and private sources.

I tell you this to make the point that we are on the ground turning our current take, make, waste economy into what we call a more circular economy, whereby we minimize the need to extract raw materials because we extend the use of those materials and remanufacture them back into new products and packaging.

We know with the right systems in place, there are opportunities to turn waste into value. In our current system, nearly $10 million of commodity value are lost to disposal each year in the United States. Small and large communities are spending billions of dollars on disposal as others have mentioned, so we are literally throwing money in the trash.

Unfortunately, the recycling industry has suffered from outdated infrastructure, especially small to medium sized communities. Over the last 30 years or so all across the country, there has been a significant lack of innovation in our supply chains.

But that is starting to change, and good policy that incentivizes growth of this vital industry will bring more investment both to reduce waste and develop thriving communities.

As mentioned also, the recycling markets have suffered from the closure of one of the biggest unused markets: China. That said, we and many others see this as an actual opportunity to accelerate domestic recycling and manufacturing infrastructure, which will help keep our dollars local.

Given the attention on waste and marine debris and the growing demand for major consumer brands and retailers for circular packaging and recovery system solutions, we are beginning to see tremendous innovation that can rapidly advance solutions.

I will give just a few examples. First is the introduction of robotics and artificial intelligence into the recycling industry. Companies like AMP Robotics have introduced robots with artificial intelligence systems that enable the sorting and production of high

quality commodity bales of paper and plastics, while adding safeguards against contamination.

The second is packaging innovation. We are seeing the emergence and growth of smart, refillable packaging systems like Algramo, that make it cheaper, safer, and more convenient for consumers to use packaging more than one time. We are also seeing significant growth in packaging that is designed to be recycled for value.

Finally, we are seeing advanced plastics recycling technologies, including purification technologies and chemical recycling technologies mentioned earlier. I just want to frame that as a whole category of technologies that remove impurities from recycled plastics or take plastics back to their base monomer, intermediary, or carbon state in order to remanufacture them into a new plastic.

These technologies have the potential to create, in success, infinite circular economy and value loops for plastics.

These and other advancements are attracting significant private capital from leading investors. Google and Sequoia have invested in AMP Robotics in Colorado; Goldman Sachs is now the largest shareholder in Lakeshore Recycling Systems, the largest independent recycler in Illinois; and Citi is the largest investor in rPlanet Earth, a bottle to bottle plastics recycling facility in Southern California.

Leading municipalities, recyclers, manufacturers, and consumer brands are starting to partner together to establish and profit from a circular economy in the United States where goods are continually manufactured using recycled material collected from recycling programs in towns large and small. This new partnership model is developing a circular economy that we believe will result in one of the largest investment opportunities in the United States over the next decade.

The additional economic impacts include major reduction in waste disposal fees paid by municipalities, and will become a significant driver of job creation in local economies.

We encourage you to develop policies that build incentives and spur market demand for recycled content and packaging of products, drive product and system innovation to eliminate waste, and create good jobs that benefit both the economy and the planet.

Thank you.

[The prepared statement of Ms. Croke follows:]

CLOSED LOOP partners

June 17, 2020

June 15, 2020

The Honorable John Barrasso, M.D.
Chairman
Committee on Environment and Public Works
United States Senate
Washington, D.C. 20510

The Honorable Thomas R. Carper
Ranking Member
Committee on Environment and Public Works
United States Senate
Washington, D.C. 20510

Dear Chairman Barrasso, Ranking Member Carper and members of the Committee,

Thank you for inviting Closed Loop Partners to speak today.

Launched in 2014, Closed Loop Partners (CLP) is the first investment firm primarily focused on building the circular economy. Our vision is to help build a new economic model focused on a profitable and sustainable future that aligns the interests of shareholders, brands and local communities and the environment that we all share. Closed Loop Partners provides equity and project finance to scale products, services and infrastructure at the forefront of the development of a circular economy. We have over the past 5 years built a development system that connects entrepreneurs, industry experts, global consumer goods companies, retailers, financial institutions and municipalities.

Today, we have over 40 investments in companies and municipal projects in the United States, all focused on helping Americans avoid landfill disposal fees while generating good jobs in the recycling and manufacturing sector. Our investors are a combination of some of the largest American based consumer brands in the world including 3M, Coca-Cola, Colgate Palmolive, Johnson & Johnson, Keurig Dr. Pepper, PepsiCo, Procter & Gamble, Unilever and The Walmart Foundation, as well as the American Beverage Association, institutional investors, family offices and environmental foundations. CLP proves that public – private partnerships are critical to unlocking the capital needed to build robust recycling and circular economy infrastructure needed to create jobs, reduce waste and build the supply chains of the future.



Despite some of the headlines we've all seen, recycling is big business in America and should create the manufacturing feedstock for future packaging. In 2019, the recycling industry in America generated over $110 billion in economic activity, $13 billion in federal, state, and local tax revenue and 530,000 jobs. In spite of COVID and market challenges in recent years, 2020 is shaping up to be a year of major innovations in the recycling industry as it becomes central to circular economy business models that major consumer goods companies and cities are deploying. Transitioning US manufacturing to circular supply chains could unlock a $2 trillion opportunity.

Recycling continues to be the most cost-effective option for the vast majority of American cities. The economics are simple. Cities have two choices when it comes to disposal: recycle or landfill. While the value of recycling is generally reported as the amount that a city can be paid for its recyclables, the core economic value of recycling is actually the opportunity for a city to avoid costly landfill disposal fees. Economic analysis conducted has shown that the U.S. scrap recycling industry is a major economic engine powerful enough to create 531,510 jobs and generate $12.9B in tax revenue for governments across the US.

New York City, the largest market in the United States, is an example of how advanced recycling infrastructure and strong local markets create long term profits. New York City has a long-term public-private partnership with Pratt Industries that converts all of its recycled paper locally into new paper products sold back into the NYC market. Via its contract with Pratt, New York City is paid for every ton of paper its residents recycle, as opposed to a cost of over $100 per ton to send paper, plastics and metals to a landfill.

Minneapolis is another good example. Eureka Recycling and the City of Minneapolis invested in local community outreach focused on keeping their recycling stream clean of contamination, defined as non-recyclable material. The result is one of the lowest contamination rates of any municipal recycling program in the country. With a clean stream of valuable recyclables, Eureka consistently shares with Minneapolis the profits earned from the sale of their recyclables. In many other cities, unfortunately, approximately 15% of the material that arrives at the municipal recycling facility is considered contamination. Municipal recycling programs that keep contaminants out of the recycling stream via strong community outreach or enforcement realize lower costs and better revenue opportunities. Municipalities that recognize that recycling is part of the commodities industry, not the waste industry, generate value.

Along with the examples of Pratt Industries in New York City and Eureka Recycling in Minneapolis, Recology in San Francisco and Balcones in Austin, among others, continue to provide their municipal and commercial customers robust recycling service. In addition, municipalities like Pensacola, Florida and Davenport, Iowa that manage their own best in class recycling facilities consistently reduce landfill disposal costs and create local economic value for their constituents.



The value of recyclable commodities continues to have a wide range. The cost to process municipal recyclables at a recycling facility is, on average, $70 per ton. That means that for a recyclable commodity to have value, it must have a market that pays the recycling facility over $70 per ton of that material. A sample of the commodities that are usually profitable to recycle include PET plastic (beverage containers), HPDE plastic (laundry detergent and soap containers), rigid polypropylene (bottle caps, some yogurt containers), cardboard and aluminum.

In 2020, three innovations are driving the increased profit potential of recycling in America and the development of a vibrant and growing Circular Economy.

1. **The introduction of robotics and artificial intelligence.** The future of the industry will be led by the recycling facilities that produce the highest quality commodity bales of materials. Companies like AMP Robotics have introduced robotics (robots) with artificial intelligence systems that enable the sorting and production of high-quality commodity bales, supply chain tracking and safeguards against contamination that were never before imagined in the industry.
2. **Packaging innovation.** We are seeing the emergence and growth of smart refillable packaging systems like Algramo that makes it cheaper and more convenient for consumers to use packaging more than one time. We are also seeing a growth in packaging that is designed to be recycled for value. Temperpack, for example, is a packaging technology that uses recycled cardboard to keep packaged food cold, replacing a significant amount of low value plastics like Styrofoam peanuts, which are both not recyclable and a common contaminant in the recycling system.
3. **Advanced plastics recycling technologies, including purification technologies and chemical recycling technologies**. Purification is an enzymatic process that improves the quality of recycled plastics so they can more easily be used again in packaging. P&G invented a technology and helped launch a company, PureCycle Technologies, that will significantly increase the value of recycled plastic by removing color and smells. Chemical recycling is a process whereby plastic is depolymerized back to the base monomer, intermediary or carbon state in order to remanufacture a new plastic. Some plastics, like PET, HDPE and rigid polypropylene have significant value and are very profitable for the recycling industry, but they can degrade after a number of recycling cycles while some other plastics currently have limited value or are challenging to recycle. Chemical recycling has the potential to create an infinite circular economy value loop for all plastics. Some of the leading innovators are backed by major consumer goods companies. In 2020, we expect a number of emerging companies to move from pilot to commercialization phase.

These and other circular advancements are attracting significant private capital from leading investors. The industry saw investments from leading investors across asset



classes. Google and Sequoia invested in AMP Robotics, Goldman Sachs is now the largest shareholder in Lakeshore Recycling Systems, Citi is largest investor in rPlanet Earth, a bottle-to-bottle plastics recycling facility in California and SJF Ventures invested in TemperPack.

The emerging leadership demonstrated by a number of retailers and consumer brands is driving the growth of the circular economy and improvements in recycling. Leadership means designing products and packaging that are free of any non-recyclable material and profitable for recycling. These packages are manufactured with recycled content, while reducing raw material inputs. Brands are telling their consumers that their commitment is to use recycled content in their packaging. Leaders are transparent in their progress, reporting in their annual reports the use of different recycled feedstocks. They know that any product or package that is not recyclable is destined for a landfill (or even worse, a river or ocean), and that cost is passed to the taxpayer.

Walmart has developed ***design for recycling guidelines*** for their suppliers to ensure the products sold in their stores are recyclable and piloting refillable packaging models. Unilever's Seventh Generation Brand uses mostly recycled HDPE plastic in its packaging and recycled paper in its paper products. And over 10 global companies have invested over $150m in CLP's investment funds so together we can help spur more innovation and create more tons of recycled feedstock coming through systems in the US.

We are also seeing a major trend amongst consumer goods companies looking to increase their use of recyclable material in the packaging and products they sell. It makes sense. At scale, along with the considerable environmental benefits, it should be less expensive for companies to manufacture using recycled material. That is why most major beverage companies including Coca-Cola, Keurig Dr. Pepper, PepsiCo, Nestle and Danone as well as the world's largest consumer goods companies such as P&G, Unilever and Colgate Palmolive are publicly communicating aggressive goals for the use of recycled materials in their products and packaging.

For Americans, recycling is a matter of economic self-interest. Recycling our cardboard, paper, beverage bottles, rigid plastics containers, and aluminum cans has three important outcomes. First, it reduces the cost to manufacture the products we buy. Second, it reduces the amount of our taxpayer dollars used every year to pay landfills. Third, it generates revenue for our communities via the sale of recyclable commodities. The average cost to landfill a ton of material in the United States is $50 and over $100 per ton in major population centers.



Despite these economic incentives, large parts of the United States still have little or no recycling collection or processing infrastructure. Much of the economic activity generated by recycling is accomplished by long standing recycling programs on the West and East Coast as well as the upper Mid-West of America. For those who live in parts of the country with limited or no recycling infrastructure, their tax dollars are wasted on the cost of sending valuable commodities to landfill that could otherwise be sold. While the 90m tons currently recycled in the United States saves American taxpayers and businesses over $3 billion annually in landfill disposal fees, over 180 million tons of recyclable materials are landfilled, costing American taxpayers and businesses over $5 billion annually in landfills fees. We are literally throwing money in the garbage.

It is also important to recognize how China, which has received much press as of late for their role in the American recycling ecosystem, impacts the industry. For much of the past 20 years, the U.S. recycling industry was dependent on China as the leading export market. As consumption and waste has increased in China, the Chinese government has decided to develop their own domestic recycling infrastructure. This may cause some short-term pain in some parts of the United States' recycling industry, but leading companies in the recycling industry, consumer goods and packaging industry, as well as a number of investors, see this as an opportunity to further develop and profit from domestic recycling and manufacturing infrastructure.

These are exciting times in the recycling industry as the development of the circular economy continues to expand. Major innovations are entering the industry ranging from robotics to supply chain mapping to advanced technologies that recycle plastics. Like any major industry analysis in the U.S., there is no one or two cities that should be extrapolated to define the industry. There are cities where recycling is profitable and a major economic engine and there are cities where the recycling program is struggling. What is clear is that the cities that focus on limiting contamination in their recycling program, build efficient and effective material recovery facilities and who contract with best in class recycling companies benefit from recycling programs that are both profitable and produce good local jobs.

Leading municipalities, recyclers, manufactures and brands are starting to partner together to establish, and profit from, a circular economy in the United States where goods are continually manufactured using recycled material from local recycling programs. This partnership in developing a circular economy will result in one of the largest investment opportunities in the United States over the next decade, major reduction in landfill disposal fee paid by municipalities, and become a primary driver of job creation in local economies.



We encourage policy makers to build incentives and develop policy to spur the market for recycled content and product and system innovation that reduces waste, creates jobs and makes recycled content competitive with the raw material market.

Thank you for your time today.

Bridget Croke,

Managing Director, Closed Loop Partners

CLOSED LOOP partners

Building the Circular Economy

Closed Loop Partners
2019 Impact Report



CEO Foreword



Closed Loop Partners launched in 2014 with a vision to build a circular economy, a new economic model focused on a profitable and sustainable future. As we continue to develop a robust portfolio of investments that further this mission, we are pleased to provide our environmental and social impact report for 2019.

In the last year, we've witnessed unprecedented growth in the circular economy as a number of forces have aligned, from increased media attention on the global waste crisis to budding legislation around the reuse, recovery and recycling of materials to the commercialization of innovative business models.

Most notably, consumers are showing their preference for products that are trustworthy and circular. Products with a sustainability claim on their packaging accounted for 16.6% of the market in 2018 and delivered nearly $114 billion in sales, up 29% from 2013[1]. Products marketed as sustainable grew 5.6 times faster than those that were not[2]. In more than 90% of the CPG categories, sustainability-marketed products grew faster than their conventional counterparts[3].

When consumer preference and regulatory expectations merge, a unique and outsized investment opportunity emerges. In 2019, most major retailers and brands made commitments that by 2025, their products would be either recyclable or compostable and that they will use a specified amount of recycled content in their packaging. 2020 will be an important year to determine if retailers and brands are able to translate those commitments to contracts for the recycled commodities that will enable them to achieve their commitments.

Trust, transparency and sustainability are three parts of a strategic triangle that will continue to point retailers and brands in the direction of customer loyalty and long-term value creation.

Thank you,
Ron Gonen
CEO, Closed Loop Partners

A Snapshot of Closed Loop Partners

OVERVIEW

45
investments

Global
Footprint

WITH A U.S. FOCUS. PORTFOLIO COMPANIES IN **4 CONTINENTS, 5 COUNTRIES,** AND **24 U.S. STATES**

1.3M
tons of materials kept in circulation

3M
tons of greenhouse gas emissions avoided





$$

$270M
in co-investment catalyzed to support circular supply chains

Our investments contribute to the following UN Sustainable Development Goals:



Table of Contents

Overview 2

Closed Loop Infrastructure Fund 7

Closed Loop Beverage Fund 15

Closed Loop Venture Fund 17

Closed Loop Leadership Fund 29

Center for the Circular Economy 32

About Our Team 38

Appendix 41

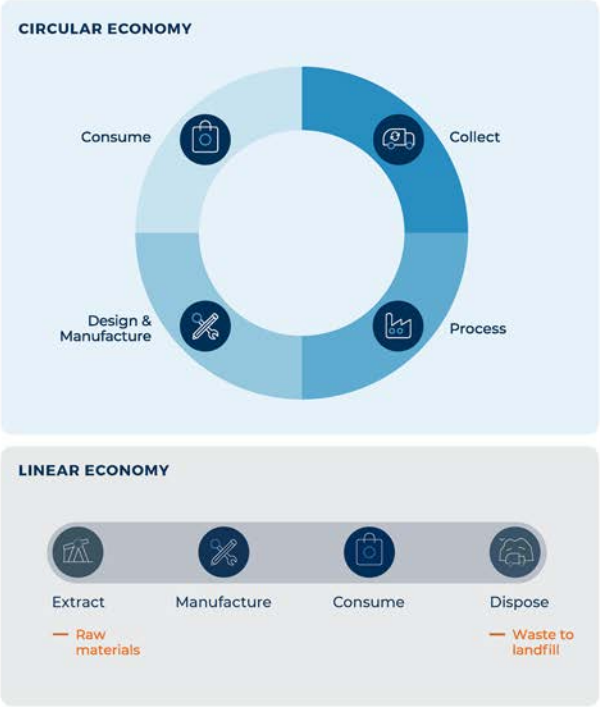
- Impact Assessment Methodology
- Closed Loop Infrastructure Fund Portfolio
- Closed Loop Venture Fund Portfolio

Acknowledgements 48

About Closed Loop Partners
What We Do

We invest in the **circular economy**, a new economic model focused on a profitable and sustainable future.

The circular economy is the most significant restructuring of global commerce since the industrial revolution. It is an overhaul of how products are designed, manufactured, sold, refurbished and recycled. It is a framework for global corporations and start ups alike to reimagine capitalism in order to reduce costs, increase efficiency and protect the environment we share.



About Closed Loop Partners

Our Model

1

Corporate Network

LPs include the world's largest retailers and consumer goods companies as well as family offices, foundations and institutions.

2

Industry Expertise

Management team comprised of industry CEOs, CFOs, investors and former heads of government agencies.

3

Track Record

Completed 45 investments in the circular economy space since 2015.



INVESTMENT PLATFORMS

Closed Loop Leadership Fund	Private Equity
Closed Loop Infrastructure Fund Closed Loop Beverage Fund	Project Finance
Closed Loop Fashion Fund	Growth Equity
Closed Loop Venture Fund	Venture Capital
Center for the Circular Economy	Innovation Center

Our Investments Span Supply Chains & Sectors

Consume

FOOD & AGRICULTURE
- Natural Machines

FASHION
- Algalife
- For Days
- Linhaus
- The Renewal Workshop
- Thrilling

CONSUMER GOODS & PACKAGING
- Algramo
- Loliware
- Preserve

Collect

RECYCLING INFRASTRUCTURE
- Lakeshore Recycling Systems
- Marquette County, MI
- City of Memphis, TN
- City of Moline, IL
- Portage County, OH
- Scott County, IA
- City of Waterbury, CT

SUPPLY CHAIN OPTIMIZATION
- CoLoadX
- Retrievr (formerly CurbMyClutter)
- Tradelanes

Process

RECYCLING INFRASTRUCTURE
- AMP Robotics
- Balcones Resources
- Council Bluffs
- Emerald Coast Utility Authority
- Emmet County, MI
- Eureka Recycling
- FirstStar Fiber
- GreenMantra
- ITR/Ecoglass
- Marquette County, MI
- Momentum Recycling
- City of Phoenix, AZ
- PureCycle Technologies
- QRS Recycling
- Revolution Systems

FOOD & AGRICULTURE
- Atlas Organics
- HomeBiogas

SUPPLY CHAIN OPTIMIZATION
- Easy Aerial

Design & Manufacture

RECYCLING INFRASTRUCTURE
- rPlanet Earth

FOOD & AGRICULTURE
- Cambridge Crops

FASHION
- Evrnu

CONSUMER GOODS & PACKAGING
- AeroAggregates
- CleanFiber
- IntegriCo
- TemperPack

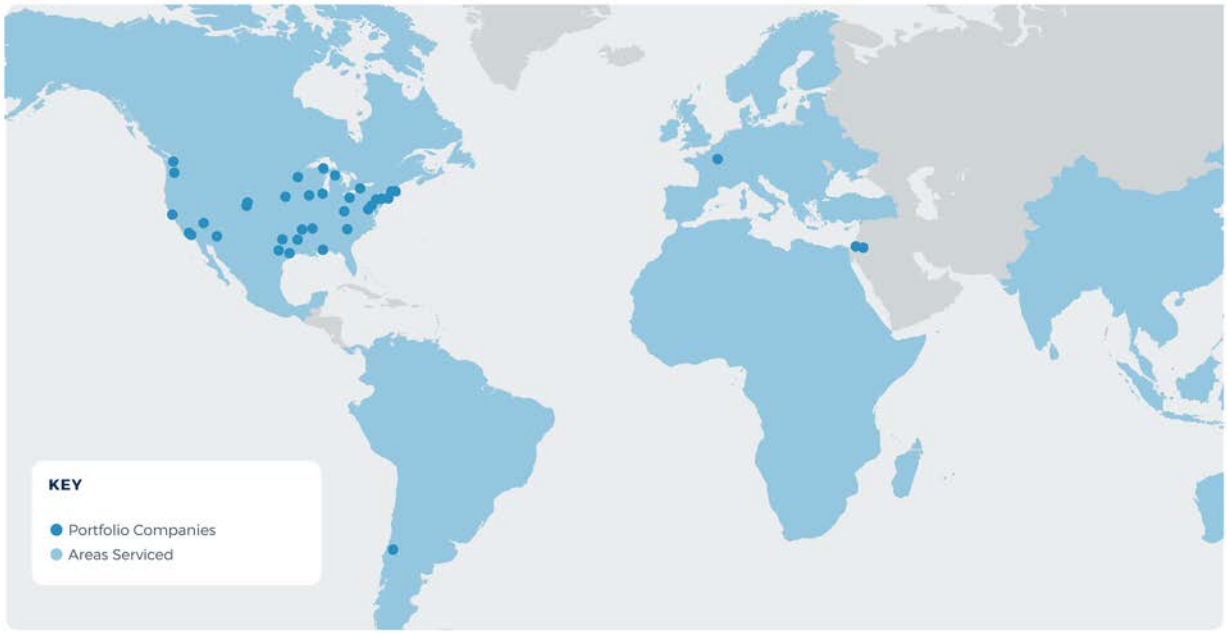
SUPPLY CHAIN OPTIMIZATION
- Rebound Technologies



SECTORS

- RECYCLING INFRASTRUCTURE
- FOOD & AGRICULTURE
- FASHION
- CONSUMER GOODS & PACKAGING
- SUPPLY CHAIN OPTIMIZATION

Our Impact Is Global



"The circular economy represents an immense business opportunity through reduced costs, increased efficiencies and the elimination of waste. But we need more investors onboard to further accelerate the shift toward a more sustainable system. Closed Loop Partners is leading the way by helping to catalyze greater investment in the space."

– Professor Bruce Usher, Columbia Business School, and CLIF Investment Committee Member



Closed Loop Infrastructure Fund

Established in 2014 and funded by the world's largest retailer and consumer goods companies, the Closed Loop Infrastructure Fund finances recycling and circular economy infrastructure.



Closed Loop Infrastructure Fund

Closed Loop Infrastucture Fund invests in recycling infrastructure to return valuable recycled materials to supply chains.

TONS RECOVERED AND RETURNED TO SUPPLY CHAINS (CUMULATIVE TO DATE)



CLIF provides project finance to private companies and municipalities, creating economic value for cities by reducing landfill expenses and increasing revenue generated from recycled commodity sales. CLIF has deployed $58M into 27 projects, with an additional $220M contributed by co-investors.

DISTRIBUTION BETWEEN MUNICIPALITIES AND PRIVATE COMPANIES BY $ INVESTED

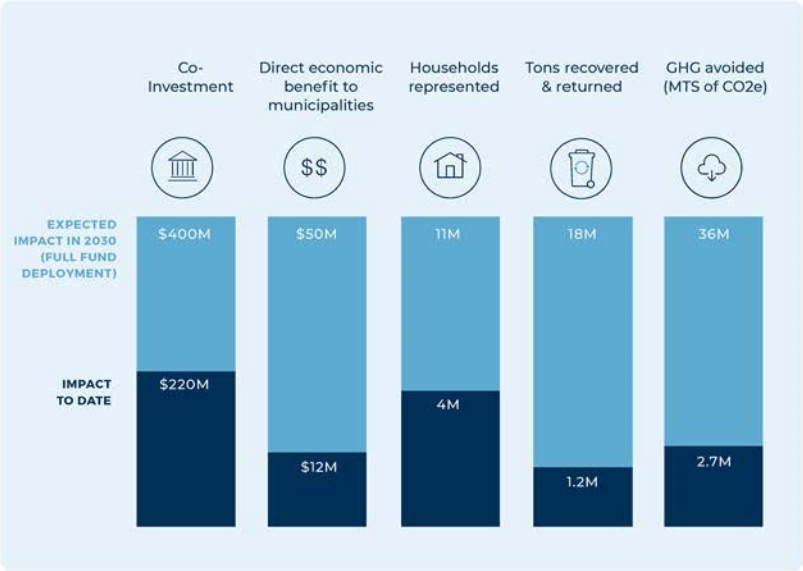


10 municipal deals

17 private deals

Closed Loop Infrastructure Fund

By the Numbers



FOR EVERY DOLLAR INVESTED TO DATE

$1 Invested =

$4
CO-INVESTMENT FROM PRIVATE AND PUBLIC SOURCES

40 lbs
OF RECYCLABLES RECOVERED AND/OR RETURNED TO SUPPLY CHAINS

95 lbs
OF CO2E GHG EMISSIONS AVOIDED

Closed Loop Infrastructure Fund

Investors

3M, amazon, Coca-Cola, Colgate-Palmolive, Johnson & Johnson Family of Consumer Companies, Nestlé Waters North America, Keurig Dr Pepper, P&G Procter & Gamble, PepsiCo, Danone North America, Danone Waters of America, Starbucks, Unilever, Walmart Foundation

"We are focused on achieving our ambitious goal to significantly increase our use of food-grade recycled plastic to 50% across our domestic portfolio by 2025. One of the key components that enables us to make bottles with other bottles is to support and encourage greater investment in the underfunded U.S. recycling system and its often outdated infrastructure. Through the Closed Loop Infrastructure Fund's investments, we are contributing toward modernizing, enhancing and improving recycling infrastructure to help realize a circular economy and a waste-free future."

– David Tulauskas, VP and Chief Sustainability Officer, Nestlé Waters North America

Closed Loop Infrastructure Fund

Case Study: Eureka

Eureka Recycling is a recycling company with a long-term contract servicing Minneapolis-Saint Paul.

3x
Polypropylene recovery post-CLIF investment

200,000
households serviced

100,000
tons of recyclables sorted each year



Kate Davenport and Lynn Hoffman, co-presidents of Eureka Recycling

Closed Loop Infrastructure Fund

Case Study: Eureka

What's a highlight from the past year?

Because of Eureka's long-term commitment to quality material, traceability in markets and education, we have continued to be resilient and maintain our best-in-class operations, even as the wake of the National Sword continues to challenge the stability of recycling.
We completed a successful upgrade in our facility that included a new optical sorter and baler, which is resulting in increased efficiencies and cleaner bales.

What are you most proud of with regard to your company?

As the dialog around waste, plastics, environmental justice and climate change continues to gain momentum, Eureka Recycling continues to be a thought leader, leveraging our operational experience to influence systems change by engaging with policy makers, industry leaders, and community advocates. For example, our Co-Presidents gave a key-note at the first ever Circularity Conference in Minneapolis, and Kate sits on the Recycled Material Standard Technical Committee, a project of GreenBlue on recycled content.

What are you looking forward to in 2020?

Through funding from the Schmidt Marine Foundation, we will continue to work on the application of AI technology to develop new metrics for recycling and its impacts. To connect to the growing interest in waste reduction in our home state of MN, we will be investing in and expanding our ability to offer tours to community members, legislators and the packaging industry. We will also be hosting our fourth Zero Waste Summit, a community event this year focused on the supply chain of plastics.

90% of material sold to markets in the Midwest and **100%** stay within North America

Closed Loop Infrastructure Fund

Case Study: TemperPack

TemperPack manufactures fully recyclable thermal packaging used to ship perishable goods such as food and pharmaceuticals. TemperPack is displacing toxic polystyrene.



7x
throughput of material post-installation of Kraft Loop machine, financed by CLIF

18x less CO2e
emitted in the manufacturing process of ClimaCell over Styrofoam

Closed Loop Infrastructure Fund

Case Study: TemperPack

What's a highlight from the past year?

In 2019, we made our biggest strides yet making a positive impact on the environment. In partnership with our customers, including HelloFresh, Misfits Market and Diplomat Specialty Pharmacy, our insulation protected over 18 million shipments this year.

What are you most proud of with regard to your company?

We are most proud of the expansion of our Las Vegas facility this year. We installed a new machine for manufacturing ClimaCell in that facility, which nearly doubles our manufacturing capacity, gives us supply redundancy, and allows us to better serve customers on the West Coast.

What are you looking forward to in 2020?

We're looking forward to making an even bigger impact across the life sciences industry. We have a growing stable of customers in that space today and expect more companies in the specialty pharmacy, genetic diagnostics, biologic medicines and pharmaceutical logistics sectors to seek out alternatives to plastic foam.

Earned
the "Widely Recyclable" designation from How2Recycle

3M
cubic feet of plastic foam diverted from landfills, equivalent to 34 Olympic-sized swimming pools

Closed Loop Beverage Fund

The Closed Loop Beverage Fund, in partnership with the American Beverage Association, seeks to improve the collection and the recycling of beverage containers. The goal is to enable the beverage industry to operate within a fully circular supply chain.



Closed Loop Beverage Fund

Fund at a Glance

$50 million fund focused on building circular economy infrastructure for the beverage industry

23 million Americans in **9 million households** will be directly impacted in key regions of the country

300+ million pounds of PET bottles recycled rather than landfilled over ten years. Equivalent of avoiding production of approximately **10 billion** PET bottles

"Plastics should not end up in waterways, the natural environment or even landfills. They represent valuable materials and recapturing that value after consumer use is a priority for PepsiCo. Through the Every Bottle Back initiative, we're proud to work with Closed Loop Partners to improve the collection of plastic bottles so that we can remake them into new bottles. Together we're modernizing recycling infrastructure with AI, robotics and other technologies to help build a circular future for packaging and a world where plastics need never become waste."

- Tim Carey, Vice President, Sustainability PepsiCo Beverages North America

INVESTORS INCLUDE

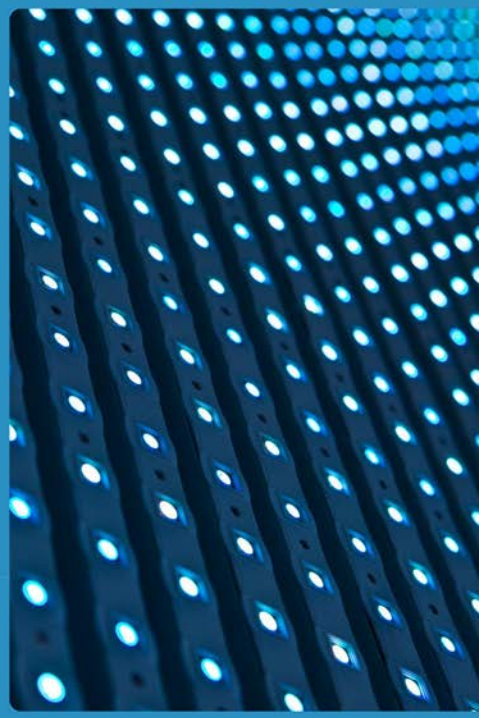
Coca-Cola · Keurig Dr Pepper · PEPSICO

PARTNERS

American Beverage Association · WWF · The Recycling Partnership

Closed Loop Venture Fund

The Closed Loop Venture Fund deploys early-stage capital into companies developing breakthrough solutions for the circular economy. Our portfolio includes companies developing leading innovations in material science, robotics, agritech, sustainable consumer products and advanced technologies.



Closed Loop Venture Fund

Portfolio Companies































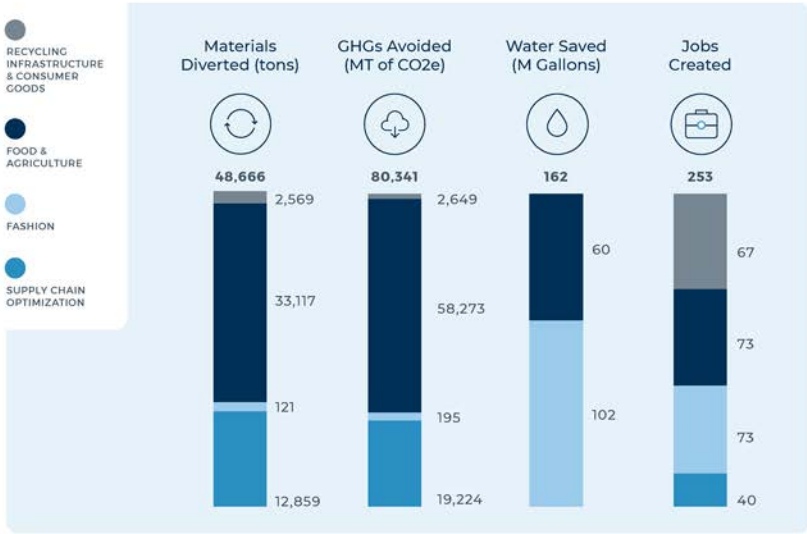


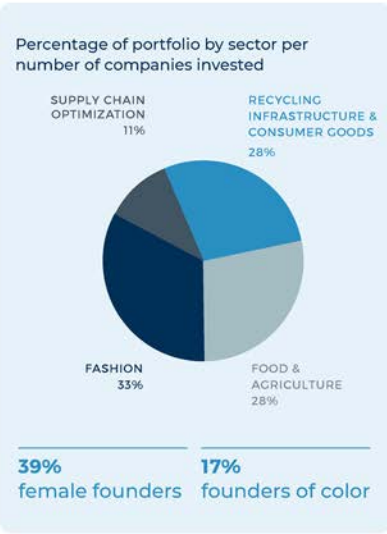




Closed Loop Venture Fund

Closed Loop Venture Fund invests in innovative technologies and business models across the verticals of recycling and consumer goods, food & agriculture, fashion & apparel, electronics and supply chain efficiency.





39% female founders

17% founders of color

Closed Loop Venture Fund

Case Study: HomeBiogas

HomeBiogas develops household and community sized anaerobic digesters that convert food and biological waste into clean energy.

9,000
systems sold in
107 countries

19
distributors
around the world



Closed Loop Venture Fund

Case Study: HomeBiogas

How does your business contribute to the circular economy?

HomeBiogas addresses waste management, energy production, sustainable food production and nutrient recycling with a product that uses natural resources in a continuous cycle. The system is a closed loop, so after HomeBiogas customers purchase the system they continue to generate value for years to come.

What's a highlight from the past year?

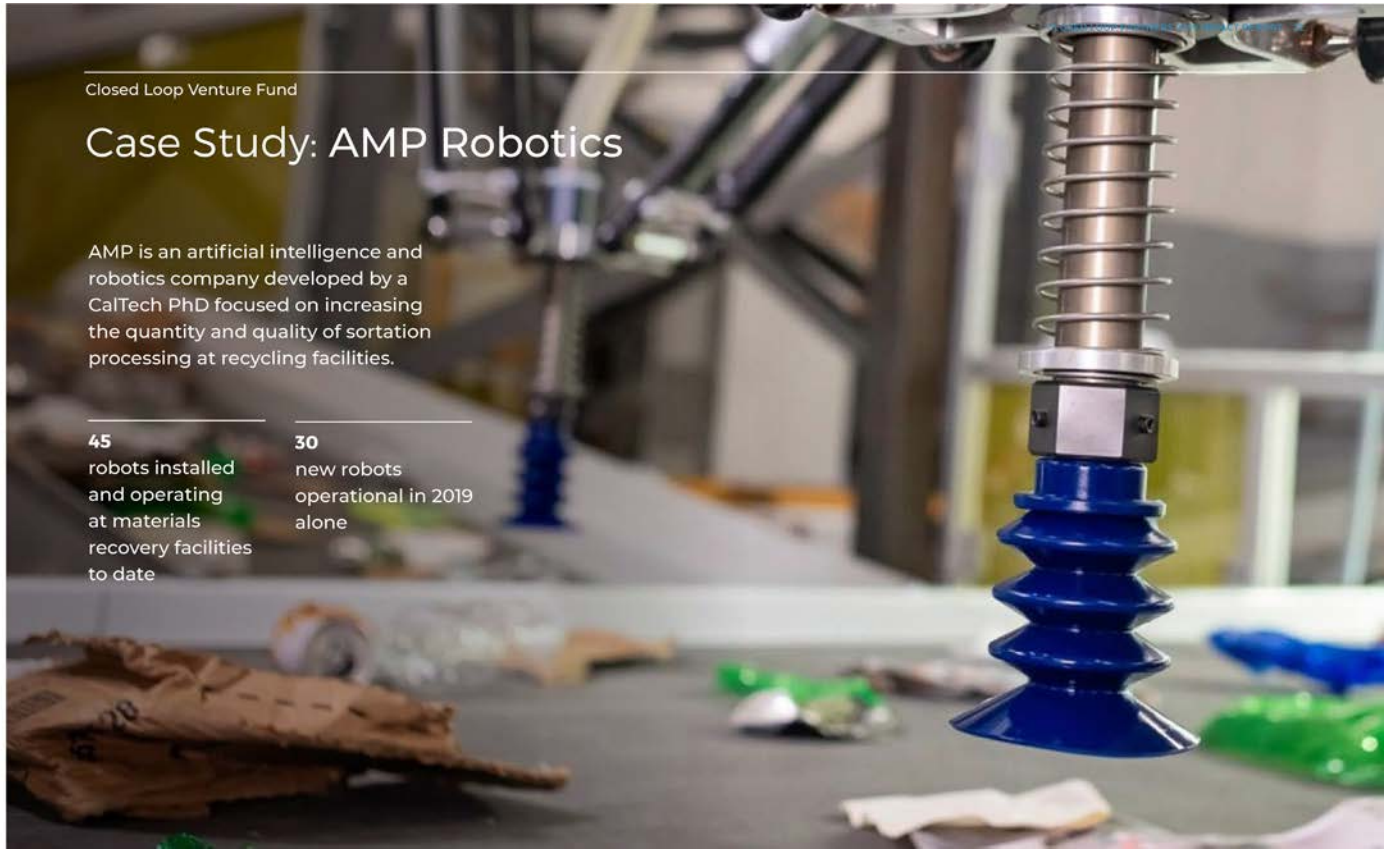
We proudly launched two new products – a larger biodigester and a toilet accessory. The HomeBiogas 7.0 offers the best and most cost-effective solution for small farmers and small businesses across the world. Through offering the Bio-Toilet solution, HomeBiogas has expanded our impact by addressing one of the biggest issues in developing countries - lack of access to sanitation solutions. The HomeBiogas Bio-Toilet solution is the most convenient, affordable and efficient off-grid option for managing human waste.

What are you most proud of with regard to your company?

Our mission is to make biogas affordable and available to all, and with each year we are reaching more people around the world. This year we are proud to have made the product more user-friendly, improved the quality and lowered the price, expanded the lifespan to 15 years and converted the product to 100% recyclable material.

What are you looking forward to in 2020?

2020 will be an exciting year for growth and expansion. We will continue to provide biogas solutions for households and small farms, and in addition focus on new market segments. This includes HomeBiogas as a solution for affordable housing projects and schools and the introduction of a smart device that allows pay-as-you-go financing options for customers in developing countries. In the second half of 2020 we will launch the commercial-scale system for restaurants and hotels that can treat on-site between 200kg and 1 ton of organic waste per day, eliminating the need to transport and treat waste off-site.


Closed Loop Venture Fund
Case Study: AMP Robotics
AMP is an artificial intelligence and robotics company developed by a CalTech PhD focused on increasing the quantity and quality of sortation processing at recycling facilities.
45
robots installed and operating at materials recovery facilities to date
30
new robots operational in 2019 alone

Closed Loop Venture Fund

Case Study: AMP Robotics

How does your business contribute to the circular economy?

The mission of AMP Robotics is to change the fundamental economics of the recycling process. We hope that by (a) significantly reducing the cost of sorting in recycling facilities (b) bringing fine grained operational data collection, and (c) creating transparency in the recycling space we can lower the cost of recycling and make them universally cost competitive with the tip fees of a landfill. We look forward to our technology bringing recycling rates up in the US and around the world. Over the long term we are particularly excited that our technology could lower the cost of recycling infrastructure and enable recycling in non-developed nations.

2019 Highlights

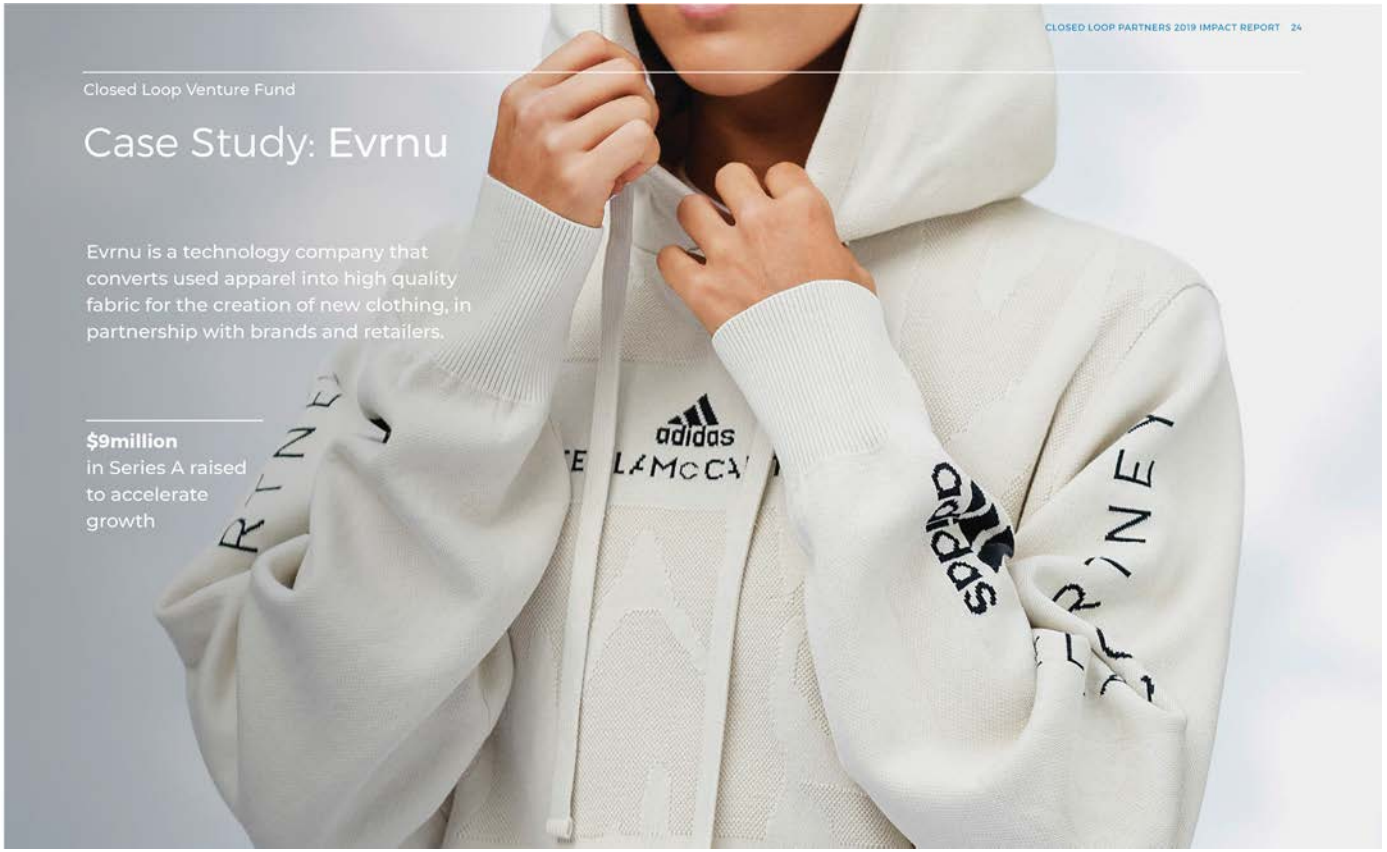
- AMP is working with Sidewalk Labs, an investor in AMP's Series A, on a pilot program in Toronto, Canada that will provide residents of a single apartment building with detailed information about their recycling habits
- AMP Robotics launches its new AMP Cortex™ dual-robot system that uses two high-performance robots that rapidly sort, pick, and place materials at an unprecedented speed of 160 pieces per minute creating optimum productivity
- ERI, the nation's leading fully integrated IT and electronics asset disposition provider and cybersecurity-focused hardware destruction company, installed AMP's system at its Indiana facility
- AMP Robotics' CEO, Matanya Horowitz, won the inaugural Waste360 Innovator Award 2019, which was created to recognize innovators and forward thinkers who often use technology to better the industry.
- AMP Robotics raised $16 Million Series A led by Sequoia Capital, joining Alphabet-backed Sidewalk Infrastructure Partners and leaders in sustainable investing

Closed Loop Venture Fund

Case Study: Evrnu

Evrnu is a technology company that converts used apparel into high quality fabric for the creation of new clothing, in partnership with brands and retailers.

$9million
in Series A raised to accelerate growth



Closed Loop Venture Fund

Case Study: Evrnu

How does your business contribute to the circular economy?

When textiles have reached the end of their useful life, the raw materials (the molecules) still have tremendous intrinsic value. They can be reused. But in the current "take-make-waste" model of production they are not. There's simply not enough air, water or soil to sustain the linear model into the future and that's why we're so passionate about making circularity achievable. Our technologies break down garment waste to the molecular level and convert the polymers into new fiber which is the basis of high-quality new textiles. This way of working is a significant paradigm shift as we can now look at the value of the useful life of a polymer, not just the product.

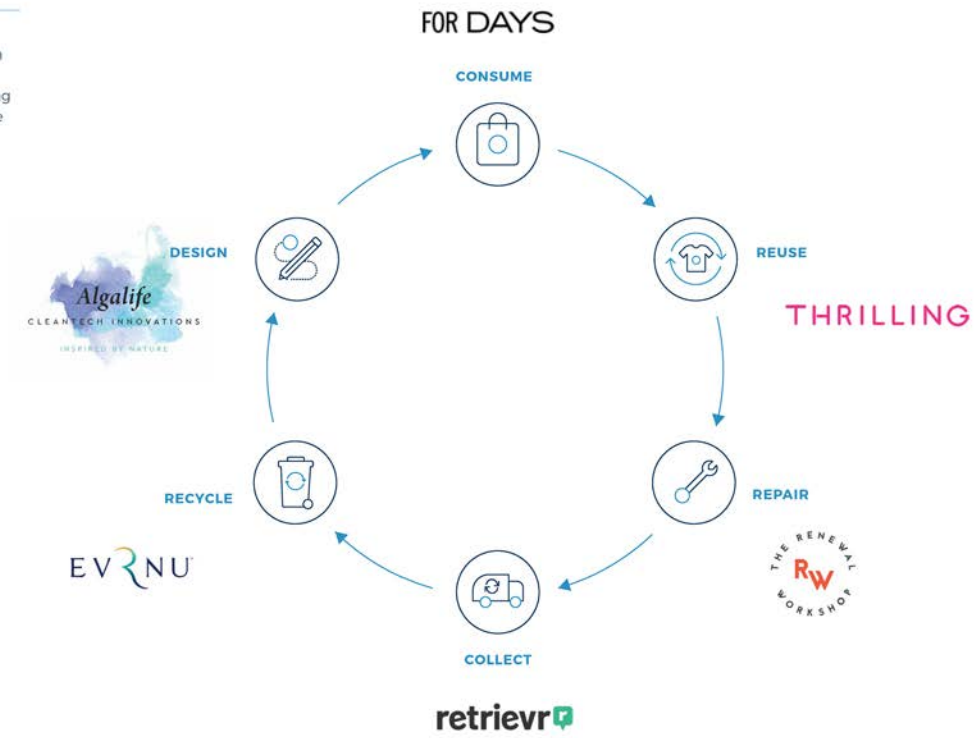
What's a highlight from this past year?

Evrnu debuted NuCycl, our new consumer brand, at a global press event alongside brand partners adidas and Stella McCartney. Using NuCycl technology, we created the performance fiber and yarn for the limited-release 100% recyclable adidas by Stella McCartney Infinite Hoodie, which was distributed to influencers and athletes. By introducing NuCycl to consumers before being available at retail we were able to leverage the high-profile moment to raise awareness with consumers that their clothing is no longer waste.

What are you most proud of with regard to your company?

I am most proud that we've closed our Series A round of funding and are now onboarding a phenomenal team to begin scaling the technology and business. Solving the massive problems around textile waste requires innovation, and an adaptive mindset to tackle the increasing complexity of today's business. With collaboration as the foundation, I've hired an A-team to do just that.

The Closed Loop Venture Fund invests in companies across the Fashion sector, touching every stage of the value chain.



Closed Loop Venture Fund

Case Study: Algramo

Algramo builds smart dispensing systems that incentivize the reuse of packaging.

Algramo's reusable packaging lowers the cost of life's essentials by **30%** comparing to business as usual

2,000 corner stores selling Algramo in Chile, reaching **320,000** households

Reduces 40% "poverty tax" for those purchasing smaller packaged products, unable to afford larger-format products.



Closed Loop Venture Fund

Case Study: Algramo

How does your business contribute to the circular economy?

Algramo offers a proven market-based upstream solution to decouple fast-moving product consumption from packaging waste. The circular economy can't exist in a vacuum, it requires systems thinking solutions applied in a more pre-competitive manner across entire value chains. Algramo is pulling together brands, technology providers, academics, governments and NGOs to collectively work towards promoting more circular packaging solutions. Examples of circularity integrated into Algramo's business model include:

- **Changing behavior:** 86% return rate of packaging in Algramo 1.0 model, while still providing an economic incentive for customers
- **Re-imagining packaging:** Creating a system where packaging can retain value, and actually increase in value the more it is reused
- **Elevating customer experience:** Delivering products to customer's doors with electric vehicles
- **Stakeholder engagement:** Aligning the incentives of brands, retailers and consumers to enable the circular economy

What's a highlight from this past year?

- Unilever pilot officially launched in May 2019
- Closed Loop Partners and Sky Ocean Ventures secured as investors
- Winning MIT Solve and National Geographic Sky Ocean Ventures Circular Economy Challenges

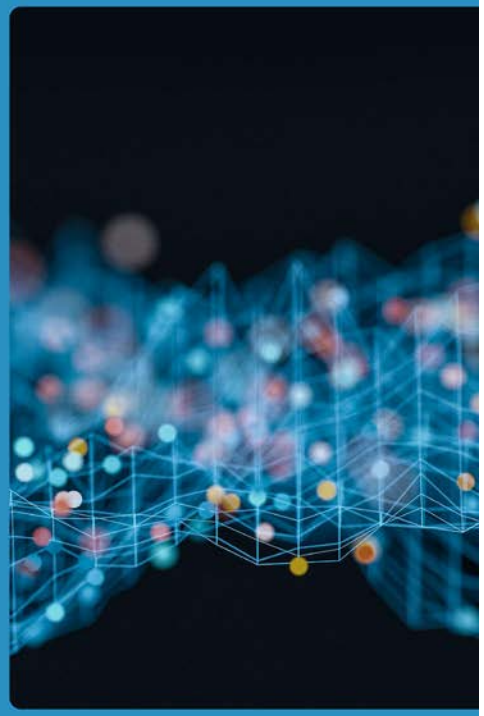
What are you looking forward to in 2020?

Using our investment to develop our team and technology so we can start expanding Algramo beyond Chile.

78% refill rate in Chile

Closed Loop Leadership Fund

The Closed Loop Leadership Fund acquires best-in-class, private companies that it can scale, utilizing Closed Loop Partners LP network and operational expertise. Investments span the sectors of recycling infrastructure, packaging, logistics, electronics, and food & agriculture.



Closed Loop Leadership Fund

Case Study: Balcones Resources

Balcones Resources has been providing recycling service to Austin and Dallas since 1994.

200,000
tons processed annually

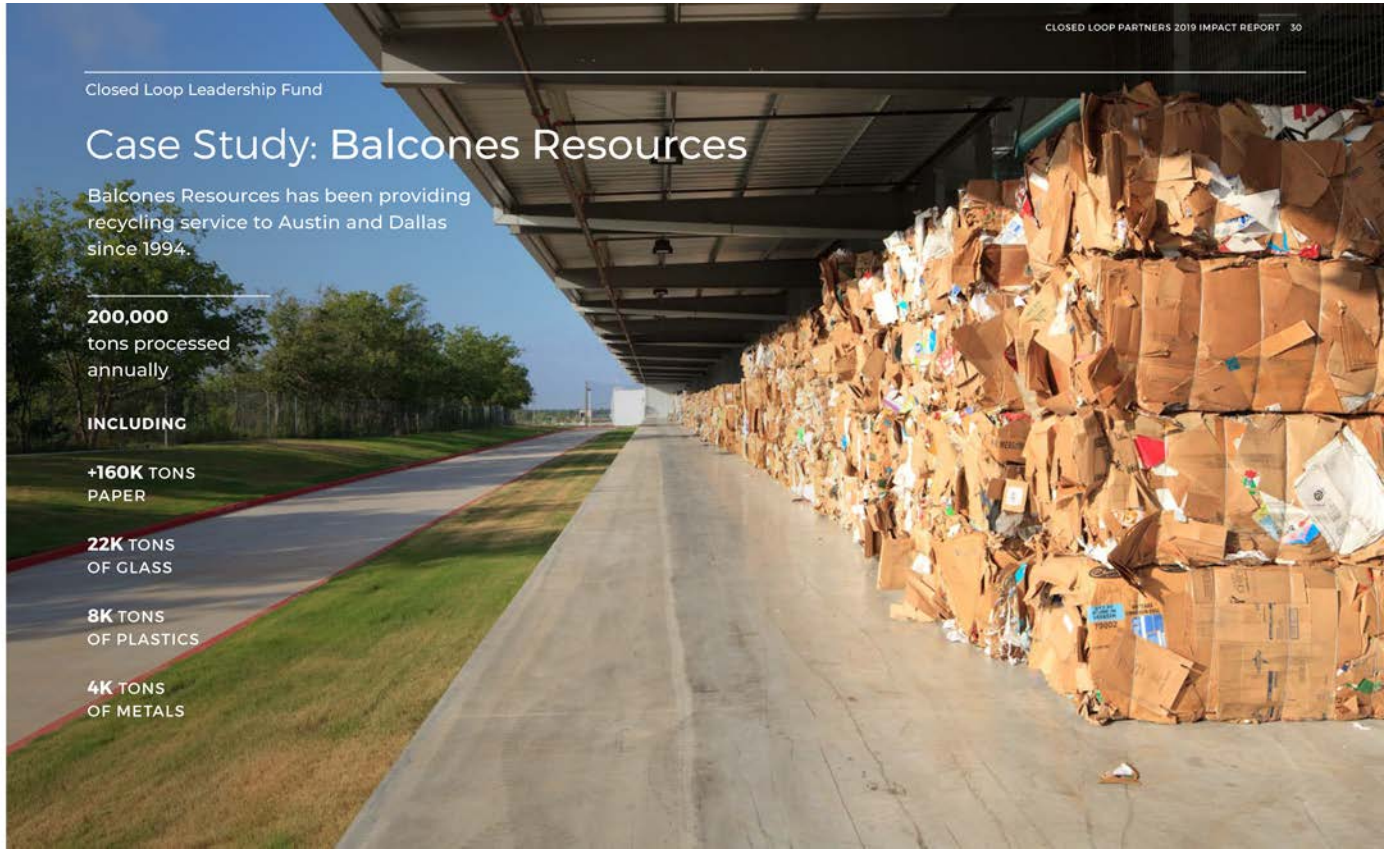
INCLUDING

+160K TONS
PAPER

22K TONS
OF GLASS

8K TONS
OF PLASTICS

4K TONS
OF METALS



Closed Loop Leadership Fund

Case Study: Balcones Resources

One of the United States' largest and best-run material recovery facilities, Balcones Resources became the Leadership Fund's first investment in October 2019. When CEO Kerry Getter sought a values-aligned private equity buyer, having known Closed Loop Partners for nearly a decade, we quickly realized through our diligence a strong alignment in financial targets, growth plans and impact.

Family-run Balcones was founded in 1994 and has been the recipient of numerous awards for leadership, from the National Recycling Coalition's Award for Outstanding Environmental Leadership (2000) to the Greater Austin Business Award (2018) to WasteDive's Executive of the Year (2019).

Its three facilities incorporate many principles of green design, from locally sourced construction materials to energy efficient equipment, low/no VOC paint and electric vehicle charging stations. The company's unique, 20-year service contract with the City of Austin has helped the city advance toward its ambitious goal to reduce 90% of its landfilled waste by 2040.

Strategically, Balcones has insulated itself from the China-driven downward price pressure of recycled commodity markets due to the strength of its North America-based client base, bale quality (low contamination rates drive higher prices), diversity of clients (municipal and commercial), long-term contracts with fixed pricing (overcoming commodity price volatility), and regular capital improvements to increase its efficiency and capacity.

3 facilities
Austin, Dallas,
Little Rock

Center for the Circular Economy

The Center for the Circular Economy is an innovation center for research, analysis and collaboration to accelerate the transition to a circular economy in which materials are shared, re-used and continuously cycled.

We take a holistic, end-to-end approach to scaling the circular solutions of the future. Our expertise spans the full lifecycle of a product, connecting upstream innovation to downstream recovery infrastructure and end markets. We work across brands, countries, sectors and industries to create the systems change necessary to advance the circular economy.

OUR SERVICES



Collaboration
We lead collaborations between brands, investors, NGOs and industry leaders to identify, test and scale solutions that solve material challenges and supply chain bottlenecks.



Research and Analysis
We conduct research and analysis, carry out landscape mappings and create investment roadmaps on circular trends, challenges and opportunities across sectors.

Center for the Circular Economy

NextGen Consortium

Collaboration

Globally, more than 250 billion fiber cups are produced each year. While many cups are potentially recyclable, in practice the vast majority end up in landfill, wasting valuable resources.

The NextGen Consortium is a multi-year, global consortium that addresses single-use food packaging waste globally by advancing the design, commercialization and recovery of food packaging alternatives.

NextGen Cup is the first initiative by the NextGen Consortium, which advances recoverable solutions for the fiber, hot and cold, to-go cup system. We believe this is a critical step to unlock wider innovations and overcome the global infrastructural challenges of single-use packaging.

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Center for the Circular Economy

NextGen Consortium

Collaboration

NEXTGEN CUP

NextGen Cup Challenge

The Challenge received nearly 500 applications from innovators with solutions to the recovery of single-use fiber cups. Twelve winners were announced in three categories, and received a share of $1 million to advance their solutions.

Category One: **Innovative Cups & Cup Liners**
These companies are rethinking the polyethylene plastic liners in cups that can currently make to-go cups difficult to recycle.

Category Two: **New Materials**
These companies are using cutting edge, plant-based materials to design compostable cups.

Category Three: **Reusable Cup Service Models**
The cups made by these companies aren't single-use, they just keep cycling - remaining in service by harnessing the power of technology and design.

NextGen Circular Business Accelerator & Advanced Solutions Program

Challenge winners received multi-industry business support, subject matter expertise and technology support, including testing opportunities through our Accelerator and Advanced Solutions program.

PROTOTYPING AT GOOGLE

In June 2019, Accelerator teams conducted live in-context prototyping across Google campus cafes in the San Francisco Bay Area. Key criteria such as user and barista experience, performance and recovery were evaluated to provide teams with tangible feedback to improve their designs. In late September, Accelerator teams showcased their progress with Consortium Partners, investors, and media at a Pitch Day event in New York City.

Cup Recovery Infrastructure & Value Chain Engagement

Given the diversity and inconsistency of recycling and recovery infrastructure, in order to close the loop on the fiber cup, we must understand the current infrastructure landscape, best practices and stakeholders at every step of the value chain. We are working across the value chain to ensure solutions can integrate into supply chains and get through recovery infrastructure systems as valuable commodities. This means addressing critical gaps and bottlenecks to identify opportunities for integration and recovery.



PHOTO CREDIT: IDEO

Center for the Circular Economy

Collaboration

The FlexPack Recovery Challenge & The Protective Packaging Design Challenge

We partnered with the Sustainable Packaging Coalition to challenge the best and brightest entrepreneurs to submit new ideas for reprocessing technologies capable of beneficially recovering multi-material flexible packaging waste - the fastest growing segment of the packaging sector.

Among five finalists, ReNew ELP was selected as the final Challenge winner to receive further mentorship and support. The company is UK-based with a chemical conversion technology that converts mixed end-of-life plastics into valuable hydrocarbon products.

Renew ELP is launching their first commercial scale plant that will be able to process 20,000 tonnes of cleaned waste plastic materials.

We are now partnering with the Sustainable Packaging Coalition and Ubuntoo on The Protective Packaging Design Challenge, which invites entrepreneurs to submit their innovations in protective packaging materials. The winner will be announced in 2020.



Center for the Circular Economy

Research & Analysis

Building Circular Supply Chains for Polypropylene in North America

The dynamics of the municipal recycling system in the United States have changed dramatically in recent years, and actors across the value chain are actively seeking opportunities for improvement across the system. In many cases, municipalities are considering removing (or have already removed) certain recyclables from acceptance in curbside programs, most notably mixed plastics, but this action runs counter to tremendous demand for these materials by plastics reprocessors.

In view of the disconnect between market demand and actions being taken by collection programs and materials recovery facilities (MRFs), we conducted research to identify MRF interventions to enhance the recovery of polypropylene (PP or plastic #5), commonly used in to-go containers. Key takeaways from our research:

- Incorporating computer vision-equipped robotics to pick polypropylene can enable attractive payback periods, even at small (15,000 TPY) MRFs.
- Brand-led PCR commitments coupled with North American capacity to purchase bales and PP's versatility suggest strong market pull for more PP in the coming years.
- Investment in infrastructure at the MRF, along with consistent and clear communication to residents, is immediately needed to meet the growing demand for recycled PP.
- Technological upgrades at the MRF - namely optical sorters, robotics, or both - are needed to consistently meet quality demands for PP bales.

2-5 years MRFs typical payback period for positive PP sortation

Center for the Circular Economy

Advancing Circular Systems for Plastic

Research & Analysis

In April 2019, Closed Loop Partners launched its Advancing Circular Systems for Plastics Initiative and released a seminal report that defined the landscape and scope of advanced recycling technologies that have the potential to transform post-consumer plastics into the building blocks for new materials.

Our takeaways after evaluating 60 advanced recycling companies:

- Technologies that can solve the plastic waste issue exist, but not at scale.
- Advanced recycling could meet an addressable $120 billion market in U.S. and Canada alone.
- It takes advanced recycling companies, on average, 17 years to reach growth scale.
- The barriers preventing investment extend beyond the technology – supply chain risks must be addressed and further analyzed.

Building on this first report, the Center for the Circular Economy has kicked off the next phase of work evaluating a subset of advanced recycling technologies for their potential economic, environmental and human health impacts. We will also identify the policies and standards that best support the sector and end-market development. The results of our work will be published in an Investment Roadmap, which will identify where and how to deploy capital across the value chain to scale advanced recycling in North America in 2020.

Team

Closed Loop Partners Team



LEADERSHIP & INNOVATION

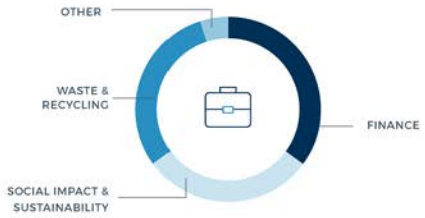


45%
of our team has run a company



52%
has participated in a major merger or acquisition

WORK EXPERIENCE PRIOR TO JOINING CLOSED LOOP



TEAM

70%
female

30%
male



Languages Spoken

Cantonese	Mandarin
Danish	Norwegian
French	Russian
German	Spanish
Hebrew	Swedish

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Appendix

Impact Assessment Methodology

We invest according to a theory of change that increasing and improving the physical recycling infrastructure for post-consumer materials, as well as investing in companies with circular business models, will generate competitive financial returns and have a net positive impact on society through reduced resource extraction, avoided GHG emissions and a systemic shift toward a circular economy.

All CLP funds track IRIS metrics as outlined by the Global Impact Investment Network (GIIN).

Calculation and monitoring of environmental and social impacts of our investments occur at both the fund and individual investment (portfolio company) levels, according to the following approach:

1. Establish a baseline forecast for "business as usual" materials impacted, landfilled tonnage, recycled tonnage, GHG emissions, water use efficiency and in some cases additional metrics unique to the project or portfolio company.
2. Project impacts on the following metrics, where applicable: landfilled material diversion (tons), recovery/return to supply chains, GHG emissions avoided (tons CO_2e), households represented, water saved (gallons), jobs created and economic benefit to municipalities (USD).
3. Track progress over time through portfolio companies' provided reports. As a condition of funding, clients are required to report to CLP fund managers their pre-agreed impact metrics. Each fund's management team reviews the data on a quarterly basis.
4. Report progress in aggregate quarterly reports to fund advisory boards and investment committees (in the case of the Closed Loop Infrastructure Fund and the Closed Loop Beverage Fund) and annual reports to investors (all funds).



Material Impacted
All materials coming through the system of the borrower's operation.

Incremental Tons
Tons impacted minus the baseline, established prior to the investment. For new builds, incremental tons are equal to tons impacted.

GHG Emissions
Emissions reduced or avoided as a funded project or company are estimated based on tons of material impacted, using data from the most recent version of US EPA Waste Reduction Model (WARM). For materials not included in the WARM model, we rely on third-party research made available by the Greenhouse Gas Protocol or data provided by clients using life cycle assessment analysis.

Households Represented
For Closed Loop Infrastructure Fund's collection and sortation projects, this metric measures households directly reached by the project; for processing and end-market manufacturing projects, this metric measures the number of households represented by calculating the total weight of material diverted or reduced divided by the weight of the same material generated by a household, on average, in a year. Closed Loop Venture Fund measures households represented uniquely per portfolio company.

Jobs Created
This metric measures new full-time or full-time equivalent positions created as part of the project or company for all funds.

Water Savings
Per company's products sold and operations. Closed Loop Venture Fund measures gallons of water saved by both industry sector and in aggregate.

Economic Benefit to Municipalities
Calculated specifically for Closed Loop Infrastructure Fund based on client reporting, including savings from landfill or Waste to Energy tip fees and shared revenues from commodities sold.

COMPANY STAGE CONSIDERATIONS
The portfolio companies of Closed Loop Ventures are very early stage, many of them pre-revenue prior to our investment. For these companies, we take a more active role with the company founders in estimating impacts, using data from reputable external sources (such as the EPA and World Bank) regarding materials impacted, GHGs avoided and water savings.

Closed Loop Infrastructure Fund Portfolio

INVESTMENT	LOCATION	MATERIAL	SUMMARY	IMPACT BY 2030
City of Phoenix	AZ	Single Stream	The City of Phoenix is working to upgrade its North Gateway materials recovery facility to enable greater diversion of plastics from landfill and to improve the quality of baled paper produced.	Recover more tons and better quality commodities out of single-stream recyclables in the City of Phoenix
CleanFiber	NY	Fiber	CleanFiber manufactures a premium cellulose insulation made from recycled feedstock, a mix of OCC and ONP.	Turn more tons of cardboard waste headed to the landfill into valuable insulation product
Council Bluffs	IA	Single stream	The Council Bluffs Recycling Center sorting facility serves 42,500 households in a rural community.	Recover more tons of post-consumer recyclables
Emerald Coast Utilities Authority	FL	Single stream	Emerald Coast Utilities Authority material recovery facility serves more than 250,000 households across Escambia County, the Florida panhandle, and eastern Alabama. ECUA's facility processes 45,000 tons of recyclables each year.	Save local municipalities nearly $1M
Eureka Recycling	MN	Single stream	Eureka Recycling is a nonprofit social enterprise based in the Twin Cities, whose mission is to demonstrate that waste is preventable, not inevitable. Eureka provides recycling collection and processing services to over 200,000 households and sorts over 90,000 tons a year.	Recover more tons of single-stream recyclables
FirstStar Fiber	NE	Single stream	FirstStar Recycling is the largest full service recycler (hauler and MRF) in the state of Nebraska ensuring comprehensive recycling in the greater Omaha and Lincoln metro areas.	Generate millions of dollars in savings and revenues for the County
GreenMantra	Ontario, Canada	Plastics	GreenMantra Technologies is focused on applying its upcycling catalytic technology to advance the circular economy. The first application of their technology transforms polyethylene and polypropylene into an industrial wax used in construction products. They have now reached commercial scale.	Divert valuable materials from landfills and create end markets for hard-to-recycle plastics
IntegriCo	LA	Plastics	IntegriCo Composites is a manufacturer of composite railway products including railway crossties and composite grade using 100% recycled plastics.	Return to supply chains more tons of waste plastics in the form of plastic railroad ties
ITR/Ecoglass	TX	Single stream, glass	ITR provides new collecting, sorting, and processing capacity for post-consumer single stream in the Houston, TX, market. At scale, the facility will handle 33,000 tons of single-stream material per year.	Improve access to convenient curbside recycling for 300,000 multifamily housing residents
Lakeshore Recycling Systems	IL	Single stream	Lakeshore Recycling Systems (LRS) is Illinois' largest private waste company, specializing in recycling and waste diversion programs for Chicagoland businesses and homeowners, dumpster services and portable restroom rental.	Recover and return to supply chains more tons of single-stream recyclables in the Chicagoland region
Marquette County	MI	Single Stream	Marquette County Solid Waste Management Authority is working to upgrade its existing MRF from a small dual-stream facility to a larger single-stream installation.	Recover more tons and better quality commodities out of single-stream recyclables in rural upper peninsula Michigan
City of Memphis	TN	Single stream	The City of Memphis introduced universal single stream curbside recycling across the city in 2016. More efficient carts and trucks bring significantly more material to the area's material recovery facility.	Recover more tons of single-stream recyclables

Closed Loop Infrastructure Fund Portfolio

City of Moline	IL	Single Stream	The City of Moline, IL, is expanding access to curbside recycling services and introducing new 96-gallon carts for its 19,000 households. Moline's recycling will go to nearby Scott County, Iowa's single-stream MRF (another Closed Loop Infrastructure Fund financed project).	New carts will yield a projected 40% increase in recycling volume annually
Momentum Recycling	CO	Glass	Momentum Recycling is a cullet processor and recycling services provider, with operations in Salt Lake City and Denver. The Denver facility processes over 75,000 tons of glass per year for container, fiberglass, and abrasives markets.	Momentum is creating a market for both single-stream and source-separated post-consumer glass
Portage County Solid Waste Recycling District	OH	Plastics	Portage County is a rural county in Ohio SE of Cleveland with a population of 165,000 residents. With support from the Closed Loop Infrastructure Fund, the city invested in new single stream recycling carts and automated recycling trucks..	Generate savings for the city in landfill tip fees avoided
Preserve	MA	Plastics	Preserve, a certified B Corporation, makes stylish, eco-friendly products for the home, including a full line of food service cutlery, kitchen products, tableware, and personal care products, using 100% recycled plastic and plant-based compostable materials.	Return to supply chains more tons of post-consumer recycled polypropylene in the form of food service cutlery
PureCycle Technologies	OH	Plastics	PureCycle Technologies uses a proprietary process to transform colored and contaminated polypropylene (PP) into an FDA-grade clear / natural PP pellet. At scale, the Lawrence County, OH, facility will process 50,000 tons of PP a year.	Return to supply chains more tons of post-consumer recycled polypropylene
QRS of Maryland	MD	Mixed 3-7 Plastics	QRS of Maryland was a plastics recovery facility that sorted and processed post-consumer mixed plastics with limited markets into a washed flake.	Recovered and returned to supply chains more than 36,000 tons of mixed 3-7 plastics in its first two years of operations
Revolution Systems	CO	Recycling Infras-tructure	Revolution manufactures low-cost, modular MRF systems for small communities.	Recover recyclables from rural and underserved areas via Modular Material Recovery Facility equipment
rPlanet Earth	CA	Plastics	rPlanet Earth is the world's first completely vertically integrated manufacturer of post-consumer recycled PET (rPET) and multiple high rPET content packaging products, creating a much needed market for PET packaging collected from curbside recycling programs across California.	The company estimates that every ton of PET recycled at rPlanet Earth's facility will help reduce global greenhouse gas emissions by 2.5 metric tons of CO2
TemperPack	NV	Packaging	TemperPack solves thermal packaging problems through sustainable design. TemperPack specializes in bringing custom solutions for clients to scale in the perishable food and life sciences industries. Today, TemperPack operates two facilities in Virginia and Nevada and is rapidly expanding its reach in the perishable and cold chain shipping market, all with the goal of reducing the amount of packaging that ends up in landfills.	Reduce the amount of expanded polystyrene used for cold-chain insulated packaging
Waste Commission of Scott County	IA	Single stream	Waste Commission of Scott County, a solid waste district in NE Iowa serves the Quad Cities area. A new material recovery facility handles more than 17,000 tons of recyclables per year from expanded curbside programs in Bettendorf and Davenport, as well as for the region.	• Improve access to convenient curbside recycling for 48,500 households • Recover more tons of single-stream recyclables • Generate savings and revenues for the County and nearby communities
City of Waterbury	CT	Single stream	The City of Waterbury CT has expanded its curbside recycling program, offering 95-gallon recycling carts to every household with a goal to increase the current 6% recycling rate to 25% in the next three years.	• Improve access to convenient curbside recycling for more than 32,000 households • Generate savings for the City

Closed Loop Venture Fund Portfolio

INVESTMENT	LOCATION	MATERIAL	SUMMARY	POTENTIAL FOR IMPACT
Algalife	Israel	Textiles	Algalife has developed a technology for converting micro-algae to textile fibers and dyes using proprietary blends and strategic feedstock sources.	· Reduces dependence on plastic fibers and toxic dyes for textiles by providing solutions produced from a renewable resource, micro-algae.
Algramo	Chile	Packaging	Algramo builds a "smart dispensing system" for CPG products that incentivizes the reuse of packaging, and provides an economic benefit to buyers (able to buy small quantities of products at bulk prices), retailers, and brand owners.	· Reduces single-use and unrecyclable CPG packaging and offers high quality products at an economic value accessible to populations regardless of socioeconomic status.
AMP Robotics	CO	Single Stream Recyclables	AMP Robotics uses state-of-the-art computer vision and robotics that rapidly identifies and recovers material from the waste stream.	· Improves the quantity and quality of recycled commodities recovered from co-mingled waste streams.
Atlas Organics	SC	Organics	Atlas Organics is an organics recycling platform that partners with municipalities to collect organic waste streams, process, and sell finished compost.	· Diverts food waste from landfill and turns it into a valuable soil amendment. Increases the accessibility of composting.
Cambridge Crops	MA	Organics	Cambridge Crops extends the shelf-life and freshness of food by using natural, edible, and invisible coatings.	· Minimizes food waste, limits GHG emissions and water waste created by the food supply chain, and reduces the reliance on plastic packaging.
CoLoadX	NY	Supply Chain Optim-ization	CoLoadX is an online commerce platform for the ocean freight industry. Using state-of-the-art technology, CoLoadX improves both operations and user experience.	· Reduces waste in the global supply chain by making international logistics simpler and more efficient.
Retrievr	NY	Electronics, Textiles	Retrievr (formerly CurbMyClutter) is a CRM application that enables municipalities and haulers to collect and recycle used electronics and apparel.	· Diverts textiles and electronics from landfill by dedicated collection and recycling. Retrievr has the potential to collect 75lbs/person/year of textile waste.
Easy Aerial	NY	Single Stream Recyclables	Easy Aerial is developing advanced and customized autonomous aerial monitoring solutions.	· Potential to improve the quality and efficiency of recycling operations, e.g., increasing the quality of material coming into MRFs by enhanced hauler visibility systems.
Evrnu	WA	Textiles	Evrnu's technology transforms post-consumer cotton garment waste into high quality cellulosic fiber.	· Diverts and recovers all cotton fiber waste and converts it to new fibers, thereby at least halving the need for virgin cotton fibers.
For Days	CA/NY	Textiles	For Days brings consumers into the circular supply chain with a subscription-based relationship to recycled garments.	· Reimagines consumption habits of basic apparel, thereby dramatically reducing the 75lbs/person/year that get disposed of in landfill.

Closed Loop Venture Fund Portfolio

HomeBiogas	Israel	Organics	HomeBiogas produces household-sized biogas systems that turn organic waste into a cooking fuel and fertilizer.	· Diverts food waste from landfill and increases its value as usable fuel, reduces indoor air pollution from dirty cookstoves, and offers "free" fertilizer.
Linhaus	NY	Metals, Minerals	Linhaus is a proprietary technology and design platform that delivers customizable and closed-loop jewelry with a unique customer experience.	· Avoids extractive diamond and gemstone mining by increasing demand for recycled metals and lab grown diamonds.
Loliware	NY	Organics	Loliware is the world's first Edible Bioplastic Company dedicated to replacing plastic with edible materials.	· Reduces the need for unrecyclable plastic straws with hyper-compostable alternatives.
Natural Machines	Spain	Organics	Natural Machines' 3D food printer allows users to print what they want to eat and nothing more, and recover food that is traditionally classified as food waste.	· Makes use of food scraps in commercial kitchens, diverting discarded food from landfill.
Rebound Technologies	CO	Organics	Rebound Technologies accelerates freezing processes with bursts of high capacity cooling and generates sub-zero temperatures at 40% greater efficiency than legacy systems.	· Cuts fresh food waste at logistics sites, and reduces energy consumption for freeze-point cooling.
The Renewal Workshop	OR	Textiles	The Renewal Workshop takes unsellable apparel and textiles and "renews" them for resale by brands.	· Diverts textiles that would otherwise be sent to landfill or incineration.
Thrilling	CA	Textiles	Thrilling is a boutique vintage clothing marketplace, leveraging the infrastructure of pre-existing "sorters"/vintage clothing store owners to accelerate the circular economy.	· Increases accessibility to vintage clothing and promotes resale of clothing, prolonging garments' useful life and keeping them out of landfill.
Tradelanes	CA	Supply Chain Optimization	TradeLanes is a global trade execution platform that connects all trade participants into a single document chain over the lifecycle of an international trade shipment.	· Saves exporters 30-80% on supply chain management by digitizing and automating supply chains.

Closed Loop Leadership Fund Portfolio

INVESTMENT	LOCATION	MATERIAL	SUMMARY	POTENTIAL FOR IMPACT
Balcones Resources	TX, AR	Recycling Infrastructure	The largest privately held recycling company in Texas, with 25 consecutive years of profitability and dividend payments to shareholders.	· Diverts 200,000 tons of recyclables from landfill annually

SOURCES

1,2 & 3. Harvard Business Review (2019).
Research: Actually, Consumers Do Buy Sustainable Products.

DISCLAIMER

Notice to Recipients

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CLOSED LOOP partners

ACKNOWLEDGMENTS

Our limited partners have exhibited tremendous leadership in coming together to support a new model for systems change. The municipalities, operators and entrepreneurs that we have invested in show the vision and execution required to achieve double bottom line success. We would also like to recognize our partners at Dentons. They have exhibited incredible patience and collaboration in structuring both our unique fund and our innovative investments. We would also like to thank our compliance partners at State Harbor. CLP acknowledges the excellent service of our auditing firm, CohnReznick, and our banking partners, Silicon Valley Bank, First Republic Bank and Signature Bank.

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Certified B Corporation

CLOSED LOOP partners
ACCELERATING CIRCULAR SUPPLY CHAINS FOR PLASTICS:
A LANDSCAPE OF TRANSFORMATIONAL TECHNOLOGIES THAT STOP PLASTIC WASTE, KEEP MATERIALS IN PLAY AND GROW MARKETS

TABLE OF CONTENTS

INTRODUCTION	3
EXECUTIVE SUMMARY	6
KEY FINDINGS	8
FINDING 1	9
FINDING 2	20
FINDING 3	24
FROM POSSIBLE TO PROBABLE	30
CALL TO ACTION	34
APPENDIX	40


INTRODUCTION

LAY OF THE LAND

Plastics are ubiquitous. Found in packaging, textiles, hardware, and consumer products, they offer performance at low cost, often with environmental benefit, for countless uses. Yet most plastic packaging and too many plastic products are eventually discarded after one use.

In the U.S. and Canada, current recycling infrastructure recovers less than 10% of post-consumer plastics, and today's supply of recycled plastics meets just 6% of real demand [1], [2]. When poorly managed, plastics waste fills our landfills and our environment. If current trends continue, global demand for plastics is forecasted to triple by 2050 [3]. At the same time, there may be more plastics than fish in oceans by 2050 [4].

Many large corporations are making commitments to use more recycled plastics in their products and their packaging, and to reduce their carbon emissions - signaling demand for solutions that keep plastics in play. Suppliers are scrambling to meet this increasing demand, but the options today are limited.

For the petrochemical industry, there is a lot at stake, too. The threats of being blamed for contributing to the problem or left out of the picture are increasingly driving change among the largest petrochemical companies and plastics manufacturers in the world.

To address the current challenges - and the current demand - transformational technologies that keep plastics in play are needed at scale.

There are at least 60 technology providers developing innovative solutions to purify, decompose, or convert waste plastics into renewed raw materials. With these available technologies, there is a clear opportunity to build new infrastructure to transform markets. These solutions can also help to decrease the world's reliance on fossil fuel extraction, lower landfill disposal costs for municipalities, and reduce marine pollution.

All of these factors indicate an inflection point for plastics.

THE PROBLEM

A majority of the plastics used are never recovered: today, in the U.S. and Canada, about 90% of plastic waste ends up in a landfill or incinerated [1]. When plastics are collected, many regions do not have the recycling infrastructure to properly and profitably sort, process and market much of this material. Manufacturers are further challenged to use recycled plastics in their current form because they often do not perform as well as prime, or virgin, plastics, due to degradation or contamination issues. Without a bold shift in approach, the mismanagement of plastics waste will worsen, resulting in the loss of valuable materials and missed opportunities to recover and harvest the value of these resources.

THE OPPORTUNITY

The good news is that innovative technologies exist - with even more emerging and scaling - to solve these challenges. These technologies are transforming waste plastics into building blocks for new materials.

If these technologies are more widely adopted and scaled, tremendous economic value can be realized. According to our analysis, there is an existing $120 billion addressable market in the U.S. and Canada for plastics and petrochemicals that could be met, in part, by recovering waste plastics. This renewed resource could displace fossil fuels being used in these markets today. Furthermore, there are environmental benefits from recycling waste plastics back into a myriad of useful products, including reducing or avoiding environmental pollution, significant amounts of CO2 emissions and potentially hazardous chemical pollutants.

To reach this potential, more investment is urgently needed to support and scale these transformational technologies. We are calling on brands and investors to seize the opportunities presented by today's landscape of innovators and the growing demand for recycled materials.



WHERE ARE WE COMING FROM?

The Center for the Circular Economy at Closed Loop Partners is committed to accelerating solutions for more circular supply chains at scale. Over the past year, the Center has been exploring innovative technologies that effectively transform waste plastics into like-new materials. While many have tremendous potential, they also challenge us to expand our current definition of recycling.

Closed Loop Partners undertook this project to learn more about technologies and their potential role in scaling circular supply chains, transforming markets, and stopping plastics waste in the US and Canada. **The goal of this report is to reflect the current landscape of technology providers focused on converting waste plastics into a variety of safe and high-quality materials, as well as the scale of opportunity for these providers to meet demand.**

We want to share these learnings with the many actors who participate in the system today. For consumer brands, chemical companies, and investment firms like Closed Loop Partners, this report is the first in an ongoing effort to shape investment strategies and infrastructure over the next five to ten years.

By developing a shared landscape and understanding of next steps, this report aims to make a complex topic more approachable and accessible, while also building on current momentum, and generating excitement about the opportunities ahead of us.



EXECUTIVE SUMMARY

This report offers a survey of the current technology landscape and opportunities for repurposing waste plastics into a variety of safe and high-quality materials.

Recommendations include:

1. Invest: Investors, brands, and industry must urgently invest to bring transformational technologies to scale.

2. Educate: Increasing awareness and adopting shared terminology and understanding of these technologies will make them more accessible to a wider audience.

3. Collaborate: Brands and industry need to develop partnerships with technology providers to create new business models that will match the current technologies with the infrastructure of plastics and petrochemical manufacturing, waste management and recycling.

KEY FINDINGS

1.
TECHNOLOGIES THAT KEEP PLASTICS IN PLAY MUST BE PART OF THE SOLUTION TO END PLASTICS POLLUTION.

+ **Demand for plastics is strong and growing**, yet the supply of recycled plastics available to meet demand is stuck at 6% [2]

+ There are an estimated 34+ million metric tons of plastics landfilled or incinerated in the U.S. and Canada each year [1], [5].

+ Current infrastructure and technologies are limited in their ability to transform all of the diverse types of plastics used today into high-value feedstocks that compete with prime, or virgin, materials.

+ Technologies exist to repurpose these plastics into valuable materials; **purification, decomposition, and conversion technologies** can all play a role.

2.
THERE IS REAL DEMAND FOR PLASTICS AND OTHER MATERIALS ACROSS THE SUPPLY CHAIN.

+ Analysis indicates that if these technologies can meet market demands, they have potential revenue opportunities of **$120 billion in the U.S. and Canada alone.**

+ The world's largest brands, retailers and plastics manufacturers are making commitments around plastics recycling, recycled and recyclable content, and recovery. **Current projections indicate new demand for recycled plastics of 5 to 7.5 million metric tons by 2030** [2], [6].

+ Beyond plastics, markets also exist for chemicals and fuels - creating even more opportunity for waste plastics to be repurposed into materials that can continue to flow through our economy.

3.
THIS IS POSSIBLE. THE INNOVATION EXISTS TO MEET THE DEMAND.

+ This study identifies **60 technology providers**, nearly all of them at least at the lab stage of maturity, with significant potential to grow and scale. Although many are in the early stages of securing the capital needed to scale and meet demand, more than 40 solution providers are operating early commercial scale plants in the U.S. and Canada today, or have plans to do so in the next two years.

+ **There is money to be made.** Technology providers are operating profitably with higher margins as they mature and scale.

+ **250 investors and strategic partners**, including the world's largest brands, private investors, petrochemical companies and plastic manufacturers, and government and NGO partners, are already engaging with the companies profiled in the study.

+ **Going from "possible" to "probable"** will require: new solutions and business models that integrate innovations with existing infrastructure, flexible technology platforms that can evolve over time, and market incentives driven by public and private policies.

KEY FINDINGS

1. TECHNOLOGIES THAT KEEP PLASTICS IN PLAY MUST BE PART OF THE SOLUTION TO END PLASTICS POLLUTION.

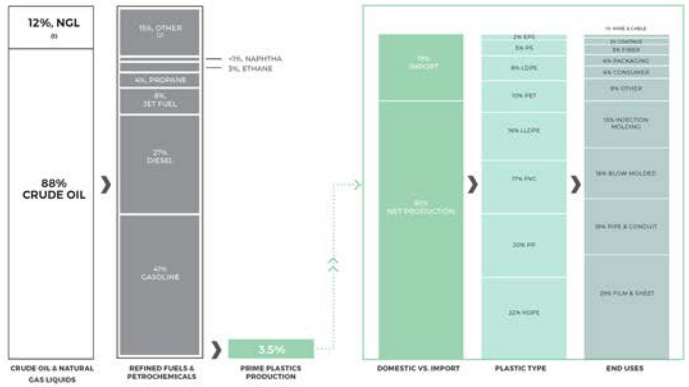
FINDING 1.

The very public issue of ocean plastics has put consumer brands and their suppliers on notice by governments and consumers. For an increasing number of brands, this monumental challenge can be solved by becoming buyers of their own products and packaging. Closing the loop on resources means reducing fossil fuel extraction and exposure to volatile oil prices, earning credit for responsible behavior from government and NGOs, and building brand loyalty with consumers. As brands commit to and shift toward circular supply chains, there is friction between existing infrastructure and the future state. The current supply of recycled plastics is far less than the demand suggested by these publicly stated goals.

It is essential that society stops thinking of plastics as waste, and starts treating them as resources. Today, our options for recycling plastics are limited and low value. With current infrastructure, a small portion - less than 10% - of plastics waste from many consumer packages and products is recovered and recycled [1]. Consumers, governments, brands, chemical companies, and investors want to change that. But it is clear that real change must include new solutions at a broader scale. Transformational technologies that allow us to keep plastics in play must be part of the solution.

In 2018, nearly 42 million metric tons of plastics were produced in North America, driving revenues of $47 billion [2]. The raw materials used in plastics production represent 3-4% of crude oil and natural gas liquid (NGL) production in North America, not including the energy used to make plastics. These raw materials can be made into many different types of plastics, such as polystyrene (PS), polypropylene (PP), and polyethylene terephthalate (PET). These plastics serve various end uses beyond packaging, including pipes, films, and coatings.

AGGREGATE MATERIAL FLOW 2018



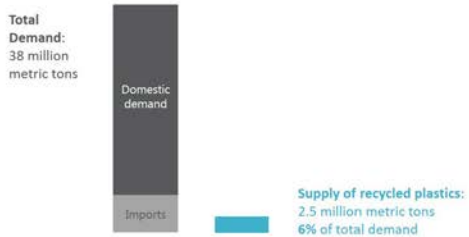
(1) 91% of raw materials used in prime plastics production in North America comes from natural gas liquids (e.g., ethane, propane).
(2) "Other" includes residual fuel oil, butane, kerosene

Source: IHS Markit, AFPA

FINDING 1.

Demand for plastics is strong and growing, but current supply of recycled plastics meets just 6% of demand. In the U.S. and Canada, 2.5 million metric tons of post-use recycled plastics were available in 2018. This represents only 6% of the 38 million metric tons of demand for the most common plastics.

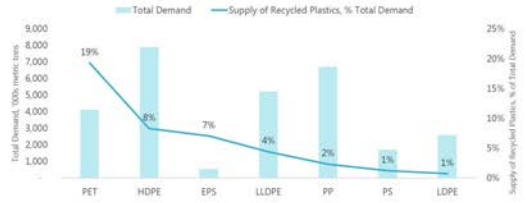
2018 AGGREGATED PLASTICS DEMAND + RECYCLED SUPPLY, U.S & CANADA



Source: IHS Markit

Six percent doesn't tell the whole story. The supply of the most commonly recycled plastic, PET, represents less than 20% of total demand, as shown in the chart below. The gap between demand and recycled supply is even greater for other common plastics, such as high density polyethylene (HDPE), polypropylene (PP), polystyrenes (PS/EPS), and films (LLDPE/LDPE).

2018 SUPPLY OF RECYCLED PLASTICS AND TOTAL DEMAND IN U.S. & CANADA



Source: IHS Markit

Plastics waste is a huge untapped resource. Using recycled plastics has benefits in many applications: it can be cheaper than prime plastics; pricing is less volatile than prime; and using it does not depend on new extraction of non-renewable fossil fuel resources.

With global demand for plastics projected to triple by 2050 [3] and an increase in demand for recycled plastics of at least 5 million tons in the next five to ten years, the overall contribution of plastics waste to this supply chain must change dramatically.

Where is the rest?

FINDING 1.

The U.S. and Canada sends 34 million tons of plastics to landfills or incinerators each year. This costs communities more than $2.2 billion in disposal fees [5], [7]. The lost commodity value from plastics that are not recycled is even greater. For example, 6.6 million metric tons of polypropylene were produced in the U.S. and Canada in 2018. Mechanical processing yielded just 150,000 metric tons (2%) of recycled PP returned to the supply chain at a value of $1,100/ton. If all production was replaced with recycled PP, this differential would translate into $4.2 billion in revenues [2], [7], [8].

We're throwing valuable material away every day. Why is this happening?

- Plastics aren't recovered effectively. Consumers are confused by messages on how to recycle, or do not have convenient services at home, work or school. These barriers translate into low capture and high contamination rates, the primary reason China and India have banned imports of recycled plastics from North America [9], [10].
- "Chop-and-wash" processing technologies were not designed to deal with the complex and highly variable plastics coming through our waste streams today. Mechanical recycling works well for certain grades of PET and HDPE, but are limited in their ability to sort and process films and labels, chip bags, pouches, consumer electronics and hardware, synthetic fibers, and other "mixed plastics". Contamination and degradation prevent the material from continuously staying in play.
- The embedded costs today cannot compete with world-scale plastics manufacturing. The cost structure of mechanical recycling from bale to pellet can exceed $1,000/ton [11].

The challenges of the current system are likely to get worse. The complexity of plastics entering the waste stream will continue to increase as more consumer products and packaging take advantage of material innovations. For example, flexible packaging is the fastest growing segment of the packaging industry [12]. At the same time, demand for recycled plastics is expected to increase dramatically, as consumer packaged goods companies and packaging producers go after recycled content goals. Current reprocessing capabilities have difficulty meeting quality specifications

FINDING 1.

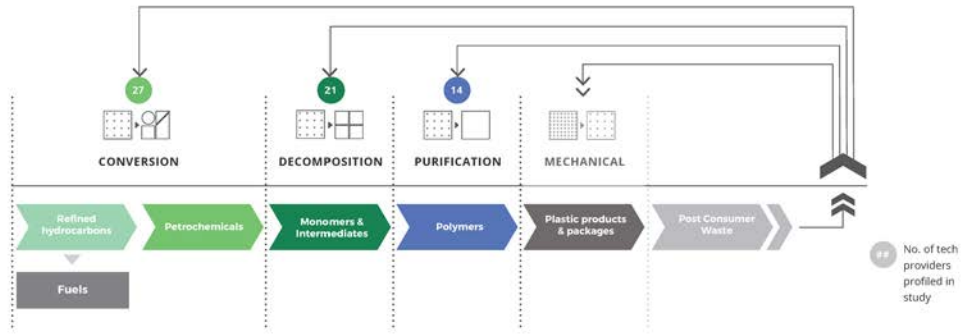
Technologies exist to repurpose plastics waste into valuable materials.

This study identifies 60 technology providers that can be broadly categorized as using one (or more) of three processes today. Detailed profiles of each provider can be found in the Appendix.

PURIFICATION is a process that involves dissolving plastic in a solvent, then separating and purifying the mixture to extract additives and dyes to ultimately obtain a "purified" plastic. The purification process does not change the polymer on a molecular level.

DECOMPOSITION is a process that involves breaking molecular bonds of the plastic to recover the simple molecules ("monomers") from which the plastic is made. Monomers may be single molecules or short fragments of molecules bound together called "oligomers," both of which are often reconstructed into plastics. This process, sometimes referred to as "depolymerization", can be biological, chemical, or thermal, and in some cases, a combination of two or three of these methods.

CONVERSION is similar to decomposition in that the process involves breaking the molecular bonds of the plastic. A key difference is that the output products from conversion processes are often liquid or gaseous hydrocarbons similar to the products derived from petroleum refining. These raw materials may enter different supply chains, such as fuels for combustion, and/or petrochemicals (e.g., naphtha) that can be made into intermediates and monomers for new plastics.



In the illustration above, "Monomers" includes other intermediates, such as paraxylene. In the current landscape, these intermediates are often made from petrochemicals produced by the conversion process.

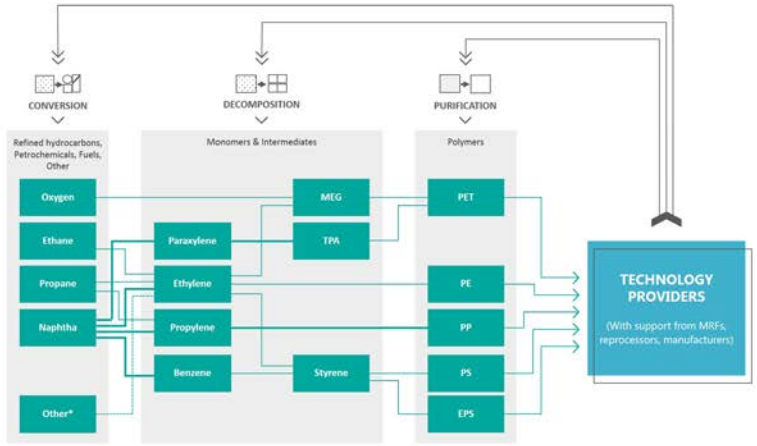
FINDING 1.

While these processes are not new, technology providers are applying them in innovative and exciting ways. **Investors and brands have an opportunity to influence and accelerate solutions that repurpose plastics waste and keep materials in play.**

Technology providers are transforming the plastics supply chain. The technology providers profiled in the landscape demonstrate real opportunities to reduce our reliance on fossil fuels and start transforming plastics waste into a renewed resource throughout the supply chain.

Technology providers have the ability to select how and where they will re-enter the plastics supply chain. The pathway of possibilities for creating new products with conversion are endless (but generally require more energy), while the pathways with decomposition and purification are more restricted (but generally require less energy).

The illustration below shows where the different processes impact many of the chemicals, monomers, and intermediates that become the most common plastics in use today.



*Note: "Other" includes butane and gas oil.
Source: IHS Markit, AFARA

Decomposition technology providers in the landscape are largely focused on producing monomers such as MEG, TPA, and styrene. One conceptual technology provider is planning to produce ethylene and propylene through decomposition. Other chemical intermediates, such as paraxylene, are referenced here to demonstrate the pathway for refining conversion products (e.g., naphtha) back into monomers and eventually to polymers.

P. 14

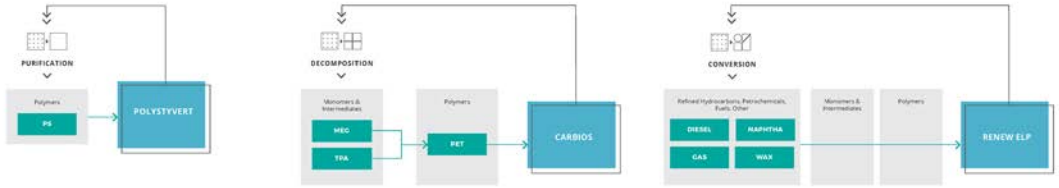
FINDING 1.

Our research looked at 60 technology providers working with different material types and at different stages of maturity. Below are examples that illustrate some of the exciting applications of technologies being developed today.

Canada-based **Polystyvert** applies a combination of filtration, dissolution, and purification using an essential oil to process all forms of polystyrene (PS), including expanded PS, extruded PS, and high-impact PS, back into PS polymer that can be remade into plastics.

Carbios, based in France, is using an enzymatic process to biologically recycle PET back into the monomers MEG and TPA to make PET polymer again.

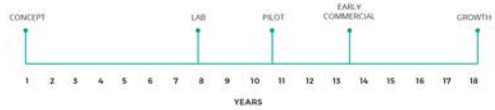
Nearly half (27) of the providers surveyed are using conversion technologies to produce diverse outputs. **Renew ELP**, as one example, is focused on recovering the most contaminated mixed plastics coming from municipal solid waste and using a chemical conversion process to produce naphtha (which is a key ingredient in many plastics), as well as fuels (diesel, gas), and other petrochemicals (waxes).



Profiles of the technology providers reviewed in this landscape are provided in the Appendix.

FINDING 1.

AVERAGE TIMELINE TO MATURITY



Source: Primary Research
Note: Based on 62 (in scope) technologies, as of January 2019

Of the 60 technology providers surveyed, **it has taken, on average, 17 years to reach growth scale.**

Furthermore, the more mature companies are typically those that produce fuels and petrochemicals from plastics waste. Those that produce polymers are at an earlier stage, on average.

Why?

Technology providers cite challenges as they try to engage with investors, partners and customers who do not understand the technology or the business models. *"[Our biggest challenge is] education that plastics can be used as feedstock and building awareness that we have solutions on what to do with it. It's more than "who is Agilyx?" says Chris Faulkner, Vice President of Technology Group, at Agilyx [13].*

Making these technologies more accessible is critical to fundraising. Approximately 25% of technology providers included in the landscape shared that they were fundraising when surveyed. Although there is a wide range of funds depending on the stage of maturity (pilot through early commercial), the average raise for provider is $15 million, or more than $200 million in aggregate. The time spent building awareness and educating to open the door to these conversations is time that cannot be spent on execution at scale.

One relative success story, **Pyrowave**, has accelerated the timeline for bringing technologies from the lab to early commercial scale. Based in Oakville, Ontario in Canada, Pyrowave decomposes post-consumer PS into styrene monomers, using microwave technology. The diverse range of input plastics that can be processed allows for flexibility in their portfolio to adapt to market needs and tap into diverse supply chains.

After a few years in development, Pyrowave became a company in 2014 and has reached commercial scale within 5 years. Pyrowave has been backed by a strong team of executives and investors, including high profile board members and advisors who have a strong understanding of the market, and developed a strategy that fits the market need. The company has taken on predominantly non-dilutive capital, including from Export Development Canada (EDC) and Business Development Bank of Canada (BDC), allowing the team to control decision making.

As CEO Jocelyn Doucet describes it: *"We've put 10 years of work into bootstrapping the technology at a time when plastic pollution was not very much debated, but still a fast growing environmental crisis. Our initial vision 10 years ago is now giving us a very good shot at solving this problem."* [14]

Many of these technologies are founded by technologists, i.e., scientists and chemists who are not necessarily experienced CEOs or marketers. Therefore, partnerships are critical for complementing their core expertise to build a successful business. **For those who have been successful, they attribute their strategic partnerships as key to accelerating their growth.**

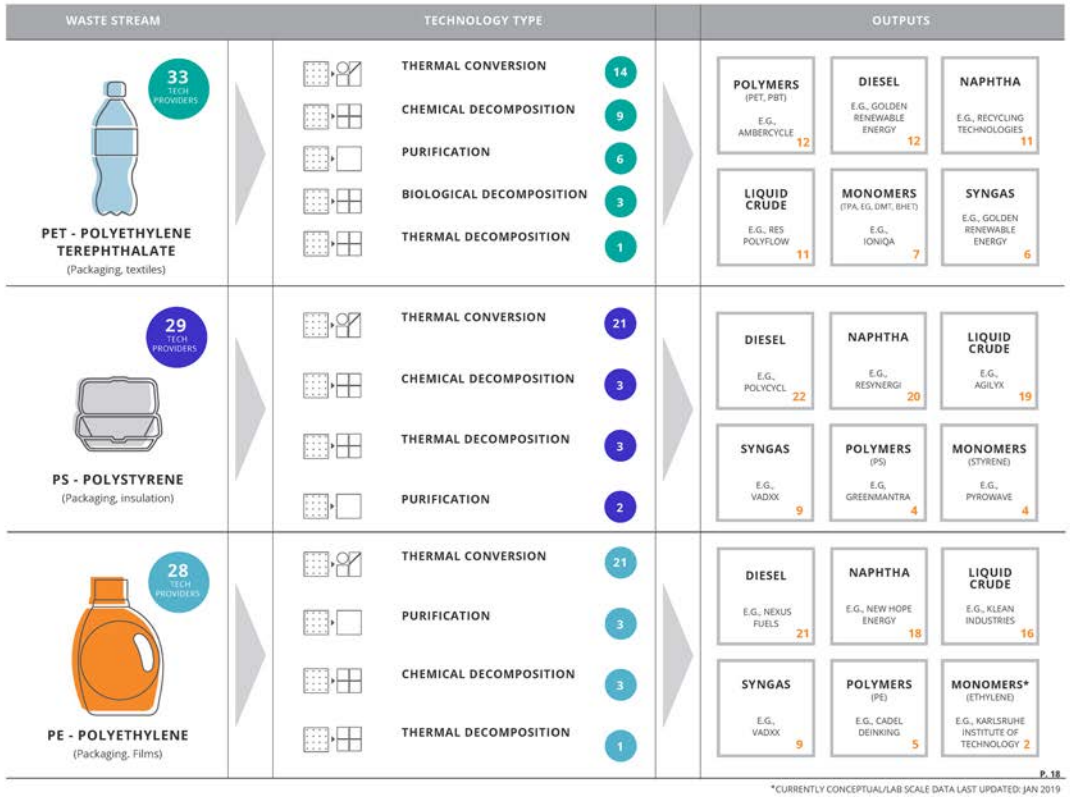
One example of a technology provider successfully forming key partnerships is **Loop Industries.** Founded in 2015, the company decomposes PET back into monomers, and then partners to produce a like-new recycled PET pellet. Loop has engaged with cross-industry stakeholders and established partnerships that can drive impactful change to the recycling supply chain. Partnerships have taken many forms. Loop has signed investment term sheets with Danone/Evian, Nestlé Waters, and L'Oreal. They have secured offtake agreements with Gatorade, PepsiCo, Coca-Cola, L'Occitane and Drinkworks. Loop has also established strategic partnerships, including a joint venture with one of the world's largest manufacturers of prime PET resin Indorama, and a global alliance agreement with thyssenkrupp.

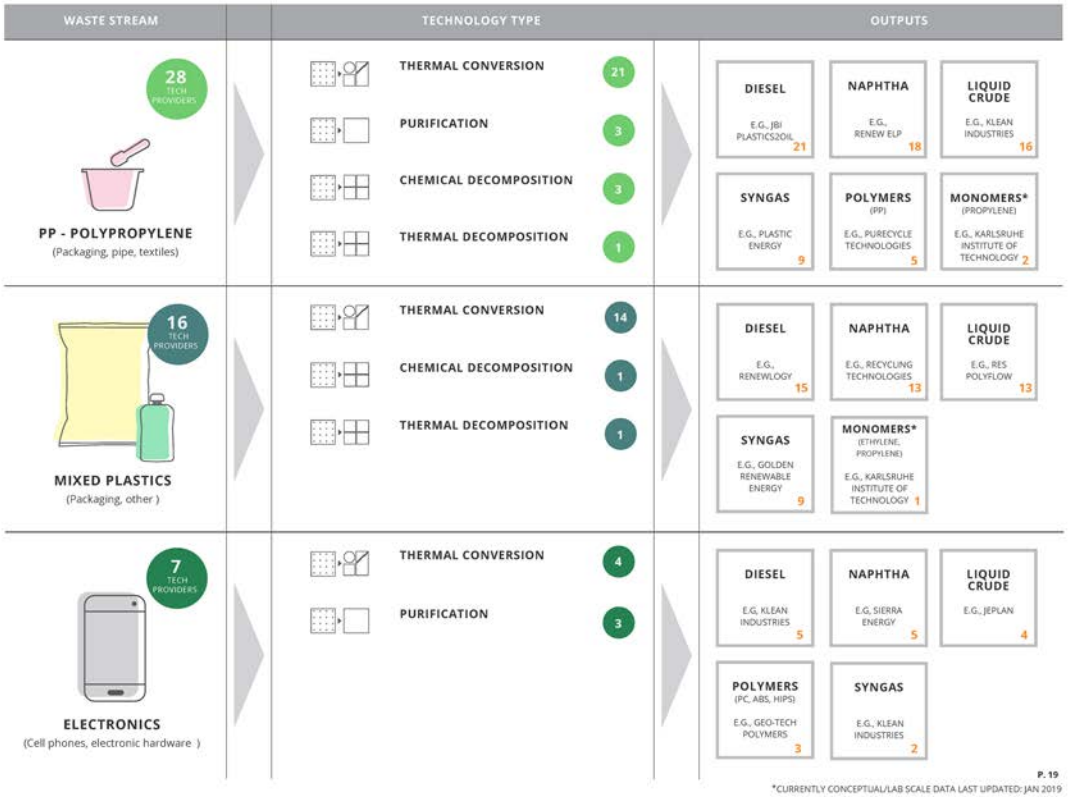
Technology providers must scale faster with support from key partners. These technologies all have the potential to scale, but their growth and commercialization needs to be accelerated in order to meet growing demand. With better access to investment capital and increasing demand from brands and supply chain partners, **technology providers may soon be able to accelerate the pace of growth.**

P. 16

What are the technologies and outputs that work for a specific type of plastic?

The following pages summarize the technology providers working with different plastics waste streams and the processes they are using to generate different output products.


WASTE STREAM
TECHNOLOGY TYPE
OUTPUTS
33 TECH PROVIDERS
PET - POLYETHYLENE TEREPHTHALATE
(Packaging, textiles)
THERMAL CONVERSION 14
CHEMICAL DECOMPOSITION 9
PURIFICATION 6
BIOLOGICAL DECOMPOSITION 3
THERMAL DECOMPOSITION 1
POLYMERS (PET, PBT) E.G., AMBERCYCLE 12
DIESEL E.G., GOLDEN RENEWABLE ENERGY 12
NAPHTHA E.G., RECYCLING TECHNOLOGIES 11
LIQUID CRUDE E.G., RES POLYFLOW 11
MONOMERS (TPA, EG, DMT, BHET) E.G., IONIQA 7
SYNGAS E.G., GOLDEN RENEWABLE ENERGY 6
29 TECH PROVIDERS
PS - POLYSTYRENE
(Packaging, insulation)
THERMAL CONVERSION 21
CHEMICAL DECOMPOSITION 3
THERMAL DECOMPOSITION 3
PURIFICATION 2
DIESEL E.G., POLYCYCL 22
NAPHTHA E.G., RESYNERGI 20
LIQUID CRUDE E.G., AGILYX 19
SYNGAS E.G., VADXX 9
POLYMERS (PS) E.G. GREENMANTRA 4
MONOMERS (STYRENE) E.G., PYROWAVE 4
28 TECH PROVIDERS
PE - POLYETHYLENE
(Packaging, Films)
THERMAL CONVERSION 21
PURIFICATION 3
CHEMICAL DECOMPOSITION 3
THERMAL DECOMPOSITION 1
DIESEL E.G., NEXUS FUELS 21
NAPHTHA E.G., NEW HOPE ENERGY 18
LIQUID CRUDE E.G., KLEAN INDUSTRIES 16
SYNGAS E.G., VADXX 9
POLYMERS (PE) E.G., CADEL DEINKING 5
MONOMERS* (ETHYLENE) E.G., KARLSRUHE INSTITUTE OF TECHNOLOGY 2
P. 18
*CURRENTLY CONCEPTUAL/LAB SCALE DATA LAST UPDATED: JAN 2019


WASTE STREAM
TECHNOLOGY TYPE
OUTPUTS
28 TECH PROVIDERS
PP - POLYPROPYLENE
(Packaging, pipe, textiles)
THERMAL CONVERSION 21
PURIFICATION 3
CHEMICAL DECOMPOSITION 3
THERMAL DECOMPOSITION 1
DIESEL
E.G., JBI PLASTICS2OIL 21
NAPHTHA
E.G., RENEW ELP 18
LIQUID CRUDE
E.G., KLEAN INDUSTRIES 16
SYNGAS
E.G., PLASTIC ENERGY 9
POLYMERS (PP)
E.G., PURECYCLE TECHNOLOGIES 5
MONOMERS* (PROPYLENE)
E.G., KARLSRUHE INSTITUTE OF TECHNOLOGY 2
16 TECH PROVIDERS
MIXED PLASTICS
(Packaging, other)
THERMAL CONVERSION 14
CHEMICAL DECOMPOSITION 1
THERMAL DECOMPOSITION 1
DIESEL
E.G., RENEWLOGY 15
NAPHTHA
E.G., RECYCLING TECHNOLOGIES 13
LIQUID CRUDE
E.G., RES POLYFLOW 13
SYNGAS
E.G., GOLDEN RENEWABLE ENERGY 9
MONOMERS* (ETHYLENE, PROPYLENE)
E.G., KARLSRUHE INSTITUTE OF TECHNOLOGY 1
7 TECH PROVIDERS
ELECTRONICS
(Cell phones, electronic hardware)
THERMAL CONVERSION 4
PURIFICATION 3
DIESEL
E.G, KLEAN INDUSTRIES 5
NAPHTHA
E.G, SIERRA ENERGY 5
LIQUID CRUDE
E.G., JEPLAN 4
POLYMERS (PC, ABS, HIPS)
E.G., GEO-TECH POLYMERS 3
SYNGAS
E.G., KLEAN INDUSTRIES 2
P. 19
*CURRENTLY CONCEPTUAL/LAB SCALE DATA LAST UPDATED: JAN 2019

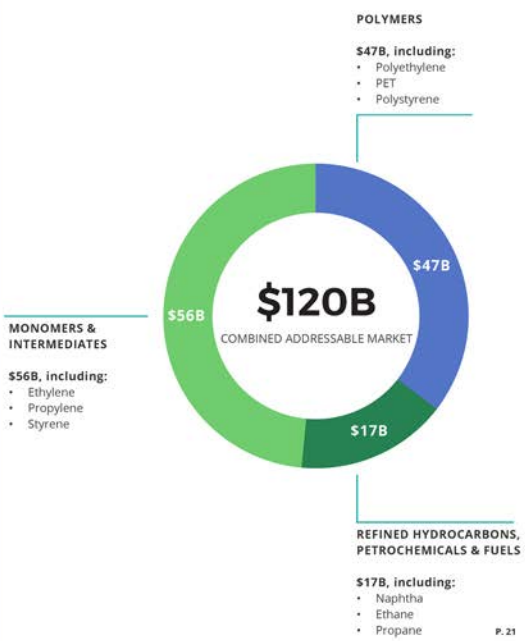

2.
THERE IS REAL DEMAND FOR PLASTICS AND OTHER
MATERIALS ACROSS THE SUPPLY CHAIN.

The technologies in this landscape produce a portfolio of materials that can meet demand for plastics and beyond. Currently, there is a significant and growing market for recycled plastics, as brands continue to make public commitments to use more recycled content and better manage plastics pollution. Beyond this, there is real demand for plastics, chemicals, and fuels that could be met by these transformational technologies.

In aggregate, the relevant market opportunity in North America -- including polymers, monomers, intermediates, and other chemicals -- totals $120 billion annually.

A $120 billion addressable market reflects those outputs that have a pathway back to plastics. However, including other outputs, such as diesel and gasoline, jet fuels, and liquid oils, would significantly increase the market opportunity.

SIZE OF THE PRIZE



FINDING 2.

Brands, retailers, and manufacturers are driving demand for recycled plastics with commitments.

Thirty-seven (37) of the world's largest consumer brands and retailers , including Coca-Cola [15], Danone [16], Nestlé [17], PepsiCo [18], Unilever [19], Walmart [20], and others [6] have made public commitments to use recycled plastics in their packaging within the next 10 years, signaling the opportunity to shift billions of dollars from the "take, make, waste" linear supply chain to circular supply chains. Current projections indicate new real demand of 5 million to 7.5 million metric tons by 2030 , requiring an increase of supply of 200-300% [2], [6].

Beyond plastics, the demand also exists for chemicals and fuels - creating even more opportunity for waste plastics to be repurposed into materials that can continue to flow through our economy. Other industries, including automotive and textiles/carpets, are already large, active end users of recycled plastics today.

Signals from large buyers are translating into contracts and offtake agreements.

TABLE 1: EXAMPLES OF RECENT OFFTAKE PARTNERS

Technology Provider	Known Offtake Partners
Agilyx	Monroe Energy (a wholly owned subsidiary of Delta Airlines), Americas Styrenics, and INEOS Styrolution
Aquafil	Adidas, Volcom, Stella McCartney, Interface, Milliken, Mannington, and Tarkett Group
GreenMantra Technologies	Sun Chemical
Ioniqa	Unilever and Indorama Ventures
Loop Industries	Indorama, PepsiCo, Coca-Cola's Cross Enterprise Procurement Group, Danone/Evian, L'Oreal, Nestlé Waters, Gatorade, L'Occitane, and Drinkworks
perPETual	Adidas, H&M, Zara, Puma, Vero Moda, and Decathalon
Plastic EnergyTM	SABIC
PureCycle	P&G
Pyrowave	INEOS Styrolution
Recycling Technologies	Interchem, Kerax
RES Polyflow	BP, AM Wax
Sierra Energy	State of California and the US Army

Plastics manufacturers such as Indorama [21] and SABIC [22] are making strategic investments in plastics-to-plastics solutions. Chemicals companies, such as BASF [23], Eastman Chemicals [103], and LyondellBasell [24], are integrating advanced technologies in their own manufacturing and supply chains. As an industry, plastics resin producers in the U.S. have announced ambitious goals [25] to responsibly manage plastics packaging, including to recover and recycle all plastics packaging by 2040. The top 20 global resin makers have also recently announced a $1.5B commitment to infrastructure and innovation through the Alliance to End Plastic Waste.

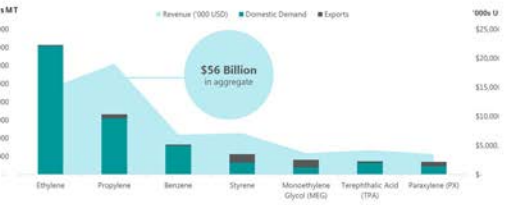
FINDING 2.

Addressable markets exist beyond plastics.
Many technology providers assessed in the landscape are able to transform plastics into many useful building blocks, creating co-products beyond raw materials for plastics. Technologies that convert mixed plastics, such as LDPE film, PP pots/tubs/trays, HDPE piping with varying material properties, levels of contamination and moisture content, such as Renew ELP, will yield naphtha (a chemical feedstock used to make plastics) and other end products. Looking at the spectrum of outputs across the supply chain, it is clear that technology providers today see a broader opportunity in addition to the plastic to plastic supply chain.

The polymers market on its own is $47 billion in annual revenue for the U.S. and Canada. Purification processes make it possible to safely transform carpet into yogurt cups -- greatly increasing the value of plastics waste and expanding the opportunities for technology providers and investors.

Decomposition and conversion technologies offer new opportunities to access petrochemical markets that have not typically been accessible to traditional plastics recyclers. The following chart shows a sampling of monomers and intermediates that represent raw materials and feedstocks used to make plastics and other useful materials. Above and beyond the market for polymers, **many of the monomers and intermediates used in the most common plastics collectively represent an addressable market of $56 billion.**

2018 DEMAND AND REVENUES FOR SELECT MONOMERS & INTERMEDIATES, U.S, & CANADA



Based on average spot prices (USD)
Source: IHS Markit

The economics of producing low-cost, more contamination-tolerant outputs has driven many technology providers to produce fuels. However, this may be changing. As illustrated by the biofuels industry [26], technology providers that solely followed a fuel-based model did not survive in that market over the long term. In the case of biofuels, many operators ultimately transitioned towards higher value chemical products for the cosmetics or pharmaceutical industries. In order to sustain their business as markets evolve, it is important for technology providers to build flexible platforms that allow for greater optionality.

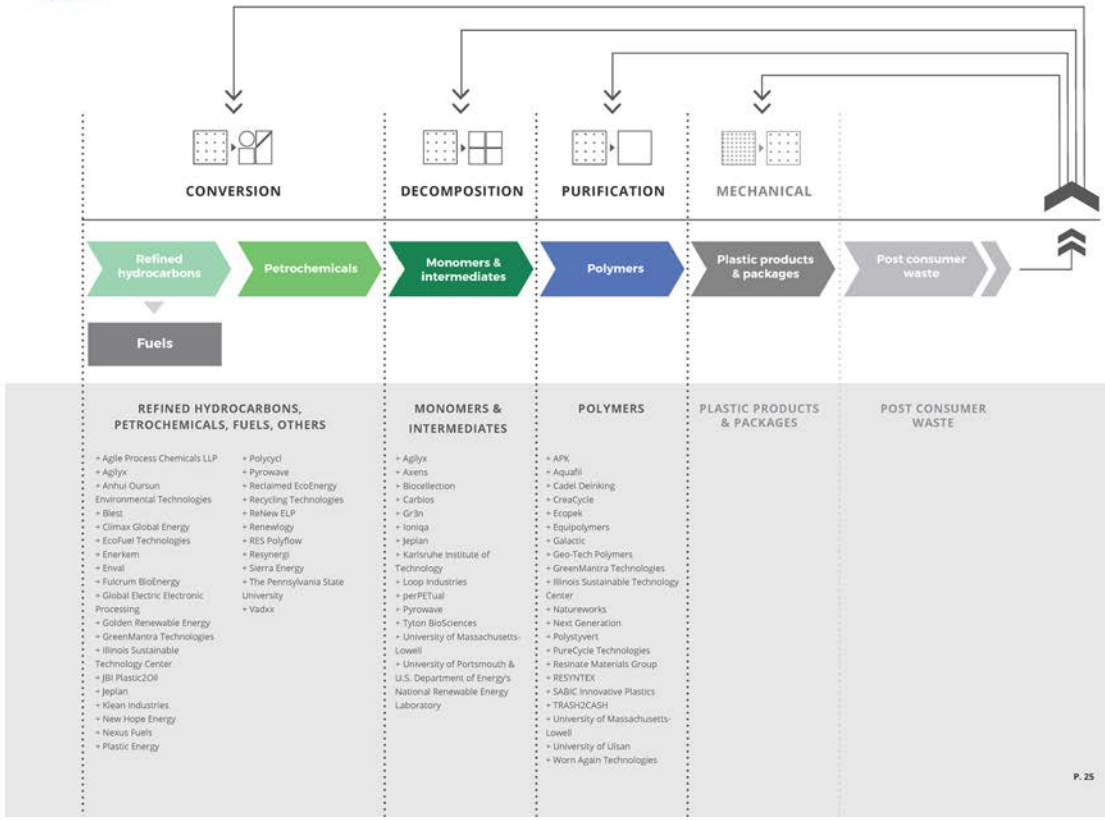
Recent shifts in demand for plastics-to-plastics solutions has encouraged innovators, such as Agilyx, to build more circular business models over time.

Founded in 2004, **Agilyx** began as a thermal conversion technology provider that takes mixed plastics and converts them into liquid oil products. Volatile and low oil prices inspired Agilyx to pursue additional revenue streams, leading them to adapt their existing technology to develop a Polystyrene-to-Styrene Monomer (PSM) System that creates chemical feedstocks for plastic. While never losing their roots in the fuel business, Agilyx has expanded their portfolio to a dual revenue model of producing both chemicals and fuels.

3. THIS IS POSSIBLE. THE INNOVATION EXISTS TO MEET THE DEMAND.

If the opportunity and demand is there, the current landscape of technologies indicates that producing the supply is possible. This assessment surveyed more than 60 technology providers; all had significant potential to grow and scale. There is also increasing momentum building among different players. The innovation exists to meet the demand.

FINDING 3.


CONVERSION
DECOMPOSITION
PURIFICATION
MECHANICAL
Refined hydrocarbons
Petrochemicals
Fuels
Monomers & intermediates
Polymers
Plastic products & packages
Post consumer waste
REFINED HYDROCARBONS, PETROCHEMICALS, FUELS, OTHERS
+ Agile Process Chemicals LLP
+ Agilyx
+ Anhui Oursun Environmental Technologies
+ Blest
+ Climax Global Energy
+ EcoFuel Technologies
+ Enerkem
+ Enval
+ Fulcrum BioEnergy
+ Global Electric Electronic Processing
+ Golden Renewable Energy
+ GreenMantra Technologies
+ Illinois Sustainable Technology Center
+ JBI Plastic2Oil
+ Jeplan
+ Klean Industries
+ New Hope Energy
+ Nexus Fuels
+ Plastic Energy
+ Polycycl
+ Pyrowave
+ Reclaimed EcoEnergy
+ Recycling Technologies
+ ReNew ELP
+ Renewlogy
+ RES Polyflow
+ Resynergi
+ Sierra Energy
+ The Pennsylvania State University
+ Vadxx
MONOMERS & INTERMEDIATES
+ Agilyx
+ Axens
+ Biocellection
+ Carbios
+ Gr3n
+ Ioniqa
+ Jeplan
+ Karlsruhe Institute of Technology
+ Loop Industries
+ perPETual
+ Pyrowave
+ Tyton BioSciences
+ University of Massachusetts-Lowell
+ University of Portsmouth & U.S. Department of Energy's National Renewable Energy Laboratory
POLYMERS
+ APK
+ Aquafil
+ Cadel Deinking
+ CreaCycle
+ Ecopek
+ Equipolymers
+ Galactic
+ Geo-Tech Polymers
+ GreenMantra Technologies
+ Illinois Sustainable Technology Center
+ Natureworks
+ Next Generation
+ Polystyvert
+ PureCycle Technologies
+ Resinate Materials Group
+ RESYNTEX
+ SABIC Innovative Plastics
+ TRASH2CASH
+ University of Massachusetts-Lowell
+ University of Ulsan
+ Worn Again Technologies
PLASTIC PRODUCTS & PACKAGES
POST CONSUMER WASTE
P. 25

FINDING 3.

More than 40 technology providers are operating pilot and commercial scale plants in the U.S. and Canada today, or have plans to do so in the next two years. The scale of operations may still be very small (and highly distributed) relative to existing petrochemical infrastructure, but the potential to scale is real.

Many technology providers have spent the last decade optimizing their technology and, in collaboration with critical partners, are emerging beyond the lab to scale up. Planned facilities include:

- **PureCycle Technologies** will be commissioning Phase 1 of their plant (the Feedstock Evaluation Unit) with support from P&G and Closed Loop Partners.
- **Recycling Technologies** is building their first commercial scale plant in Scotland with support from InterChem, Kerax, and Swindon Borough Council, and may soon look to expand to North America.
- **Worn Again** is planning to establish their first industrial demonstration plant to be operational by 2021 with support from H&M, Kering, Sulzer Chemtech, Himes Corporation among others.

There's a critical need to replicate and scale operating facilities to process enough waste plastics to make a meaningful impact on current supply.

There is money to be made.
The landscape shows that technology providers can profitably transform waste plastics through conversion, decomposition, and purification technologies.

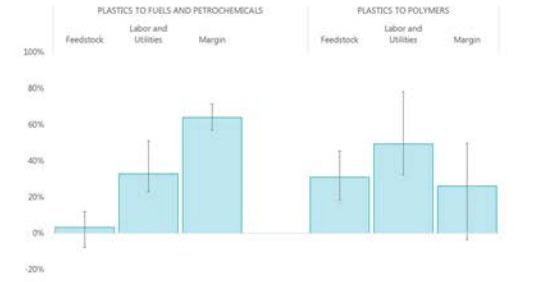
Today, the business case is stronger for providers producing petrochemicals and fuels, with **consistently positive margins, ranging from 60-70%** (Operating Expenses [OpEx] only, based on EBITDA - see figure to the right). Overall, the 27 providers converting plastics in this way are further along on the maturity scale, which contributes to higher margins and stronger economic performance.

Note: The margins presented in the figure represent EBITDA on technology providers' OpEx (Operating Expenses) only. These margins will be impacted by the cost of servicing debt and relevant taxes. Data presented is based on information shared by a subset of technology providers. Closed Loop Partners has not conducted financial due diligence on this information.

TECHNOLOGY PROVIDERS



OPERATING EXPENSES AND GROSS MARGINS, WITH RANGES



Source: Technology providers, AFARA, team analysis

FINDING 3.

These investments represent the first wave of opportunities, but not the only ones. The 14 providers in the landscape that are producing polymers have less track record and a longer time horizon to scale. For these technology providers, expected margins are still mostly positive today, ranging from -4% up to 50% (OpEx only, based on EBITDA), but highly variable.

Investing in both pathways can keep materials in play. While diverting waste plastics into fuels gives the material an additional "loop" in the economy, transforming waste plastics into petrochemicals or back into plastics can keep material flowing through the economy over multiple generations.

In reality, the two pathways are not mutually exclusive. Some technology providers generate a mix of outputs creating petrochemicals for plastics and fuels simultaneously. Ultimately, investment is needed in this space to mature all the technologies that can capture the economic opportunity. Technology providers who produce predominantly fuels are, on average, more mature, and require later stage investment, while the technology providers who produce predominantly plastic polymers are, on average, an attractive opportunity for earlier stage investors. A mix of financial instruments and strategies is needed to capture the full market opportunity.

Investors and strategic partners are already getting on board.
In the survey, we identified some 250 unique investors, suppliers, customers, and other partners that are engaged with these technology providers. We expect technology providers are enlisting help from many more partners and capital providers that are not yet publicly named as well.

Among those included in the landscape are:

- **National and local government agencies**, quasi-governmental capital providers, **research institutions, and support organizations**, including (in the U.S.) NASA, NREL (the National Renewable Energy Lab), REMADE Institute, state economic development agencies, and (in Canada) BDC, BIC, and Sustainable Development Technologies Canada; notable examples outside of North America can be found in the EU and UK, e.g., Ellen MacArthur Foundation
- **Private capital providers,** including Blackrock, Breakthrough Energy Ventures, Closed Loop Partners, Cycle Capital Management, Kleiner Perkins, Rabobank, and Royal Bank of Canada
- **Brands** and their venture funds, across categories including: consumer packaged goods (e.g., Coca-Cola, Danone, Kraft, Nestlé, PepsiCo, P&G, and Unilever), airlines (e.g., Cathay Pacific, Delta, Japan Airlines), cosmetics (e.g., L'Occitane, L'Oreal), fashion and apparel (e.g., Adidas, H&M, Levi Strauss & Co.), consumer electronics (e.g., Samsung), and furnishings (e.g., IKEA)
- **Most promisingly, petrochemicals and plastics industry** investment and partnerships, such as DAK, Dow, DSM, Indorama, Lyondell Basell, SABIC, TOTAL, and others

❯ Momentum is growing

Over the course of our research, which began in earnest in October 2018, **there has also been an uptick in the pace of research** on plastics waste, the future of the petrochemical industry, and solutions that include many of these technologies. This in and of itself is notable, as perspectives and data are emerging to inform decision-making in markets, policy, infrastructure, and investment capital. See Appendix for additional resources.

With growing interest and engagement coming from many different players in the system, **there is clear momentum for adopting and scaling** purification, decomposition and conversion infrastructure for waste plastics. Every sector of society is engaged in the broad challenges of climate change and the visible problem of plastics waste. The world's largest and most influential brands are taking ownership of the problem and looking at their own supply chains. Technology development is happening. There are solutions that are tackling key material types, producing materials in an environmentally beneficial way, attracting partners and capital, and becoming commercially viable.

We have reached an inflection point.



GOING FROM "POSSIBLE" TO "PROBABLE": IMPORTANT CONSIDERATIONS

In this moment of technology transition from a linear to circular system, a fundamental question is: **How fast and how far can we go?** For investors, brands, and industry, the answer depends upon four key shifts that will be critical to success.

We need to match up the scale of plastics manufacturing with the distribution of municipal solid waste.

Our linear patterns of consumption have been very good at creating infrastructure that goes from big (petrochemical pipelines) to little (single-use packages), but we now need to go from little (municipal recycling programs and curbside carts) to big (back to pipe). A few models, such as Renewlogy and Recycling Technologies, illustrate what more distributed infrastructure could look like. Fixing this mismatch will be key to achieving scale and market transformation over time.

We need more vertically integrated models to bring down cost structures and make sure the economics work to turn more material back to plastics.

While these models have been proven in the mechanical recycling space, the same cannot be said of more advanced technologies, which may require a very low-contamination stream of feedstock. For a technology provider, that may mean adding pre-processing capabilities to do advanced sorting of mixed materials or co-locating with a supplier or customer. Additional integration, whether through strategic partnerships, such as Ioniqa's partnership with Indorama, or bolt-ons to the core business model, will bring cost structures down as well.

We need to invest in technology platforms that are flexible and can evolve over time.

The benefits of going "upstream" to producing chemicals and fuels that meet many non-plastic markets needs to be considered carefully against the costs of switching as markets evolve. In the interest of scaling these technologies quickly, we risk locking in to technologies that incentivize more "single-use" behavior (i.e., optimizing for fuel production over feedstocks for plastics). Solutions with flexible platforms, such as Agilyx, are demonstrating process agility, allowing them to adapt as feedstocks and end markets shift.

We need market incentives to change.

In the EU and UK, policies have created incentives for scaling these technologies, and a clear framework within which different actors and innovators are developing infrastructure. However, policies in the U.S. and Canada today do not recognize or incentivize the use of these technologies for recycling. As one example, certain conversion technologies are understood as waste combustion, rather than recycling, in jurisdictions such as California and Quebec. Policies, both public and private, can help catalyze action and further scale. Supportive policy mechanisms in other markets have included: landfill bans, minimum recycled content requirements for production and manufacturing, credit schemes for tracking materials in the system, and resources dedicated to more comprehensive collections and recovery of post-use plastics. Models that can be adapted in the U.S. and Canada need to be better understood to shape adoption of these technologies across North America.

Where Are We Going?

By recognizing the opportunities to invest in and scale the technologies highlighted in this landscape, brands, investors and the plastics industry can dramatically impact plastics pollution and waste, create new value in markets and reduce carbon impact of plastics and petrochemical production. But the technologies alone will not solve these problems. Changing the system will only be successful if investments in transformational technologies are made alongside shifts in behavior, infrastructure, and economic incentives of multiple actors. If all of these shifts occur, **we can accelerate solutions at scale in North America.**

CALL TO ACTION: Investors, brands, and industry need to take action now to bring solutions to scale.

The demand for expanded capacity and technologies to recycle plastics is clear. The landscape indicates that it is possible to return far more waste plastics to supply chains than is currently in play today, thanks to the innovation being developed and scaled by technology providers. Now, we are calling on investors, brands, and industry partners to invest in innovative technologies that will accelerate the recycling of plastics. These investments will build capacity, expand to new markets, and scale current infrastructure.

This section outlines recommendations and tangible next steps. It is a call to action to work together to end plastics pollution and create a more circular plastics supply chain.


OUR RECOMMENDATIONS INCLUDE:
Invest: Investors, brands, and industry must urgently invest to advance the recycling of plastics and bring these solutions to scale.
Educate: Clearly define terminology to create shared understanding while making these technologies and processes more accessible to a wider audience.
Collaborate: To build on these findings, brands and industry need to work together to develop partnerships with technology providers to create new business models and agreements, and match the very small scale of current technologies with the very large scale infrastructure of plastics and petrochemical manufacturing.

CALL TO ACTION

INVEST

Investors: We need to engage a range of investors, including strategic investors, private equity, venture capital, impact investors, and public or philanthropic funders, to put more capital to work. These investments will help:

- **Accelerate scale and growth of current technology providers.** We can't afford to wait 17 years for new solutions to reach maturity.
- **Create value across the system.** We know successful models are likely to serve multiple end markets. By incentivizing continued recovery and return of plastics to material supply chains, we can prioritize models that create a throughline for materials to exist over multiple generations.
- **Deploy capital toward overall collection and recovery of plastics.** Scaling existing infrastructure or innovating new collections solutions can support the growth of many of these solutions. Closed Loop Fund, The Recycling Partnership and others are investing in collections infrastructure around the country, in close partnership with municipalities and independent operators. Innovation in this space, such as developing new collections models, are strongly needed. Public infrastructure financing schemes can help evolve the system too.

Brand & Industry: Large supply chains have a tremendous amount of influence to solving the plastics waste problem. At this moment, we are seeing significant alignment and opportunity to act. In order to propel the development of technologies and models forward, brands and industry must:

- **Continue to signal strong demand for recycled material.** Further commitments to secure feedstocks through long-term offtake agreements ensure that technology providers will have capital to scale. In the near-term, this may mean allowing for more flexible or premium pricing as technologies mature.
- **Support new business models and partnerships** (e.g., Ioniqa has received support from The Coca-Cola Company, Unilever and Indorama [27]). We need technology providers to have better access and feedback from downstream partners. Strategic investments will ensure that solving plastics waste is now core to a company's competitive advantage. Likewise, we need brands and their suppliers to invest together to help experiment and develop technology providers.

EDUCATE

- **Make the technology accessible.** One of the key challenges that technology providers expressed was the difficulty of explaining the technical side of their solution - whether to potential investors, municipalities, regulatory and permitting agencies, or brands. These technologies are not well understood by decision makers and influencers outside of the industry and academia. This landscape study has been a first attempt to make the issue accessible to a non-technical audience. There is still much work to be done to educate investors, brands and industry about these technologies, and clarify many other terms being used, e.g., chemical recycling, pyrolysis, gasification, or depolymerization.
- **Use shared language.** Intermediaries should make efforts to create common frameworks and definitions to help non-technical decision makers better understand how technologies apply to different supply chains and waste streams.
- **Share what we know.** Research needs to be shared widely. We suspect that much of the data exists, but has been held privately. A knowledge hub would help to consolidate and interpret the latest research.

COLLABORATE

- **Convene stakeholders to create opportunities for feedback and collaboration.** If we are interested in seeing a plastics supply chain in which more recycled plastic is reintroduced into plastic resin manufacturing, chemicals manufacturing, and even farther upstream to refining operations, then we have to bring more operators in the system to the table.
- **Learn from each other.** In the course of our research, we also recognize that technology providers do not have the benefit of learning from others in the field. A pre-competitive community of practice could help spread successful strategies at each stage of maturity.
- **Create syndicate investment opportunities.** Likewise, while it is remarkable that we identified so many investors already investing in individual companies, a forum for investors to share knowledge and syndicate investment into individual companies could increase deal flow and reduce the time technology providers must spend fundraising.

CALL TO ACTION

❯ It's time for bold action.

There is a clear and achievable opportunity to expand the role of transformational technologies that return waste plastics to material supply chains in the United States and Canada. To build on the progress made thus far, the system must drive investment in these solution providers, build awareness to make this work more accessible and encourage collaboration across stakeholders. Doing so will lead to a dramatic shift in plastics and chemicals supply chains over the next ten years - one that keeps plastics in play.

What's next?

This landscape introduces the current state of play for technologies that transform waste plastics and keep materials in play.

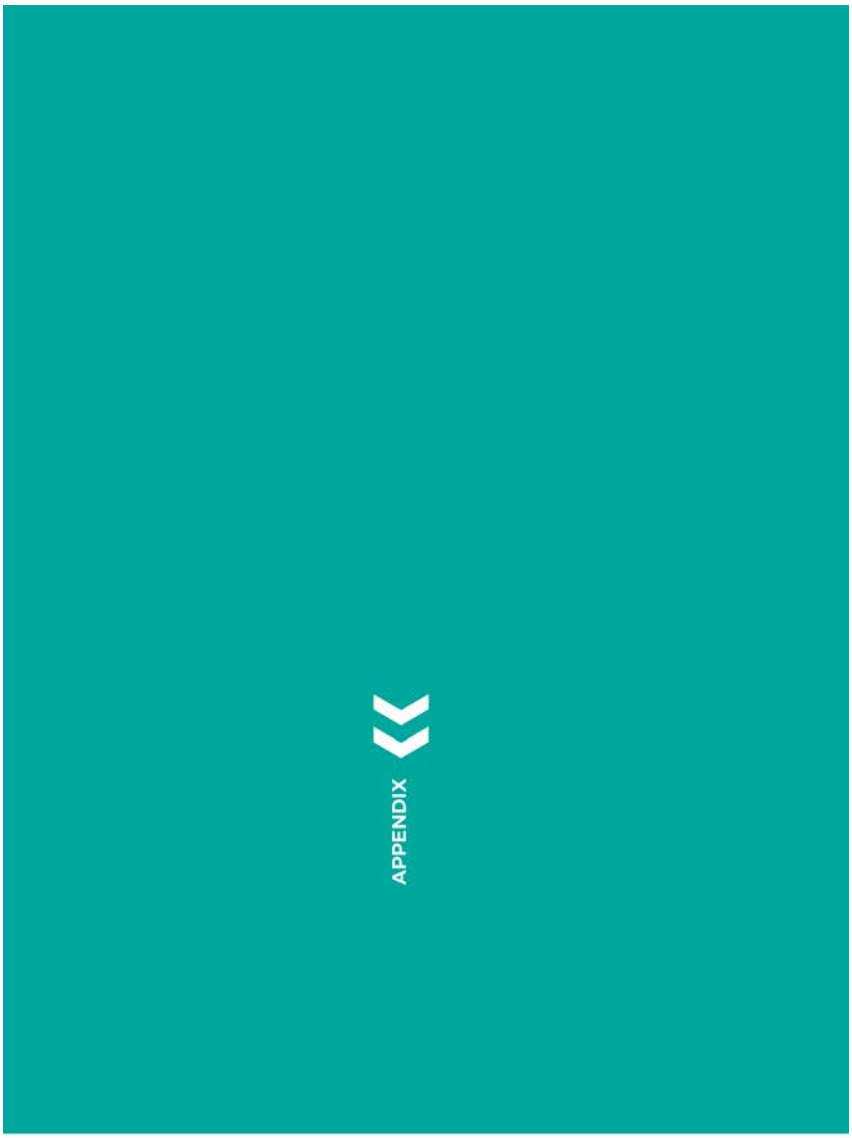
For more information: Additional research, articles, and an interactive map of existing infrastructure in the US and Canada are available on the Closed Loop Partners website: [www.closedlooppartners.com/plastics].

To contribute or update information: We invite technology providers and researchers to contribute to the data collected in late 2018/early 2019 by providing updates and add to the landscape: admin@closedlooppartners.com

Future topics
There are further topics that must be explored in greater depth, including:

- An **investment roadmap** that defines the aggregate capital needed to scale solutions across North America and outlines the breadth of investment and other strategies to achieve impact and scale.
- The **role and impact of policies**, credit or certification schemes and standards as incentives to stimulate market demand in North America.
- The **role of alternative materials that would lead to deselection of extraction-based plastics** in accelerating circular supply chains, including how alternatives would perform within existing prime production and recycling infrastructure from both economic and environmental perspectives.
- An **assessment of impacts**, both positive and adverse, on health, safety and environment associated with existing or emerging technologies.

Join us: If you are interested in participating in our ongoing research, convening, and investment in this area, we encourage you to introduce yourself to the Center for the Circular Economy: admin@closedlooppartners.com


APPENDIX

APPENDIX TABLE OF CONTENTS

I. PLASTICS 101	P. 42
II. PROFILES OF TECHNOLOGY PROVIDERS	P. 46
III. SOURCES	P. 88
IV. ACKNOWLEDGEMENTS	P. 90

I. Plastics 101

What are plastics? All plastics are polymers. A polymer is a large molecule made of repeating units of smaller molecules, called monomers, that are linked together by chemical bonds to form long chains.

Polymers can be made by connecting a single type of monomer, such as those commonly found in packaging, pipes, and toys (e.g., polyethylene, polypropylene, polystyrene, or polyvinyl chloride); or by the reaction between two different types of monomers, such as those commonly found in carpets and clothes (e.g., polyethylene terephthalate, nylon).

Furthermore, plastics can be characterized as thermosets or thermoplastics. Only thermoplastics are recyclable.

- Thermoset plastics are hard and durable and cannot be recycled into new polymers due to irreversible chemical bonds between polymer chains called crosslinks. Examples include polyurethanes and epoxy resins.
- Thermoplastics, by contrast, do not contain crosslinks and are less rigid than thermosets, allowing the material to soften when heated and can be reshaped. Thermoplastics are easily molded and extruded into films, fibers, and packaging. Examples of thermoplastics include polyethylene (PE), polypropylene (PP) and polystyrene (PS).

Plastics bio-degrade slowly, over hundreds and even thousands of years, so dealing with post-consumer and post-industrial plastics is a global imperative.

CHEMICAL NAMES/ABBREVIATION SIDEBAR

Term	Description or Example	
Intermediates	Paraxylene	Chemicals which are precursors to the production of monomers and/or polymers
MEG	Monoethylene Glycol	Monomer used in PET
PCR	Post-consumer resin	Waste plastics coming from residential or commercial consumer sources
PE (incl. HDPE, LDPE)	Polyethylene High-Density Polyethylene Low-Density Polyethylene	HDPE: Milk jugs, detergent containers LDPE: Sandwich bags, cling wrap
PET	Polyethylene Terephthalate	Water bottles, soda bottles
PP	Polypropylene	Automotive parts, pipes, yogurt containers, bottle caps
PS	Polystyrene	Plastic cutlery, packaging foam
PVC	Polyvinyl Chloride	Plumbing pipes, ducts
Prime	Virgin	Newly extracted plastic or other material, as opposed to recycled, which is sometimes referred to as "secondary"
TPA	Terephthalic Acid	Monomer used in PET

Who makes plastic?

In today's mostly linear economy, chemical and petrochemical (oil and gas) companies are major players in the plastics sector, since they produce crude oil, natural gas liquids and natural gas that is refined into petrochemicals that make plastic polymers. The top 5 plastic producers by market capitalization today are ExxonMobil, INEOS, BASF, ENI, and SABIC. In the U.S. and Canada, infrastructure is very large, highly concentrated in a few key regions.

FIGURE A: OIL AND GAS REFINERIES IN NORTH AMERICA



Prime plastics are produced and sold globally. In the U.S. and Canada, much of the infrastructure where crude oil is extracted and refined exists on the Gulf Coast and in Alberta. Refining yields fractions of raw materials, such as naphtha, ethane, and propane; less than 10% of the material coming out of the refining process can become plastics [28].

FIGURE B: RESIN PRODUCTION FACILITIES IN NORTH AMERICA



Brand owners and manufacturers buy these polymers to use in a wide range of products and packaging - everything from beverage bottles and food containers, textiles, and consumer electronics, to construction materials and automotive parts.

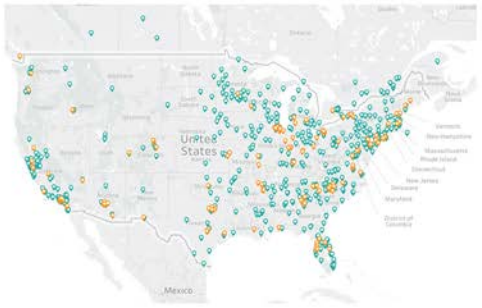
Plastics Production in US & Canada by End-Use [2]

Molded Parts	31%
Films	29%
Pipes	18%
Packaging	4%
Consumer products	4%
Textiles	3%
Coatings	2%
Wire & Cable	1%
Other	8%

Who makes plastic?

There is no shortage of plastics consumed in the United States and Canada. The challenge is that it's highly distributed; we find plastics where people live. After sale and use, post-consumer plastics are collected and either disposed of as waste or, if there is recycling infrastructure, the plastic may make its way to a recycling facility, often called a materials recovery facility (MRF), to be sorted and baled. Then, plastics are mostly recycled mechanically by reclaimers, reprocessors and converters to make new products and packaging from the recycled material.

FIGURE C: POTENTIAL SOURCES OF WASTE PLASTICS



Within the United States, 70% of recycled commodities are processed domestically. According to the Institute of Scrap Recycling Industries (ISRI), 815,000 metric tons of plastic scrap was processed in 2016. In addition, an estimated 5 million+ tons of electronics scrap is processed each year, of which an increasing proportion is plastics. This material flow map shows primary sources of municipal solid waste, coming from residences, commercial businesses, light industrial and construction and demolition sites. Material that is recovered for recycling typically flows through a materials recovery facility (MRF). (Not shown here: Textile mills and other manufacturers that generate significant post-industrial scrap, as well as stadiums, retail malls, airports and other institutional sources of post-commercial material.) Despite the existing infrastructure, 90% of plastics end up in a landfill today (source: US EPA). Recovery is key to keeping plastics in play.

The most significant advantage of utilizing the full spectrum of advanced technologies is the diversity and volume of materials that can be recycled back into useful end products – continuously. Figure C depicts the locations of Material Recovery Facilities (MRFs) and e-waste recyclers. This is a small subset of all of the materials that are potentially available as feedstocks for recycling.

However, the entire Eastern seaboard and Great Lakes regions are ripe for processing mixed plastics from rigid and flexible packaging collected from municipal residential programs. Not pictured, but also important, are post-industrial sources of waste plastics, such as textile mills and packaging manufacturers, which produce scrap material that is more concentrated, more homogenous (i.e., higher quality) and less contaminated than post-consumer sources.

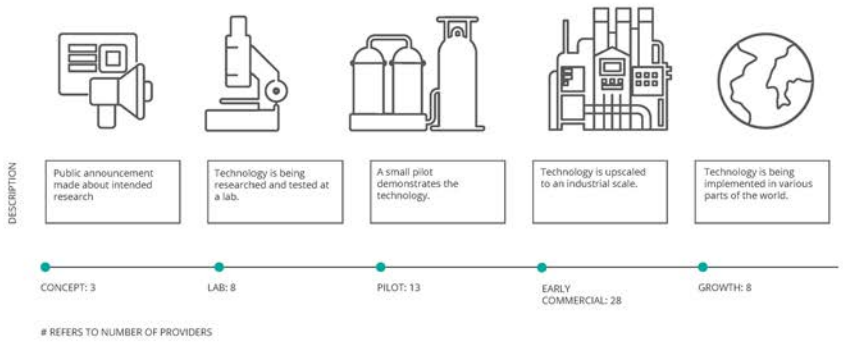
FIGURE D: RECLAIMERS AND REPROCESSORS



Figure D shows the many reclaimers and reprocessors operating today; nearly all use mechanical processing technologies (28).

Technologies that transform waste plastics into new materials have the potential to create a circular materials economy for all industries, not just the packaging sector.

Defining Stages of Maturity



REFERS TO NUMBER OF PROVIDERS

FULL LIST OF TECHNOLOGY PROVIDERS REVIEWED

	Technology Provider	Profile Available in Appendix (Total: 60)
1	Agile Process Chemicals LLP	Yes
2	Agilyx	Yes
3	AmberCycle (moral fiber)	Yes
4	Anhui Oursun Environmental Technologies	Yes
5	APK	Yes
6	Aquafil	Yes
7	Axens	Yes
8	BASF ChemCycling	No
9	Battery Resourcers	No
10	Biocellection	Yes
11	Bioplasatech	No
12	BioXycle	No
13	Blest	Yes
14	ByFusion	No
15	Cadel Deinking	Yes
16	CarBios	Yes
17	Climax Global Energy	Yes
18	Cogent Energy Systems	No
19	Connora Technologies	No
20	CreaCycle GmbH	Yes
21	Cynar Recycling	No
22	EcoFuel Technologies	Yes
23	Ecopek	Yes
24	Enerkem	Yes
25	Enval	Yes
26	Envion	No
27	Equipolymers	Yes
28	Esun	No
29	Evrnu	No

	Technology Provider	Profile Available in Appendix (Total: 60)
30	Fulcrum BioEnergy	Yes
31	FWD Energy	No
32	Galactic	Yes
33	Garbo	Yes
34	GEEP (Global Electric Electronic Processing)	Yes
35	Generated Materials Recovery	No
36	Genomatica	No
37	Geo-Tech Polymers	Yes
38	Golden Renewable Energy	Yes
39	Gr3n	Yes
40	Green EnviroTech Holdings	No
41	GreenMantra Technologies	Yes
42	IBM VolCat	No
43	Illinois Sustainable Technology Center	Yes
44	Ioniqa	Yes
45	JBI Plastic2Oil	Yes
46	Jeplan	Yes
47	Jet Plastics	No
48	Karlsruhe Institute of Technology	Yes
49	Klean Industries	Yes
50	Kyoto Institute of Technology	No
51	Loop Industries	Yes
52	MBA Polymers	No
53	Modular Genetics, Inc	No
54	Natureworks	Yes
55	New Hope Energy	Yes
56	Next Generation	Yes
57	Nexus Fuels	Yes

	Technology Provider	Profile Available in Appendix (Total: 60)
58	Omnifusion	No
59	Opus12	No
60	Origin Materials	No
61	P4SB	No
62	perPETual	Yes
63	Plastic Energy	Yes
64	Polycycl (previously Ventana Cleantech)	Yes
65	Polystyvert	Yes
66	PureCycle Technologies	Yes
67	Pyrowave	Yes
68	Quality Circular Polymers	No
69	Re:NewCell	No
70	Recenso GmbH	No
71	Reclaimed EcoEnergy	Yes
72	Recycling Technologies	Yes
73	ReNew ELP	Yes
74	Renewlogy	Yes
75	Rensselaer Polytechnic Institute	No
76	RES Polyflow	Yes
77	Resinate Materials Group	Yes
78	Resynergi	Yes
79	RESYNTEX	No
80	SABIC Innovative Plastics	Yes
81	saperatec	No
82	Sep-All	No
83	Sierra Energy	Yes
84	Sustane Technologies Inc.	No
85	Teijin	No

	Technology Provider	Profile Available in Appendix (Total: 60)
86	The Infinited Fiber Company	No
87	The Pennsylvania State University	Yes
88	Total Corbion	No
89	TRASH2CASH	Yes
90	Tyton BioSciences	Yes
91	University of Massachusetts-Lowell	Yes
92	University of Portsmouth	Yes
93	University of Ulsan	Yes
94	Vadxx	Yes
95	Valoren	No
96	VinyLoop	No
97	Worn Again Technologies	Yes

II. Profiles of Technology Providers

We reviewed more than 90 providers, and have completed profiles for 60 technology providers in scope.

apc
Agile Process Chemicals LLP

LOCATION:
Mumbai, Maharashtra, India

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Growth

SUPPLY CHAIN:
Plastics to fuels

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Feb 28, 2019

DESCRIPTION	Agile Process Chemicals (apc) offers an internationally patented pyrolysis technology that converts plastic and tire waste into pyrolysis oil, carbon black, and hydrocarbon gas. For every 12,000 kg of feedstock, the Plastic Pyrolysis Plants and Tire Pyrolysis Plants yield 70-90% and 40-45% pyrolysis oil, respectively.
FEEDSTOCK	apc processes both post-consumer and post-industrial plastics, including laminates, multi-layer plastics, packaging, as well as municipal solid waste (MSW) segregated plastic and tires.
FACILITIES	apc has helped clients establish over 35 pyrolysis plants in United Kingdom, India, Kenya, and United Arab Emirates, among others. Plant capacity ranges from 3 to 12 metric tons/day of plastics.
PARTNERS	Data not available.
BUSINESS MODEL	Currently, apc offers products and services in following steps: 1) Pyrolysis Consultancy, 2) Pilot Plant Trials, 3) Drafting a Business Plan, 4) Signing of Confidentiality Agreement & Plant Visit, 5) Design, Manufacturing, Supply, Installation and Commissioning of Pyrolysis Plant, and 6) Operation and Maintenance of Pyrolysis Plant for the First 2 Years.

*Based on research and validated with Agile Process Chemicals.

agilyx

Reduces. Produces. Creates.

LOCATION:
Tigard, Oregon, USA

TECHNOLOGY TYPE:
1. MPC: Conversion (thermal)
2. PSM: Decomposition (thermal)

STAGE OF MATURITY:
Early commercial

SUPPLY CHAIN:
1. MPC: Plastics to fuels
2. PSM: Plastics to monomers

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Mar 23, 2019

DESCRIPTION	Agilyx creates circular recycling pathways for plastics through the company's two Conversion Facility platforms: The Mixed Plastics-to-Crude (MPC) System which produces lower-carbon crude oil for fuel production, naphtha cracker feed and the single polymer pathway such as the Polystyrene-to-Styrene Monomer (PSM) System which produces styrene oil.
FEEDSTOCK	Agilyx processes both post-consumer and post-industrial mixed plastics. Agilyx performs physical and chemical characterization to understand the feedstock composition before selecting the optimal platform and generates feedstock recipes suitable for the value chain.
FACILITIES	Agilyx owns and operates one facility in Tigard, Oregon, USA with a capacity of 10 tons of PS/day. Agilyx has shipped 800,000+ gallons (processing 8,000,000+ lbs of mixed plastics) of Agilyx Synthetic Crude Oil (ASCO) from prior systems.
PARTNERS	Agilyx works with members in the entire value chain from brand owners and retail to chemical manufacturers, polymer producers, waste industry, and municipal governments. For the MPC Platform, Agilyx is partnered with Delta Airlines and Monroe Energy, a wholly owned subsidiary of Delta Air Lines, to take up to 2,500 bbl/day of ASCO and has an ongoing existing relationship with US Oil. For the PSM Platform, Agilyx has collaborations with Americas Styrenics, INEOS Styrolution, and others to develop 50 ton/day PS recycling facilities.
BUSINESS MODEL	Currently, Agilyx has more than 50 projects in various stages of development that have not been publicly disclosed. In the short term, Agilyx will develop a production facility near Monroe Energy's facility in phases. In the long term, Agilyx plans to continue building multi-stakeholder supply chains through additional partnerships. Agilyx has three business pillars: 1) Conversion Facilities that employ pyrolysis technology to process plastics; 2) Research and Development that generates new circular pathways; and 3) 'Cyclyx' a feedstock logistics division that aggregates and prepares feedstock for the purpose of chemical and circular recycling.

*Based on research and an interview. Validated with Agilyx.

AMBERCYCLE

LOCATION:
Los Angeles, California, USA

TECHNOLOGY TYPE:
Decomposition (biological)

STAGE OF MATURITY:
Lab

SUPPLY CHAIN:
Plastics to polymers

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Mar 22, 2019

DESCRIPTION	Ambercycle (moral fiber) is a materials company that creates virgin-grade materials from textile waste.
FEEDSTOCK	moral fiber targets PET-containing materials (e.g., polyester textiles, PET bottles).
FACILITIES	Data not available.
PARTNERS	moral fiber has a partnership with H&M to create a textile produced entirely from old clothing and has been awarded the Global Change Award from the H&M Conscious Foundation to commercialize their technology. In May 2018, moral fiber was selected for the Fashion for Good Scaling Programme.
BUSINESS MODEL	Currently, moral fiber is scaling with support from their partners. In the long term, moral fiber will aim to build modular recycling units to be co-located with producers of PET waste streams or consumers of PET.

*Based on research and validated with moral fiber.

ANHUI OURSUN RESOURCE TECHNOLOGY

LOCATION:
Hefei, Anhui, China

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Growth

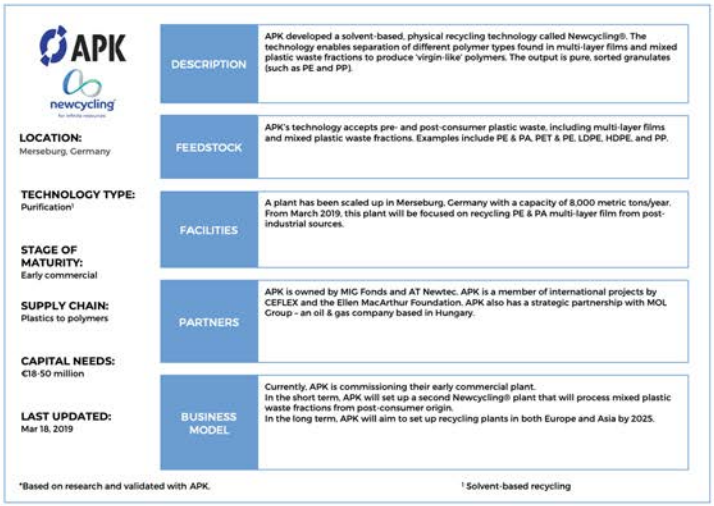
SUPPLY CHAIN:
Plastics to fuels

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Feb 14, 2019

DESCRIPTION	Anhui Oursun Resource Technology Co., Ltd (Oursun Resources) converts plastic waste into diesel oil, gasoline oil, gas, and slag. The company's machine system is continuous and automatic, using computer-controlled equipment. The company has patents on its constant-temperature slagging device, its batch-type mixer, its gas recovery and voltage stabilizing supply device, its plastic cracking catalyst formulation, and its plastic cracking process.
FEEDSTOCK	Oursun Resources targets PE, PP, and PS (Plastics No. 2, 4, 5, 6).
FACILITIES	Oursun Resources' facilities can process between 10 to 500 tons/day of plastic and can yield between 50-90% of oil, depending on the feedstock. The facilities require approximately 280 kWh of electricity for every ton of plastic processed.
PARTNERS	Oursun Resources was established as a joint venture between China, America, and Taiwan.
BUSINESS MODEL	Currently, Oursun Resources is a manufacturer and exporter of pyrolysis technology.

*Based on research only.


APK
newcycling
LOCATION:
Merseburg, Germany
TECHNOLOGY TYPE:
Purification[1]
STAGE OF MATURITY:
Early commercial
SUPPLY CHAIN:
Plastics to polymers
CAPITAL NEEDS:
€18-50 million
LAST UPDATED:
Mar 18, 2019
DESCRIPTION
APK developed a solvent-based, physical recycling technology called Newcycling®. The technology enables separation of different polymer types found in multi-layer films and mixed plastic waste fractions to produce 'virgin-like' polymers. The output is pure, sorted granulates (such as PE and PP).
FEEDSTOCK
APK's technology accepts pre- and post-consumer plastic waste, including multi-layer films and mixed plastic waste fractions. Examples include PE & PA, PET & PE, LDPE, HDPE, and PP.
FACILITIES
A plant has been scaled up in Merseburg, Germany with a capacity of 8,000 metric tons/year. From March 2019, this plant will be focused on recycling PE & PA multi-layer film from post-industrial sources.
PARTNERS
APK is owned by MIG Fonds and AT Newtec. APK is a member of international projects by CEFLEX and the Ellen MacArthur Foundation. APK also has a strategic partnership with MOL Group - an oil & gas company based in Hungary.
BUSINESS MODEL
Currently, APK is commissioning their early commercial plant.
In the short term, APK will set up a second Newcycling® plant that will process mixed plastic waste fractions from post-consumer origin.
In the long term, APK will aim to set up recycling plants in both Europe and Asia by 2025.
*Based on research and validated with APK.
[1] Solvent-based recycling

AQUAFIL
synthetic fibres and polymers

LOCATION:
Arco, Italy

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Growth

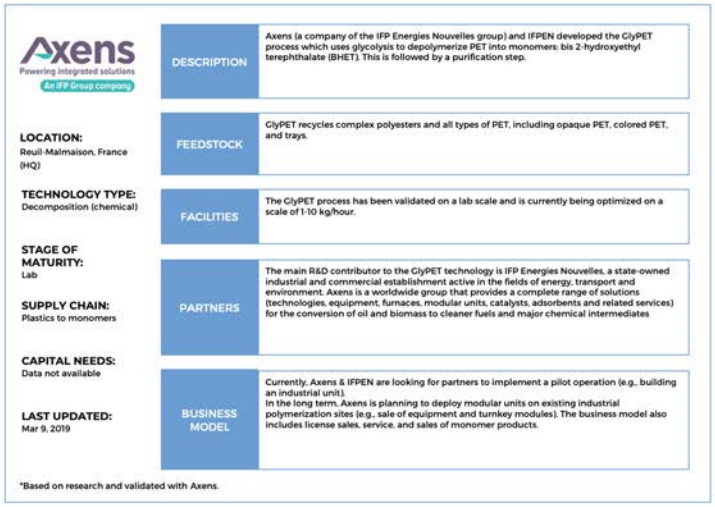
SUPPLY CHAIN:
Plastics to fuels

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Feb 14, 2019

DESCRIPTION	Aquafil's ECONYL® Regeneration System depolymerizes PA6 to its monomer: caprolactam. The monomers are polymerized to produce two kind of yarns: ECONYL® nylon yarns for textile applications and ECONYL® nylon yarns for carpet applications.
FEEDSTOCK	Aquafil processes pre- and post-consumer PA6 products. The three main sources include PA6 fishnets (collected worldwide), PA6 carpets, and oligomers/other plastic waste generated by polymer industries.
FACILITIES	Aquafil has 16 facilities operating in 8 countries over 3 continents. The Group's headquarter is located Arco, Italy, while the ECONYL® Regeneration System is located in Ljubljana, Slovenia. Linked sites are located in Ajdovščina, Slovenia (PA6 waste storage and preparation) and Phoenix, Arizona, USA (Aquafil Carpet Recycling #1 - ACR #1). ACR#1 is able to recycle 16,000 tons/year of used carpet.
PARTNERS	Aquafil has strong relationships with all players along the value chain, from PA6 waste providers to final customers, including clothing brands (e.g., Adidas, Volcom, Stella McCartney) and carpet manufacturers (e.g., Interface, Milliken, Mannington, Tarkett Group).
BUSINESS MODEL	In the short term, Aquafil is planning to open a second plant for carpet recycling (ACR #2) in Spring 2019 in Woodland, California, USA.

*Based on research and validated with Aquafil.


Axens
Powering integrated solutions
An IFP Group company
LOCATION:
Reuil-Malmaison, France (HQ)
TECHNOLOGY TYPE:
Decomposition (chemical)
STAGE OF MATURITY:
Lab
SUPPLY CHAIN:
Plastics to monomers
CAPITAL NEEDS:
Data not available
LAST UPDATED:
Mar 9, 2019
DESCRIPTION
Axens (a company of the IFP Energies Nouvelles group) and IFPEN developed the GlyPET process which uses glycolysis to depolymerize PET into monomers: bis 2-hydroxyethyl terephthalate (BHET). This is followed by a purification step.
FEEDSTOCK
GlyPET recycles complex polyesters and all types of PET, including opaque PET, colored PET, and trays.
FACILITIES
The GlyPET process has been validated on a lab scale and is currently being optimized on a scale of 1-10 kg/hour.
PARTNERS
The main R&D contributor to the GlyPET technology is IFP Energies Nouvelles, a state-owned industrial and commercial establishment active in the fields of energy, transport and environment. Axens is a worldwide group that provides a complete range of solutions (technologies, equipment, furnaces, modular units, catalysts, adsorbents and related services) for the conversion of oil and biomass to cleaner fuels and major chemical intermediates
BUSINESS MODEL
Currently, Axens & IFPEN are looking for partners to implement a pilot operation (e.g., building an industrial unit).
In the long term, Axens is planning to deploy modular units on existing industrial polymerization sites (e.g., sale of equipment and turnkey modules). The business model also includes license sales, service, and sales of monomer products.
*Based on research and validated with Axens.

BioCellection

LOCATION:
Menlo Park, California, USA

TECHNOLOGY TYPE:
Decomposition (chemical)

STAGE OF MATURITY:
Lab

SUPPLY CHAIN:
Plastics to monomers

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Feb 16, 2019

DESCRIPTION	BioCellection deploys a selective oxidation process to decompose post-consumer plastics into shorter chain molecules, such as oligomers and dibasic acids. The process uses two catalysts, which are both recovered and recycled back into the system.
FEEDSTOCK	BioCellection targets post-consumer plastic feedstocks after industrial sorting, including plastic films (mainly LDPE and HDPE), rigid plastics (PP, PET, PS, PE), and foam plastics (mainly PS).
FACILITIES	BioCellection has a lab in Menlo Park, California, USA, with the ability to process 2 kg/day of plastics.
PARTNERS	BioCellection has a partnership with the City of San José and GreenWaste Recovery.
BUSINESS MODEL	Currently, BioCellection is planning to build a unit which will process 500 kg/day of plastics. In the short term, BioCellection plans to experiment with compost-treated plastics and small format plastic residuals. In the long term, BioCellection will aim to license their technology.

*Based on research only.

Blest
Protect earth from contamination

LOCATION:
Kanagawa, Japan

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Growth

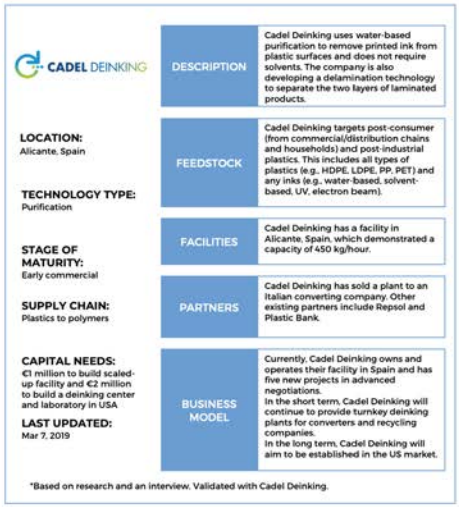
SUPPLY CHAIN:
Plastics to fuels

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Mar 22, 2019

DESCRIPTION	Blest manufactures three different scales of plastic to oil pyrolysis technology, operating between 400-450°C. The technology produces a mixed synthetic light sweet crude composed of diesel, gasoline, kerosene, and heavy oils.
FEEDSTOCK	Blest targets PE, PP, and PS feedstock. Blest machines do not accept PET or PVC.
FACILITIES	Blest offers both batch type machines and continuous system machines. The highest capacity model processes 1,000 kg/day.
PARTNERS	Blest has sold over 100 machines in more than 41 countries. Countries using machines with higher capacities include Japan, Palau, and Canada. Blest's customers include a mix of governments and recycling companies (e.g., Nagatashigyo Co., Ltd. and P&M Recycling Center).
BUSINESS MODEL	Currently, Blest is a manufacturer and distributor of pyrolysis technology.

*Based on research only.



CADEL DEINKING

LOCATION:
Alicante, Spain

TECHNOLOGY TYPE:
Purification

STAGE OF MATURITY:
Early commercial

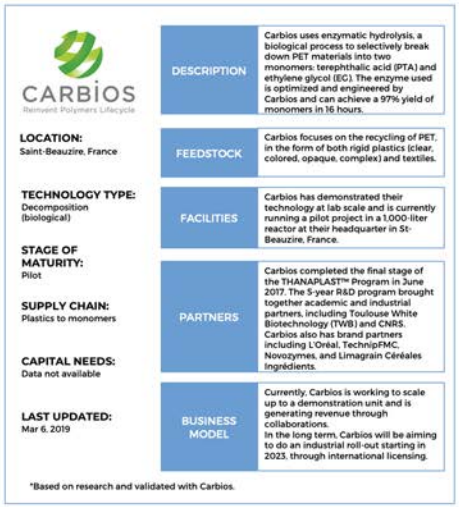
SUPPLY CHAIN:
Plastics to polymers

CAPITAL NEEDS:
€1 million to build scaled-up facility and €2 million to build a deinking center and laboratory in USA

LAST UPDATED:
Mar 7, 2019

DESCRIPTION	Cadel Deinking uses water-based purification to remove printed ink from plastic surfaces and does not require solvents. The company is also developing a delamination technology to separate the two layers of laminated products.
FEEDSTOCK	Cadel Deinking targets post-consumer (from commercial/distribution chains and households) and post-industrial plastics. This includes all types of plastics (e.g., HDPE, LDPE, PP, PET) and any inks (e.g., water-based, solvent-based, UV, electron beam).
FACILITIES	Cadel Deinking has a facility in Alicante, Spain, which demonstrated a capacity of 450 kg/hour.
PARTNERS	Cadel Deinking has sold a plant to an Italian converting company. Other existing partners include Repsol and Plastic Bank.
BUSINESS MODEL	Currently, Cadel Deinking owns and operates their facility in Spain and has five new projects in advanced negotiations. In the short term, Cadel Deinking will continue to provide turnkey deinking plants for converters and recycling companies. In the long term, Cadel Deinking will aim to be established in the US market.

*Based on research and an interview. Validated with Cadel Deinking.



CARBIOS
Reinvent Polymers Lifecycle

LOCATION:
Saint-Beauzire, France

TECHNOLOGY TYPE:
Decomposition (biological)

STAGE OF MATURITY:
Pilot

SUPPLY CHAIN:
Plastics to monomers

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Mar 6, 2019

DESCRIPTION	Carbios uses enzymatic hydrolysis, a biological process to selectively break down PET materials into two monomers: terephthalic acid (PTA) and ethylene glycol (EG). The enzyme used is optimized and engineered by Carbios and can achieve a 97% yield of monomers in 16 hours.
FEEDSTOCK	Carbios focuses on the recycling of PET, in the form of both rigid plastics (clear, colored, opaque, complex) and textiles.
FACILITIES	Carbios has demonstrated their technology at lab scale and is currently running a pilot project in a 1,000-liter reactor at their headquarter in St-Beauzire, France.
PARTNERS	Carbios completed the final stage of the THANAPLAST™ Program in June 2017. The 5-year R&D program brought together academic and industrial partners, including Toulouse White Biotechnology (TWB) and CNRS. Carbios also has brand partners including L'Oréal, TechnipFMC, Novozymes, and Limagrain Céréales Ingrédients.
BUSINESS MODEL	Currently, Carbios is working to scale up to a demonstration unit and is generating revenue through collaborations. In the long term, Carbios will be aiming to do an industrial roll-out starting in 2023, through international licensing.

*Based on research and validated with Carbios.

CLIMAX GLOBAL ENERGY

LOCATION:
Allendale, South Carolina, USA

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Pilot

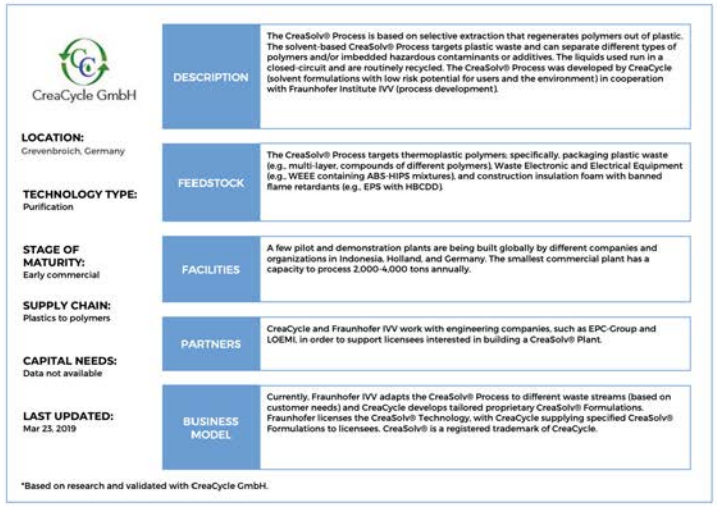
SUPPLY CHAIN:
Plastics to fuels & petrochemicals

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Feb 14, 2019

DESCRIPTION	Climax Global Energy's microwave pyrolysis technology converts waste plastics, used oils, forestry-industry by-products, and biomass into synthetic crude oil, transportation fuels, and industrial petrochemicals. The process does not require a catalyst. Generally, 1 ton of plastic produces approximately 5 barrels of oil.
FEEDSTOCK	Climax Global Energy focuses on non-recyclable plastics such as "mixed" 3-7, but can accept all types of plastics (e.g., PET, HDPE, PVC). The feedstock can be mixed, dirty and wet.
FACILITIES	Climax Global Energy successfully completed a pilot demonstration in Allendale, South Carolina, USA with a capacity to process 3 tons/day.
PARTNERS	Climax Global Energy has relationships with SC Launch and South Carolina Research Authority.
BUSINESS MODEL	Currently, Climax Global Energy is the sole owner-operator of the facility. In the short term, Climax Global Energy will establish direct relationships with refineries for the offtake of their output. In the long term, Climax Global Energy will aim to develop facilities that are modular and replicate their technology on a commercial scale worldwide.

*Based on research only.



CreaCycle GmbH

LOCATION:
Grevenbroich, Germany

TECHNOLOGY TYPE:
Purification

STAGE OF MATURITY:
Early commercial

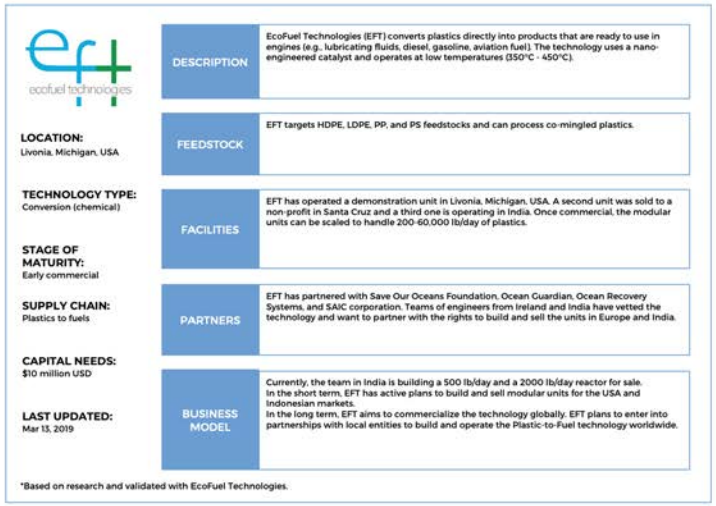
SUPPLY CHAIN:
Plastics to polymers

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Mar 23, 2019

DESCRIPTION	The CreaSolv® Process is based on selective extraction that regenerates polymers out of plastic. The solvent-based CreaSolv® Process targets plastic waste and can separate different types of polymers and/or imbedded hazardous contaminants or additives. The liquids used run in a closed-circuit and are routinely recycled. The CreaSolv® Process was developed by CreaCycle (solvent formulations with low risk potential for users and the environment) in cooperation with Fraunhofer Institute IVV (process development).
FEEDSTOCK	The CreaSolv® Process targets thermoplastic polymers; specifically, packaging plastic waste (e.g., multi-layer, compounds of different polymers), Waste Electronic and Electrical Equipment (e.g., WEEE containing ABS-HIPS mixtures), and construction insulation foam with banned flame retardants (e.g., EPS with HBCDD).
FACILITIES	A few pilot and demonstration plants are being built globally by different companies and organizations in Indonesia, Holland, and Germany. The smallest commercial plant has a capacity to process 2,000-4,000 tons annually.
PARTNERS	CreaCycle and Fraunhofer IVV work with engineering companies, such as EPC-Group and LOEMI, in order to support licensees interested in building a CreaSolv® Plant.
BUSINESS MODEL	Currently, Fraunhofer IVV adapts the CreaSolv® Process to different waste streams (based on customer needs) and CreaCycle develops tailored proprietary CreaSolv® Formulations. Fraunhofer licenses the CreaSolv® Technology, with CreaCycle supplying specified CreaSolv® Formulations to licensees. CreaSolv® is a registered trademark of CreaCycle.

*Based on research and validated with CreaCycle GmbH.



*Based on research and validated with EcoFuel Technologies.

ECOPEK

LOCATION:
Pacheco, Buenos Aires, Argentina

TECHNOLOGY TYPE:
Purification[1]

STAGE OF MATURITY:
Early commercial

SUPPLY CHAIN:
Plastics to polymers

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Mar 28, 2019

DESCRIPTION	Ecopek (formerly CabelmaPET) produces food-grade rPET raw materials from PET bottles. The PET bottles are first mechanically processed into rPET flakes, followed by chemical processes which turn the flakes into rPET pellets.
FEEDSTOCK	Ecopek targets post-consumer PET.
FACILITIES	Ecopek's facility in Pacheco, Buenos Aires, Argentina with a production capacity of 16,000 tons/year of rPET production.
PARTNERS	DAK Americas Argentina S.A. (virgin PET producer) acquired CabelmaPET S.A. in 2014.
BUSINESS MODEL	Currently, a portion of Ecopek's post-consumer rPET is integrated into DAK Americas' virgin PET production at its manufacturing facility in Zarate, Argentina. Ecopek also sells directly to merchants.

*Based on research and validated with DAK Americas.

[1] Mechanical recycling followed by chemical upgrading.

Enerkem

LOCATION:
Montreal, Quebec, Canada

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Early commercial

SUPPLY CHAIN:
Plastics to fuels & chemicals

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Feb 15, 2019

DESCRIPTION	Enerkem processes municipal solid waste (MSW) into chemicals and biofuels. A thermochemical process (gasification and partial oxidation) converts the material to syngas, which is then washed with water to remove particulates. The syngas is then converted into biofuels using catalytic synthesis.
FEEDSTOCK	Enerkem targets non-recyclable, non-compostable MSW.
FACILITIES	The company operates one facility in Edmonton, Alberta, Canada, which initiated the production of methanol in 2015 and ethanol in 2017. The capacity of this facility is 10 million gallons/year of biofuels.
PARTNERS	Enerkem's partners include Alberta Innovates, BlackRock, Sinobioway, Rho Ventures, Braemar Energy Ventures, Waste Management of Canada, Investissement Quebec, Fonds de solidarite FTQ, Cycle Capital, Fondaction, The Westly Group, and National Bank of Canada.
BUSINESS MODEL	Currently, Enerkem is constructing a facility in Varennes, Quebec, Canada. In the short term, Enerkem will begin project development with their partners in Rotterdam and China. In the long term, Enerkem will aim to license their technology and develop prefabricated modular systems that can be deployed globally.

*Based on research only.

enval

LOCATION:
England, UK

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Early commercial

SUPPLY CHAIN:
Plastics to fuels

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Feb 16, 2019

DESCRIPTION	Enval utilizes microwave-induced pyrolysis, powered by electricity, to convert pouches and plastic aluminum laminates into low-carbon aluminium and hydrocarbons. The hydrocarbons are separated into high value gas and oil for fuel or specialty chemicals.
FEEDSTOCK	Enval processes multilayer packaging/film, such as pouches and plastic aluminium laminates (e.g., aluminium foil sandwiched between plastic layers).
FACILITIES	Enval's typical plant operates at a nominal capacity of 2,000 metric tons/year. The pyrolysis gas generated by the process is used to produce the electricity required to operate the plant.
PARTNERS	Enval has partnered with Little Freddie, an organic baby food company, for a zero waste to landfill solution for their pouches. Other partners include Kraft Foods and Nestlé.
BUSINESS MODEL	Currently, Enval offers a modular, turnkey solution which includes full training to operate and maintain the equipment, as well as engineering support throughout the lifetime of the plant.

*Based on research only.

equipolymers™

LOCATION:
Schkopau, Germany

TECHNOLOGY TYPE:
Data not available

STAGE OF MATURITY:
Early commercial

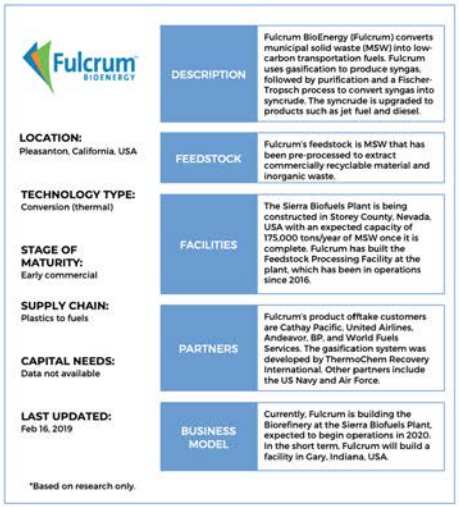
SUPPLY CHAIN:
Plastics to polymers

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Feb 16, 2019

DESCRIPTION	Equipolymers is producing 'Viridis 25'; a food-grade PET made with 25% recycled content. In 2009, Equipolymers also launched Viridis 10, a PET containing up to 10% recycled content.
FEEDSTOCK	Equipolymers processes PET feedstocks.
FACILITIES	There is currently a production plant in Schkopau, Germany, operating at a capacity of 350 kiloton/year. At full production, Equipolymers expects to process up to 30,000 metric tons of post-consumer PET per year.
PARTNERS	Equipolymers is owned by MEGlobal, which is a joint venture between Dow Chemical and Kuwait-based Equate Group. Coca-Cola has played a strong role supporting the development of the material and partook in the launch of Viridis 25.
BUSINESS MODEL	Currently, Equipolymers is aiming to start commercial production and claims Viridis 25 will be available for sale in late 2019.

*Based on research only.


Fulcrum BIOENERGY
LOCATION:
Pleasanton, California, USA
TECHNOLOGY TYPE:
Conversion (thermal)
STAGE OF MATURITY:
Early commercial
SUPPLY CHAIN:
Plastics to fuels
CAPITAL NEEDS:
Data not available
LAST UPDATED:
Feb 16, 2019
*Based on research only.
DESCRIPTION
Fulcrum BioEnergy (Fulcrum) converts municipal solid waste (MSW) into low-carbon transportation fuels. Fulcrum uses gasification to produce syngas, followed by purification and a Fischer-Tropsch process to convert syngas into syncrude. The syncrude is upgraded to products such as jet fuel and diesel.
FEEDSTOCK
Fulcrum's feedstock is MSW that has been pre-processed to extract commercially recyclable material and inorganic waste.
FACILITIES
The Sierra Biofuels Plant is being constructed in Storey County, Nevada, USA with an expected capacity of 175,000 tons/year of MSW once it is complete. Fulcrum has built the Feedstock Processing Facility at the plant, which has been in operations since 2016.
PARTNERS
Fulcrum's product offtake customers are Cathay Pacific, United Airlines, Andeavor, BP, and World Fuels Services. The gasification system was developed by ThermoChem Recovery International. Other partners include the US Navy and Air Force.
BUSINESS MODEL
Currently, Fulcrum is building the Biorefinery at the Sierra Biofuels Plant, expected to begin operations in 2020. In the short term, Fulcrum will build a facility in Gary, Indiana, USA.

LOOPLA® by GALACTIC

LOCATION:
Escanaffles, Belgium

TECHNOLOGY TYPE:
Decomposition (chemical)

STAGE OF MATURITY:
Early commercial

SUPPLY CHAIN:
Plastics to polymers

CAPITAL NEEDS:
$10 million USD

LAST UPDATED:
Mar 6, 2019

DESCRIPTION	Galactic is a PLA producer and the company operates its own LOOPLA® PLA feedstock recovery scheme using the technology provided by Futerro.
FEEDSTOCK	Futerro's technology targets PLA.
FACILITIES	Futerro's in-house LOOPLA® feedstock recovery scheme supports Galactic's operation in Escanaffles, Belgium. Another plant is currently under construction in China.
PARTNERS	Galactic has partnerships with other major players in the PLA industry, including NatureWorks.
BUSINESS MODEL	Currently, Galactic is building another plant with Futerro's technology in China. In the long term, Galactic and Futerro plans to be a technology provider and be involved in PLA recycling activities.

*Based on research and validated by Galactic.

GARBO your innovative partner

LOCATION:
Cerano, Italy

TECHNOLOGY TYPE:
Decomposition (chemical)

STAGE OF MATURITY:
Pilot

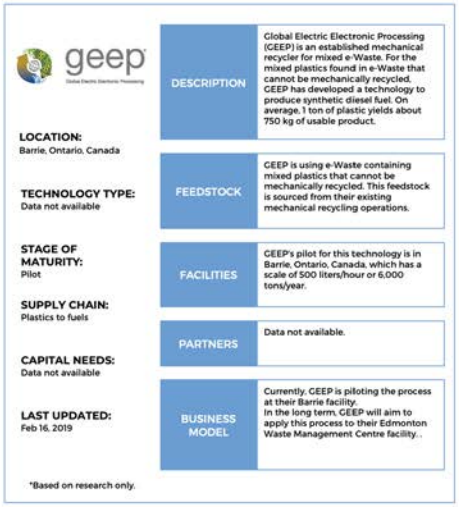
SUPPLY CHAIN:
Plastics to monomers

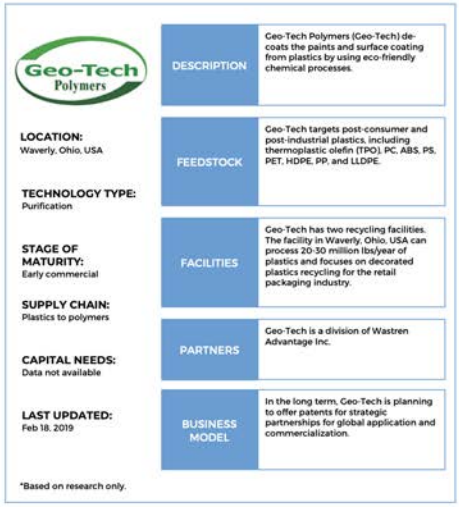
CAPITAL NEEDS:
Data not available

LAST UPDATED:
Feb 16, 2019

DESCRIPTION	Garbo developed ChemPET®, a depolymerization process which uses glycolysis to produce a monomer, bis 2-hydroxyethyl terephthalate (BHET). Following the chemical reaction, Garbo purifies the monomers. The entire process takes less than 6 hours.
FEEDSTOCK	Garbo uses PET feedstock, including PET sourced from packaging, fabrics, and fine waste from mechanical recycling processes.
FACILITIES	Garbo has validated the technology at a lab scale of 10 kg/day. The company is currently starting up and validating a pre-industrial production line with a capacity of 3 tons/day.
PARTNERS	Garbo's partners include Indorama, Plastipak, IKEA, and Ester (India) to support the company with recycled PET outlets and quality assessment methods. ChemPET® was developed in collaboration with the University of Modena and Bologna.
BUSINESS MODEL	Currently, Garbo is validating scaled up production. In the short term, Garbo will be building and operating their own recycling line and selling purified BHET. In the long term, Garbo plans to polymerize the BHET and to sell polymers.

*Based on research only.


geep
LOCATION:
Barrie, Ontario, Canada
TECHNOLOGY TYPE:
Data not available
STAGE OF MATURITY:
Pilot
SUPPLY CHAIN:
Plastics to fuels
CAPITAL NEEDS:
Data not available
LAST UPDATED:
Feb 16, 2019
*Based on research only.
DESCRIPTION
Global Electric Electronic Processing (GEEP) is an established mechanical recycler for mixed e-Waste. For the mixed plastics found in e-Waste that cannot be mechanically recycled, GEEP has developed a technology to produce synthetic diesel fuel. On average, 1 ton of plastic yields about 750 kg of usable product.
FEEDSTOCK
GEEP is using e-Waste containing mixed plastics that cannot be mechanically recycled. This feedstock is sourced from their existing mechanical recycling operations.
FACILITIES
GEEP's pilot for this technology is in Barrie, Ontario, Canada, which has a scale of 500 liters/hour or 6,000 tons/year.
PARTNERS
Data not available.
BUSINESS MODEL
Currently, GEEP is piloting the process at their Barrie facility.
In the long term, GEEP will aim to apply this process to their Edmonton Waste Management Centre facility..


Geo-Tech
Polymers
LOCATION:
Waverly, Ohio, USA
TECHNOLOGY TYPE:
Purification
STAGE OF MATURITY:
Early commercial
SUPPLY CHAIN:
Plastics to polymers
CAPITAL NEEDS:
Data not available
LAST UPDATED:
Feb 18, 2019
*Based on research only.
DESCRIPTION
Geo-Tech Polymers (Geo-Tech) de-coats the paints and surface coating from plastics by using eco-friendly chemical processes.
FEEDSTOCK
Geo-Tech targets post-consumer and post-industrial plastics, including thermoplastic olefin (TPO), PC, ABS, PS, PET, HDPE, PP, and LLDPE.
FACILITIES
Geo-Tech has two recycling facilities. The facility in Waverly, Ohio, USA can process 20-30 million lbs/year of plastics and focuses on decorated plastics recycling for the retail packaging industry.
PARTNERS
Geo-Tech is a division of Wastren Advantage Inc.
BUSINESS MODEL
In the long term, Geo-Tech is planning to offer patents for strategic partnerships for global application and commercialization.

Golden Renewable Energy

LOCATION:
Yonkers, New York, USA (HQ)

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Early commercial

SUPPLY CHAIN:
Plastics to fuels

CAPITAL NEEDS:
Currently finishing B Round

LAST UPDATED:
Mar 11, 2019

DESCRIPTION	Golden Renewable Energy (GRE) uses pyrolysis technology to produce a liquid fuel, with the same characteristics of #2 diesel fuel, from waste plastics.
FEEDSTOCK	GRE processes both post-consumer and post-industrial waste streams. The company does not source its feedstock by polymer type and is flexible to take in different mixes of plastics (No. 1-7).
FACILITIES	GRE currently owns and operates one facility in Zebulon, North Carolina, USA, which has a feedstock capacity of ~8,000 tons/year, producing ~2.0 MM gallons of recycled diesel/year.
PARTNERS	GRE has received plenty of interest and demand for the technology. GRE has contracts/plans in hand to deliver 5 more units in the second half of 2019.
BUSINESS MODEL	Currently, the facility in Yonkers is being converted into an assembly plant to build at least 5 more units. In the short term, GRE will continue to be an owner-operator and generate revenue through both ongoing operations as well as sales and licensing. In the long term, GRE will consider either contract manufacturing or the development of a manufacturing facility with the ability to deliver 50 to 100 units/year.

*Based on research and an interview. Validated with Golden Renewable Energy.

gr3n

LOCATION:
Castagnola, Switzerland

TECHNOLOGY TYPE:
Decomposition (chemical)

STAGE OF MATURITY:
Pilot

SUPPLY CHAIN:
Plastics to monomers

CAPITAL NEEDS:
€750,000 this year and an additional €3-4 million next year

LAST UPDATED:
Feb 16, 2019

DESCRIPTION	gr3n uses hydrolysis to depolymerize PET plastics to produce two monomers: terephthalic acid (TPA) and ethylene glycol (EG). This technology uses microwaves to catalyze the reaction.
FEEDSTOCK	gr3n can take all types of PET, including bottles, trays (both mono and multi-layer), and textiles (e.g., polyester).
FACILITIES	A small-scale pilot is located in Piacenza, Italy, with a capacity of 10 kg/hour.
PARTNERS	gr3n has partners throughout the entire value chain. Partners include brands and PET users (e.g., H&M, adidas, Nestlé, Unilever, Coca-Cola, IKEA, ALPLA, Logoplaste, Henkel), PET producers (e.g., NEO GROUP), municipalities (e.g., Suez), and equipment producers (e.g., Sorema). The monomer purification process was developed and industrially implemented with Danish Technical University and Processi Innovativi srl.
BUSINESS MODEL	Currently, gr3n is scaling up production. In the short term, gr3n will be selling the monomers. In the long term, gr3n will sell the equipment (e.g., small modular units) and provide maintenance services. gr3n is also planning to license the patented purification process technology.

*Based on research and an interview. Validated with gr3n.

GREENMANTRA TECHNOLOGIES

LOCATION:
Brantford, Ontario, Canada

TECHNOLOGY TYPE:
Conversion (chemical)

STAGE OF MATURITY:
Early commercial

SUPPLY CHAIN:
Plastics to polymers & petrochemicals

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Mar 5, 2019

DESCRIPTION	GreenMantra Technologies (GreenMantra) developed a thermo-catalytic process to transform recycled plastics into CERANOVUS® PE and PP polymer additives, waxes, and styrenic polymers. CERANOVUS® additives are used in asphalt roofing, asphalt roads, polymer processing, and plastic composites. Styrenic polymers are used in coatings, inks, and insulation.
FEEDSTOCK	GreenMantra targets post-consumer and post-industrial HDPE, LDPE, PP, and PS.
FACILITIES	GreenMantra operates one commercial facility in Brantford, Ontario, Canada, containing 3 production lines. A 4th production line will be commissioned in Q4 2019, which upon completion, will double the capacity for CERANOVUS® additives.
PARTNERS	GreenMantra has partnerships with Bioindustrial Innovation Canada, Business Development Bank of Canada, and Sun Chemical.
BUSINESS MODEL	Currently, GreenMantra owns and operates their facility focused on PE and PP. In the short term, GreenMantra will begin operation of their demonstration facility for PS. In the long term, GreenMantra will continue to build capacity at the Brantford facility to meet the growth in market demand, with the intent to establish additional facilities across the globe.

*Based on research and an interview. Validated with GreenMantra Technologies.

ILLINOIS SUSTAINABLE TECHNOLOGY CENTER
PRAIRIE RESEARCH INSTITUTE

LOCATION:
Champaign, Illinois, USA

TECHNOLOGY TYPE:
1. Purification
2. Conversion (thermal)

STAGE OF MATURITY:
Lab

SUPPLY CHAIN:
1. Plastics to polymers
2. Plastics to fuels

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Mar 18, 2019

DESCRIPTION	Illinois Sustainable Technology Center (ISTC) is developing two pathways for plastics. One employs a solvent extraction process to produce pure PC. The solvent used is N-methyl-2-pyrrolidone (NMP). The second pathway uses pyrolysis to convert complex mixtures of plastics to fuel.
FEEDSTOCK	ISTC processes plastic feedstocks from e-Waste, including simple mixtures such as PC/PA (via solvent extraction) and complex mixtures such as PC/PA/ABS/PMMA (via pyrolysis).
FACILITIES	ISTC has proven the purification and thermal conversion processes at the lab scale using Plastics No. 7 (Other). ISTC has also conducted pilot scale testing for the thermal conversion of Plastics No. 5 (PP), which is representative of thermal conversion applications to Plastics No. 2, 4, and 6 (HDPE, LDPE, PS.)
PARTNERS	Data not available.
BUSINESS MODEL	Data not available.

*Based on research and validated by Illinois Sustainable Technology Center.

Ioniqa Technologies

LOCATION:
Eindhoven, Netherlands

TECHNOLOGY TYPE:
Decomposition (chemical)

STAGE OF MATURITY:
Early commercial

SUPPLY CHAIN:
Plastics to monomers

CAPITAL NEEDS:
€2 million to recycle polyester textiles

LAST UPDATED:
Feb 27, 2019

DESCRIPTION	Ioniqa uses a glycolysis reaction with magnetic metal particles as a catalyst to produce a monomer: bis 2-hydroxyethyl terephthalate (BHET). This process can separate out colorants and other contaminations.
FEEDSTOCK	Ioniqa accepts all types and colors of PET feedstocks.
FACILITIES	Ioniqa has been conducting tests with a 1,000-liter batch reactor and is now building their first continuous unit with a capacity of 10,000 metric tons/year in the Netherlands. The industrial plant is expected to commission in the first half of 2019.
PARTNERS	Ioniqa is a spin-off from the Eindhoven University of Technology. Ioniqa is in a partnership with Unilever and Indorama Ventures. Coca-Cola has extended a loan to Ioniqa to accelerate the development of the technology.
BUSINESS MODEL	Currently, Ioniqa is scaling up with support from their partners. In the short term, Ioniqa will be pursuing the licensing model, potentially to PET producers or plastics recyclers. In the long term, Ioniqa is planning to broaden its technology platform and explore other materials such as polyamides (PA) and polyethylene furanoate (PEF).

*Based on research and an interview. Validated with Ioniqa Technologies.

Plastic2Oil

LOCATION:
Niagara Falls, New York, USA (HQ)

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Early commercial

SUPPLY CHAIN:
Plastics to fuels

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Feb 18. 2019

DESCRIPTION	3BI. Inc. developed the Plastic2Oil (P2O) technology which transforms unsorted, unwashed waste plastic into ultra-clean, ultra-low sulphur fuel without the need for refinement. Fuel products include naphtha, fuel no. 2 (such as furnace oil or diesel), and fuel no. 6 (such as heavy fuel for industrial boilers and ships).
FEEDSTOCK	The P2O technology targets HDPE, LDPE, PP, and other plastics (No. 2, 4, 5, 7) and does not accept PET and PVC (No. 1, 3).
FACILITIES	3BI has three operational facilities in the USA.
PARTNERS	3BI has a 20-year master agreement with Veridisyn, who has agreed to license the P2O technology and purchase P2O processors. Other partners include GTI, Indigo Energy, RockTenn, XTR Energy, and Coco Paving.
BUSINESS MODEL	Currently, 3BI licenses its P2O technology and is planning to resume fuel production and sales.

*Based on research only.

JEPLAN

LOCATION:
Tokyo, Japan (HQ)

TECHNOLOGY TYPE:
1. Decomposition (chemical)
2. Conversion (thermal)

STAGE OF MATURITY:
1. Pilot
2. Early commercial

SUPPLY CHAIN:
1. Plastics to polymers
2. Plastics to fuels

CAPITAL NEEDS:
$20 million USD for R&D to sort textiles for pure polyester

LAST UPDATED:
Mar 11, 2019

DESCRIPTION	Jeplan is pursing multiple innovation streams in advanced recycling. The first innovation is a chemical depolymerization process for PET using glycolysis to produce a monomer: bis 2-hydroxyethyl terephthalate (BHET). The monomers are used to produce polyester textiles. The second innovation uses pyrolysis to recover oil and metals from e-Waste.
FEEDSTOCK	Jeplan accepts PET (e.g., bottles, polyester textiles) and e-Waste, which are processed through their respective innovation streams.
FACILITIES	Jeplan operates one pilot polyester textiles plant in Kitakyushu, Japan, with a capacity of 2,000 tons/year. Jeplan also acquired a PET facility in Kawasaki, near Tokyo, with a capacity of 20,000 tons/year (currently not operational).
PARTNERS	Jeplan acquired Pet Refine Technology Co., Ltd. (PRT). For the recycling of e-Waste, Jeplan is partnered with DoCoMo.
BUSINESS MODEL	In the short term, Jeplan will supply fabric for uniforms used in the 2020 Olympics using output from the Kitakyushu facility. In the long term, Jeplan will expand capacity to establish factories in China, Indonesia, and USA.

*Based on research and an interview.

Karlsruhe Institute of Technology

LOCATION:
Karlsruhe, Germany

TECHNOLOGY TYPE:
Decomposition (chemical)

STAGE OF MATURITY:
Concept

SUPPLY CHAIN:
Plastics to monomers

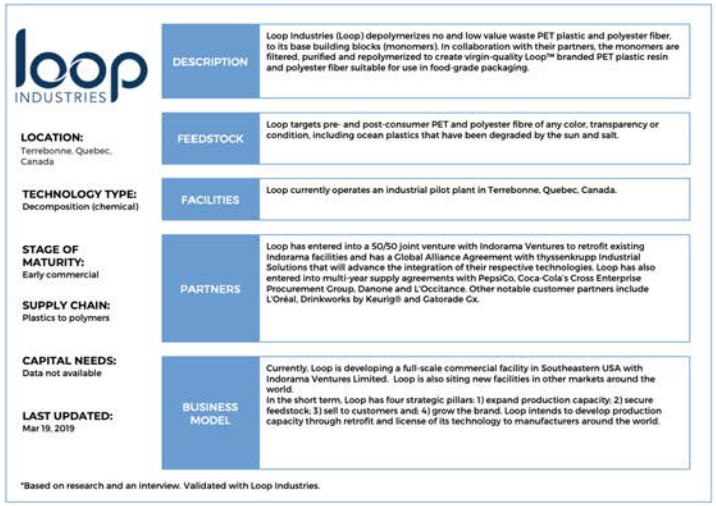
CAPITAL NEEDS:
Not actively fundraising

LAST UPDATED:
Feb 18, 2019

DESCRIPTION	Karlsruhe Institute of Technology (KIT) is developing a new catalyst that can be used to depolymerize plastic feedstocks into monomers such as ethylene and propylene. The technology is being explored by a number of companies and involves using a chemical catalyst to heat the material to approximately 932°F.
FEEDSTOCK	KIT targets post-consumer plastics.
FACILITIES	Data not available.
PARTNERS	KIT has signed an agreement with LyondellBasell to advance plastics recycling.
BUSINESS MODEL	Data not available.

*Based on research only.


KleanIndustries
LOCATION:
Vancouver, British Columbia, Canada (HQ)
TECHNOLOGY TYPE:
Conversion (thermal)
STAGE OF MATURITY:
Growth
SUPPLY CHAIN:
Plastics to fuels
CAPITAL NEEDS:
Data not available
LAST UPDATED:
Mar 26, 2019
DESCRIPTION
Klean Industries (Klean) uses pyrolysis, liquefaction, and gasification systems to produce refined fuels, recovered carbon black, and nano carbon filler compounds from various petroleum-based feedstocks.
FEEDSTOCK
Klean targets all types of post-consumer and post-industrial plastics (e.g., agricultural plastics, films, automotive shredder residues, e-Waste) and can handle high volumes of undesirable plastics such as PVC and PET alongside the ideal feedstock of HDPE, LDPE, PP, PS, and "mixed" 3-7.
FACILITIES
Klean currently has 17 operational plastics recycling facilities around the globe. The Sapporo Plastic Recycling (SPR) plant in Hokkaido, Japan, was built to process 15,000 metric tons/year and was installed in 1999. The facility was designed as a commercial scale flagship facility and has led to Klean's commercial success for the last 2 decades.
PARTNERS
Klean provides their technology and know-how to the Sapporo Plastic Recycling facility and to Greenfuels AG. Organizations involved with Klean's projects include Dow Chemical, Bayer, BASF, Toshiba Corporation, Sapporo City Government, Mitsui & Co. Ltd., Sacre-Davey, BDC, EDC, and Newalta.
BUSINESS MODEL
Currently, Klean has 15+ active projects for new plastics recycling facilities. Examples include: KleanFuels in Vancouver, Canada which will process 5,000 metric tons/year, GreenFuels in Germany which will process over 35,000 metric tons/year, and a 20,000 tons/year facility in Malta which will also incorporate the new KleanLoop blockchain technology that will bring in additional operational transparency. In the short term, Klean will roll out more facilities in North America and Europe that incorporate new advancements to the SPR technology that is used in Japan.
*Based on research and an interview. Validated with Klean Industries.


loop
INDUSTRIES
LOCATION:
Terrebonne, Quebec, Canada
TECHNOLOGY TYPE:
Decomposition (chemical)
STAGE OF MATURITY:
Early commercial
SUPPLY CHAIN:
Plastics to polymers
CAPITAL NEEDS:
Data not available
LAST UPDATED:
Mar 19, 2019
DESCRIPTION
Loop Industries (Loop) depolymerizes no and low value waste PET plastic and polyester fiber, to its base building blocks (monomers). In collaboration with their partners, the monomers are filtered, purified and repolymerized to create virgin-quality Loop™ branded PET plastic resin and polyester fiber suitable for use in food-grade packaging.
FEEDSTOCK
Loop targets pre- and post-consumer PET and polyester fibre of any color, transparency or condition, including ocean plastics that have been degraded by the sun and salt.
FACILITIES
Loop currently operates an industrial pilot plant in Terrebonne, Quebec, Canada.
PARTNERS
Loop has entered into a 50/50 joint venture with Indorama Ventures to retrofit existing Indorama facilities and has a Global Alliance Agreement with thyssenkrupp Industrial Solutions that will advance the integration of their respective technologies. Loop has also entered into multi-year supply agreements with PepsiCo, Coca-Cola's Cross Enterprise Procurement Group, Danone and L'Occitance. Other notable customer partners include L'Oréal, Drinkworks by Keurig® and Gatorade Gx.
BUSINESS MODEL
Currently, Loop is developing a full-scale commercial facility in Southeastern USA with Indorama Ventures Limited. Loop is also siting new facilities in other markets around the world.
In the short term, Loop has four strategic pillars: 1) expand production capacity; 2) secure feedstock; 3) sell to customers and; 4) grow the brand. Loop intends to develop production capacity through retrofit and license of its technology to manufacturers around the world.
*Based on research and an interview. Validated with Loop Industries.

NatureWorks

LOCATION:
Minnetonka, Minnesota, USA

TECHNOLOGY TYPE:
Decomposition (chemical)

STAGE OF MATURITY:
Early commercial

SUPPLY CHAIN:
Plastics to polymers

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Mar 5, 2019

DESCRIPTION	NatureWorks depolymerizes PLA via a hydrolysis reaction to recover lactic acid monomers. PLA is heated at 120-160°C and the process takes ~1-8 hours. The monomers are used to manufacture the company's Ingeo brand PLA and lactides which are used to make plastics and fibers.
FEEDSTOCK	NatureWorks utilizes internally generated pre-consumer PLA waste streams.
FACILITIES	NatureWorks operates a commercial Ingeo polylactide facility in Nebraska, USA, with a capacity of 150,000 metric tons/year.
PARTNERS	NatureWorks is jointly owned by PTT Global Chemical and Cargill. The company has business in North America, Europe, Japan, and Asia Pacific. Partners include EMF, Etimex, Taghleef Industries, Sidaplax, Constantia Flexibles, See Box Corporation, and Synerlink. Envirogreen has tolled converted PLA to lactic acid for NatureWorks.
BUSINESS MODEL	Currently, NatureWorks owns and operates their Nebraska facility and sells Ingeo brand PLA and lactides.

*Based on research and an interview. Validated with NatureWorks.

NEW HOPE ENERGY

LOCATION:
Tyler, Texas, USA

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Early commercial

SUPPLY CHAIN:
Plastics to fuels & petrochemicals

CAPITAL NEEDS:
Capital required to expand capacity through additional fabrication

LAST UPDATED:
Mar 22, 2019

DESCRIPTION	New Hope Energy (NHE) uses a pyrolysis process to convert plastics into high-quality petroleum products (e.g., bunker 2 and 4, marine gasoil, home heating oil, fuel oil 2 and 4, naphtha, paraffin, asphalt). NHE completes all fabrication in-house, which includes building their patented heat exchange vessels.
FEEDSTOCK	NHE accepts all post-consumer and post-industrial waste plastics, including plastics of mixed colors. NHE prefers HDPE, LDPE, PP, and PS.
FACILITIES	In 2018, NHE commissioned the Trinity Oaks facility in Tyler, Texas, which holds the first of several plastic conversion facilities (PCFs).
PARTNERS	NHE is a member of the American Chemistry Council's Plastics-to-Fuel & Petrochemistry Alliance. NHE has previously sold their renewable oil product to a refinery in Texas and has relationships with several other buyers.
BUSINESS MODEL	Currently, NHE is expanding the Trinity Oaks facility through in-house fabrication. NHE is in the initial stages of production and continues to conduct additional R&D related to technology, product development, renewable alternatives, and recovery. In the long term, NHE plans to issue licenses to plants where NHE is the operating company of record.

*Based on research and an interview.

NGR PLASTIC RECYCLING TECHNOLOGIES

LOCATION:
Feldkirchen, Austria (HQ)

TECHNOLOGY TYPE:
Purification

STAGE OF MATURITY:
Pilot

SUPPLY CHAIN:
Plastics to polymers

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Feb 18, 2019

DESCRIPTION	Next Generation Group is an established mechanical PET recycling equipment provider. Since 2015, Next Generation Group has also been developing a PET-recycling technology called Liquid State Polycondensation (LSP) to produce food-grade rPET. With LSP, decontamination and rebuilding of the molecular chain takes place in the liquid phase.
FEEDSTOCK	The LSP technology targets PET. Established initially for fibers only, LSP can now allow mixed PET feedstock, including bottles, flakes, sheets, strapping, and thermoforms. LSP can also process co-polymers of PET such as PETG and streams with polyolefin content (e.g., PE, PP).
FACILITIES	Next Generation Group demonstrated the LSP technology at its facility in Feldkirchen, Austria in Nov 2018.
PARTNERS	Next Generation Group is partnered with Ingka Group (parent company of IKEA) in this venture.
BUSINESS MODEL	Currently, Next Generation Group is working with their partner to scale up the technology.

*Based on research and validated with Next Generation Group.

nexus FUELS

LOCATION:
Atlanta, Georgia, USA

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Early commercial

SUPPLY CHAIN:
Plastics to fuels & petrochemicals

CAPITAL NEEDS:
Closing next round for capacity additions

LAST UPDATED:
Mar 14, 2019

DESCRIPTION	Nexus Fuels was founded in 2008 and uses modern pyrolysis technology to process waste plastics into high-grade fuels and waxes composed of a "clean crude" consisting of gasoline, kerosene, diesel, and wax.
FEEDSTOCK	Nexus Fuels processes both post-consumer/commercial/industrial plastics waste streams with preference to feedstock from upstream retail, commercial, agricultural, and industrial sources. System is optimized to accept HDPE, LDPE, PP, and PS and tolerates contaminants. The company performs pre-cycling® to eliminate PVC and PET.
FACILITIES	Nexus Fuels currently operates a commercial 50 ton/day plant scaled from a successful pilot in Atlanta, Georgia, USA. Nexus Fuels welcomes appropriate visitors.
PARTNERS	Nexus Fuels has contracts with plastic waste providers and off-takers around the USA and are signing strategic partnerships as part of their commercialization strategy.
BUSINESS MODEL	In the short term, Nexus Fuels is focusing on strategic operating partnerships to scale. The company will not be pursuing licensing; instead, joint partnerships.

*Based on research and an interview. Validated with Nexus Fuels.

PERPETUAL

LOCATION:
Nashik, India

TECHNOLOGY TYPE:
Decomposition (chemical)

STAGE OF MATURITY:
Growth

SUPPLY CHAIN:
Plastics to monomers

CAPITAL NEEDS:
Raising capital for expansion

LAST UPDATED:
Mar 8, 2019

DESCRIPTION	perPETual has commercialized its own proprietary low temperature glycolysis process, paired with color removal and depth filtration, to depolymerize plastics into an ester chemical compound. The ester is used to produce polyester yarns for textiles.
FEEDSTOCK	perPETual uses post-consumer PET water bottles, and can also process polyester textiles, PET packaging, and PET film.
FACILITIES	perPETual has a facility in Nashik, India which currently converts ~2 million plastic bottles per day.
PARTNERS	perPETual's recycled yarns are supplied on a repeat basis to over forty customers worldwide, such as adidas, H&M, Zara, Puma, Vero Moda, and Decathlon. perPETual has also partnered with textile mills in several countries.
BUSINESS MODEL	Currently, perPETual owns and operates their facility in India and sells their recycled polyester yarns. In the short term, perPETual aims to increase the capacity of the existing plant and are on track to recycle over 50 million plastic bottles per day by the end of 2021.

*Based on research and validated with perPETual.

PLASTIC ENERGY

LOCATION:
London, UK (HQ)

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Growth

SUPPLY CHAIN:
Plastics to fuels & petrochemicals

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Mar 13, 2019

DESCRIPTION	Plastic Energy™ uses patented thermal anaerobic conversion (TAC) technology to convert waste plastics into TACOIL, a mixture of naphtha and diesel. TACOIL can be used as feedstock to create new plastics or used as alternative low-carbon fuels.
FEEDSTOCK	Plastic Energy™ targets mixed, contaminated, multi-layered, as well as plastics that can no longer be mechanically recycled. This includes LDPE, HDPE, PS, and PP.
FACILITIES	Plastic Energy™ owns and operates two benchmark facilities: one in Seville, Spain, and one in Almeria, Spain.
PARTNERS	Plastic Energy™ signed a memorandum of understanding for the supply of feedstock to support SABIC's petrochemical operations in Europe. The company has also made commitments to divert plastics with organizations such as WWF Indonesia and the Ellen MacArthur Foundation.
BUSINESS MODEL	Currently, Plastic Energy™ owns and operates their two facilities and sells their TACOIL product. In the short term, Plastic Energy™ will focus on expanding in Europe and Asia and intends to expand its activities globally in the next 3 years.

*Based on research and validated with Plastic Energy.

POLYCYCL

LOCATION:
Kalka, Haryana, India (HQ)

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Pilot

SUPPLY CHAIN:
Plastics to fuels & petrochemicals

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Mar 12, 2019

DESCRIPTION	PolyCycl offers Contiflow Cracker™ - a patented technology that converts waste plastics to high value petrochemical feedstock and industrial fuels using a next-generation ***continuous*** process.
FEEDSTOCK	PolyCycl processes post-consumer and post-industrial plastics, including HDPE, LDPE, PP, PS, and multilayer packaging/film.
FACILITIES	In 2016-2017, PolyCycl setup India's first continuous process demonstration plant for conversion of municipal waste plastics to industrial middle distillate fuels.
PARTNERS	PolyCycl has a joint venture with Ramky Environment - India's largest waste management company. The company's demonstration plant has been audited by Mott MacDonald for product yield and fuel quality. PolyCycl has also established product market offtake acceptance and retails fuel generated from the plant to its industrial clients. PolyCycl was previously Ventana Cleantech.
BUSINESS MODEL	Currently, PolyCycl sells fuel generated from its demonstration plant to several industrial customers. In the short term, PolyCycl will be setting up its first plant in Hyderabad, India with Ramky Group. In the long term, PolyCycl will license its technology to waste management companies globally. PolyCycl also plans to form joint ventures with selective Tier-1 waste management companies to build and operate plastic-to-fuel facilities globally.

*Based on research and validated with PolyCycl.

Polystyvert

LOCATION:
Montreal, Quebec, Canada

TECHNOLOGY TYPE:
Purification

STAGE OF MATURITY:
Pilot

SUPPLY CHAIN:
Plastics to polymers

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Feb 18, 2019

DESCRIPTION	Polystvert uses a mix of filtration, dissolution, and purification to recycle PS back into PS (in the form of pellets). A coarse filtration process removes large contaminants (e.g., paper, other plastics, cardboard, metals, etc.). The dissolution and purification occur in an essential oil, which acts as the solvent and is recovered.
FEEDSTOCK	Polystvert processes all forms of PS, including expanded PS, extruded PS, and high-impact PS.
FACILITIES	Polystvert has a continuous industrial pilot operating at 125 kg/hr. The estimated output is 600 metric tons/year.
PARTNERS	Polystvert has many investors and financing partners, including capital from grants, equity from seed shareholders, and loans. Polystvert also has an industrial partnership with TOTAL Group.
BUSINESS MODEL	In the short term, Polystvert will begin commercial deployment through a licensing system in Europe and North America. In the long term, Polystvert will continue commercialization through licenses on a worldwide scale.

*Based on research only.

PURECYCLE TECHNOLOGIES

LOCATION:
Lawrence County, Ohio, USA

TECHNOLOGY TYPE:
Purification

STAGE OF MATURITY:
Early commercial

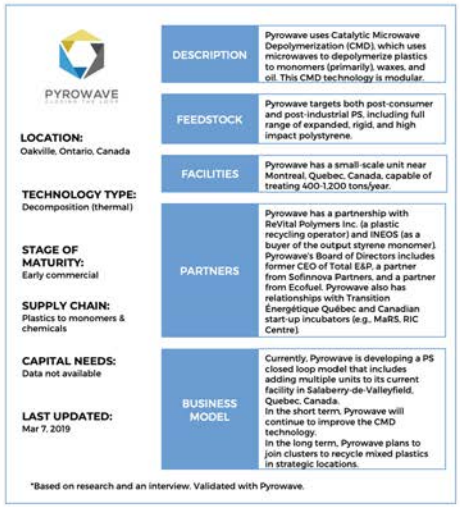
SUPPLY CHAIN:
Plastics to polymers

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Mar 11, 2019

DESCRIPTION	PureCycle is a solvent-based physical separation process that removes colorants, odors, and other contaminants from PP. It is a 2-stage process.
FEEDSTOCK	PureCycle uses waste PP.
FACILITIES	PureCycle is beginning commissioning of their Feedstock Evaluation Unit (FEU), which is a smaller scale of the commercial scale line, in Hanging Rock, Ohio, USA.
PARTNERS	The technology was developed by Procter & Gamble (P&G). PureCycle has a strategic partnership with P&G as well as relationships with other businesses that are not public at this time.
BUSINESS MODEL	Currently, PureCycle is focusing on start-up and commissioning of Phase I of the plant (the Feedstock Evaluation Unit). In the short term, PureCycle will begin construction on Phase II which will produce 50 kiloton/year, which has already been designed. In the long term, PureCycle will sell their ultra-pure recycled polypropylene (UPRP) at a slight premium to virgin PP.

*Based on research and validated with PureCycle Technologies.



PYROWAVE

LOCATION:
Oakville, Ontario, Canada

TECHNOLOGY TYPE:
Decomposition (thermal)

STAGE OF MATURITY:
Early commercial

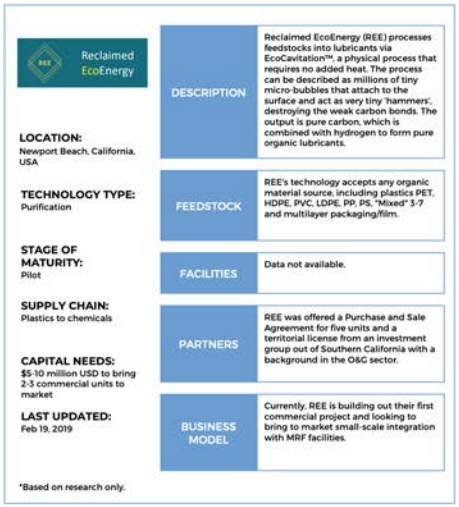
SUPPLY CHAIN:
Plastics to monomers & chemicals

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Mar 7, 2019

DESCRIPTION	Pyrowave uses Catalytic Microwave Depolymerization (CMD), which uses microwaves to depolymerize plastics to monomers (primarily), waxes, and oil. This CMD technology is modular.
FEEDSTOCK	Pyrowave targets both post-consumer and post-industrial PS, including full range of expanded, rigid, and high impact polystyrene.
FACILITIES	Pyrowave has a small-scale unit near Montreal, Quebec, Canada, capable of treating 400-1,200 tons/year.
PARTNERS	Pyrowave has a partnership with ReVital Polymers Inc. (a plastic recycling operator) and INEOS (as a buyer of the output styrene monomer). Pyrowave's Board of Directors includes former CEO of Total E&P, a partner from Sofinnova Partners, and a partner from Ecofuel. Pyrowave also has relationships with Transition Énergétique Québec and Canadian start-up incubators (e.g., MaRS, RIC Centre).
BUSINESS MODEL	Currently, Pyrowave is developing a PS closed loop model that includes adding multiple units to its current facility in Salaberry-de-Valleyfield, Quebec, Canada. In the short term, Pyrowave will continue to improve the CMD technology. In the long term, Pyrowave plans to join clusters to recycle mixed plastics in strategic locations.

*Based on research and an interview. Validated with Pyrowave.



Reclaimed EcoEnergy

LOCATION:
Newport Beach, California, USA

TECHNOLOGY TYPE:
Purification

STAGE OF MATURITY:
Pilot

SUPPLY CHAIN:
Plastics to chemicals

CAPITAL NEEDS:
$5-10 million USD to bring 2-3 commercial units to market

LAST UPDATED:
Feb 19, 2019

DESCRIPTION	Reclaimed EcoEnergy (REE) processes feedstocks into lubricants via EcoCavitation™, a physical process that requires no added heat. The process can be described as millions of tiny micro-bubbles that attach to the surface and act as very tiny 'hammers', destroying the weak carbon bonds. The output is pure carbon, which is combined with hydrogen to form pure organic lubricants.
FEEDSTOCK	REE's technology accepts any organic material source, including plastics PET, HDPE, PVC, LDPE, PP, PS, "Mixed" 3-7 and multilayer packaging/film.
FACILITIES	Data not available.
PARTNERS	REE was offered a Purchase and Sale Agreement for five units and a territorial license from an investment group out of Southern California with a background in the O&G sector.
BUSINESS MODEL	Currently, REE is building out their first commercial project and looking to bring to market small-scale integration with MRF facilities.

*Based on research only.

Recycling Technologies

LOCATION:
Swindon, England (HQ)

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Early commercial

SUPPLY CHAIN:
Plastics to fuels & chemicals

CAPITAL NEEDS:
£10 million in mixture of equity and debt

LAST UPDATED:
Mar 12, 2019

DESCRIPTION	Recycling Technologies has engineered a modular and scalable technology to chemically convert residual plastic wastes into Plaxx®. Plaxx® is oil cut into fractions. Target applications for Plaxx® fractions are steam cracker feedstock for plastic production (~70%) and wax (~30%).
FEEDSTOCK	Recycling Technologies targets post-consumer and post-industrial PET, HDPE, LDPE, PP, PS, Mixed 3-7, and multilayer packaging/film.
FACILITIES	Recycling Technologies has a demonstration machine (the Beta Plant) with a processing capacity of 100 kg/hour, built and operating at Swindon Borough Council's Recycling Centre.
PARTNERS	Recycling Technologies has offtake partners with InterChem for liquid fractions and Kerax for the wax fraction. Other partners include Ecosurety and Swindon Borough Council. The company is a member of the New Plastic Economy.
BUSINESS MODEL	Currently, Recycling Technologies is building the first commercial scale plant, the RT7000, to be installed in Scotland. In the long term, Recycling Technologies aims to mass produce and sell RT7000 machines to waste management companies, recycling centers or third parties, with ~1,350 machines sold by 2027.

*Based on research and an interview. Validated with Recycling Technologies.

ReNew ELP

LOCATION:
Redcar, UK

TECHNOLOGY TYPE:
Conversion (chemical)

STAGE OF MATURITY:
Early commercial

SUPPLY CHAIN:
Plastics to fuels & petrochemicals

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Mar 5, 2019

DESCRIPTION	ReNew ELP (ReNew) uses a patented hydrothermal upgrading platform (Cat-HTR™) to convert end-of-life waste plastics into hydrocarbon feedstocks (e.g., naphtha, diesel, vacuum gas oil, and heavy waxes).
FEEDSTOCK	ReNew recycles post-consumer plastics, including PET, HDPE, LDPE, PP, PS, and "mixed" 3-7 plastics.
FACILITIES	ReNew is building their first commercial-scale facility in Teesside, UK, which will process 20,000 metric tons/year of plastic.
PARTNERS	ReNew's Cat-HTR™ technology was developed by Licella and the University of Sydney. The commercial facility is being built through a joint venture with Licella and Armstrong Chemicals. ReNew has also partnered with Neste.
BUSINESS MODEL	Currently, ReNew is negotiating feedstock supply agreements and completing construction of its Teesside facility for Q4 2019. In the short term, ReNew will scale up the Teesside facility to 80,000 metric tons/year through 3 additional modular units. In the long term, ReNew will aim to globally roll-out and license the technology to waste producers and waste processing companies.

*Based on research and validated with ReNew ELP.

RENEWLOGY

LOCATION:
Salt Lake City, Utah, USA

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Early commercial

SUPPLY CHAIN:
Plastics to fuels & petrochemicals

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Mar 12, 2019

DESCRIPTION	Renewlogy uses a continuous, automated thermal conversion process to convert waste plastics into liquid fuels (e.g., naphtha, diesel, kerosene, and light fuels).
FEEDSTOCK	Renewlogy targets all post-consumer waste plastics, including "mixed" 3-7.
FACILITIES	Renewlogy currently has two facilities: a demonstration facility in Salt Lake City, Utah, USA, and a large-scale facility in Chester, Nova Scotia, Canada. The Chester facility is capable of processing 6 million lbs/year of plastics.
PARTNERS	Renewlogy partnered with Sustane Technologies and Canada SDTC to set up their Nova Scotia facility. Renewlogy is also working with Western Recycling and Firstar Fiber on the Hefty® EnergyBag® program.
BUSINESS MODEL	Currently, Renewlogy is working with the City of Phoenix on developing a second large-scale facility in Phoenix, Arizona, USA. In the short term, Renewlogy has a pipeline of commitments in other cities across North America, as well as projects in Asia which have support from National Geographic and the Alliance to End Plastic Waste.

*Based on research and an interview. Validated with Renewlogy.

RES POLYFLOW™

LOCATION:
Chagrin Falls, Ohio, USA (HQ)

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Early commercial

SUPPLY CHAIN:
Plastics to fuels

CAPITAL NEEDS:
Not actively fundraising

LAST UPDATED:
Mar 9, 2019

DESCRIPTION	RES Polyflow converts mixed contaminated plastics to naphtha, distillate, and paraffin wax. The technology is process dependant, rather than feedstock dependant; therefore, RES Polyflow can obtain consistent outputs despite inconsistent feedstocks.
FEEDSTOCK	RES Polyflow accepts post-consumer and post-industrial plastics (e.g., PET, HDPE, "Mixed" 3-7) which the company pre-treats before feeding into its process.
FACILITIES	RES Polyflow has one demonstration unit that operated in Perry, Ohio, USA and is building a commercial plant incorporating four commercial units in Ashley, Indiana, USA with each conversion vessel running at 6,000 lbs/hr.
PARTNERS	RES Polyflow is partnered with BP and AM WAX in offtake agreements to take products in finished form. RES Polyflow is working with an aggregator in Chicago for its feedstock.
BUSINESS MODEL	Currently, the Ashley, Indiana facility is being retrofitted for scale-up to produce 1,600 bbl/day of ultra-low sulfur diesel fuel and naphtha blend stocks. In the short term, RES Polyflow will own and operate their facility. In the long term, RES Polyflow will license the technology to waste processors, petrochemical companies and other strategic partners, and take the output liquids to refine and sell.

*Based on research and an interview. Validated with RES Polyflow.

Resinate® MATERIALS GROUP

LOCATION:
Plymouth, Michigan, USA

TECHNOLOGY TYPE:
Decomposition (chemical)

STAGE OF MATURITY:
Pilot

SUPPLY CHAIN:
Plastics to polymers

CAPITAL NEEDS:
Open to equity stake

LAST UPDATED:
Mar 22, 2019

DESCRIPTION	Resinate Materials Group (Resinate) developed Recycolysis™, a glycolysis process to convert PET into polyester polyols. The polyols can be used to manufacture coatings, adhesives, sealants, elastomers, lubricants, and foams for various applications, such as flooring, furniture, building materials, packaging, and building insulation.
FEEDSTOCK	Resinate targets post-consumer and post-industrial PET plastics, including water bottles, carpet, automotive components, and medical packaging.
FACILITIES	Resinate has an 8,200 sq ft R&D facility in Plymouth, Michigan, USA.
PARTNERS	Resinate collaborated with the Ford Motor Company to test the performance of the output polyols in automotive foam applications.
BUSINESS MODEL	Currently, Resinate has access to 200 metric ton of pilot-scale and 4,500 metric ton of production-scale capacity annually with existing contract manufacturing partners. In the long term, Resinate plans to scale the Resinate brand in North America with technology licensing options for other global regions - all within a Circular Economy model.

*Based on research and validated by Resinate Materials Group.

Resynergi

LOCATION:
Santa Rosa, California, USA

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Pilot

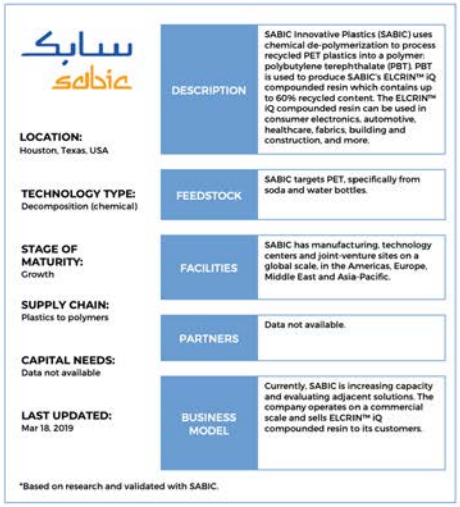
SUPPLY CHAIN:
Plastics to fuels & petrochemicals

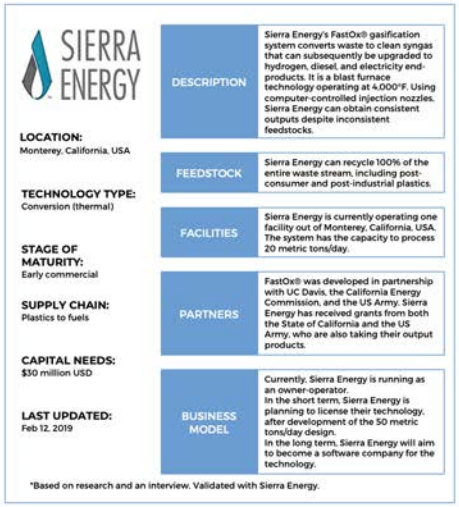
CAPITAL NEEDS:
Data not available

LAST UPDATED:
Feb 14, 2019

DESCRIPTION	Resynergi provides pyrolysis and gasification systems for converting plastics to low-carbon and low-sulfur fuels. The system's outputs are 80% ASTM-grade diesel (which is generally sulfur-free) and 20% petrochemicals, comprising of naphtha mixed with heavier oil.
FEEDSTOCK	Resynergi processes HDPE, LDPE, PP, and PS.
FACILITIES	Resynergi is currently operating out of Washington and California in the USA. The company's Evolucient Continuous Microwave Assisted Pyrolysis (CMAP) system is modular, compact, and portable, with a per-unit capacity to process 1-5 metric ton/day of feedstock.
PARTNERS	Resynergi has partnered with the University of Minnesota to develop this microwave-based technology.
BUSINESS MODEL	In the long term, Resynergi aims to sell its modular microwave system to a range of buyers, such as big box stores and manufacturers.

*Based on research only.


LOCATION:
Houston, Texas, USA
TECHNOLOGY TYPE:
Decomposition (chemical)
STAGE OF MATURITY:
Growth
SUPPLY CHAIN:
Plastics to polymers
CAPITAL NEEDS:
Data not available
LAST UPDATED:
Mar 18, 2019
DESCRIPTION
SABIC Innovative Plastics (SABIC) uses chemical de-polymerization to process recycled PET plastics into a polymer. polybutylene terephthalate (PBT). PBT is used to produce SABIC's ELCRIN™ iQ compounded resin which contains up to 60% recycled content. The ELCRIN™ iQ compounded resin can be used in consumer electronics, automotive, healthcare, fabrics, building and construction, and more.
FEEDSTOCK
SABIC targets PET, specifically from soda and water bottles.
FACILITIES
SABIC has manufacturing, technology centers and joint-venture sites on a global scale, in the Americas, Europe, Middle East and Asia-Pacific.
PARTNERS
Data not available.
BUSINESS MODEL*
Currently, SABIC is increasing capacity and evaluating adjacent solutions. The company operates on a commercial scale and sells ELCRIN™ iQ compounded resin to its customers.
*Based on research and validated with SABIC.


SIERRA ENERGY
LOCATION:
Monterey, California, USA
TECHNOLOGY TYPE:
Conversion (thermal)
STAGE OF MATURITY:
Early commercial
SUPPLY CHAIN:
Plastics to fuels
CAPITAL NEEDS:
$30 million USD
LAST UPDATED:
Feb 12, 2019
DESCRIPTION
Sierra Energy's FastOx® gasification system converts waste to clean syngas that can subsequently be upgraded to hydrogen, diesel, and electricity end-products. It is a blast furnace technology operating at 4,000°F. Using computer-controlled injection nozzles, Sierra Energy can obtain consistent outputs despite inconsistent feedstocks.
FEEDSTOCK
Sierra Energy can recycle 100% of the entire waste stream, including post-consumer and post-industrial plastics.
FACILITIES
Sierra Energy is currently operating one facility out of Monterey, California, USA. The system has the capacity to process 20 metric tons/day.
PARTNERS
FastOx® was developed in partnership with UC Davis, the California Energy Commission, and the US Army. Sierra Energy has received grants from both the State of California and the US Army, who are also taking their output products.
BUSINESS MODEL
Currently, Sierra Energy is running as an owner-operator.
In the short term, Sierra Energy is planning to license their technology, after development of the 50 metric tons/day design.
In the long term, Sierra Energy will aim to become a software company for the technology.
*Based on research and an interview. Validated with Sierra Energy.

PennState

LOCATION:
Pennsylvania, USA

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Lab

SUPPLY CHAIN:
Plastics to fuels

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Feb 15, 2019

DESCRIPTION	The Pennsylvania State University developed a process to densify waste plastic into fuel nuggets called Plastofuel™. The technology works by forcing film or rigid plastics through a heated extrusion die.
FEEDSTOCK	Plastofuel can process all plastics but targets non-recyclable plastics, with a focus on agricultural and household waste.
FACILITIES	The scaled-up prototype at the Pennsylvania State University produces 500 lbs/hr of Plastofuel™.
PARTNERS	The technology was developed in the Department of Agricultural and Biological Engineering.
BUSINESS MODEL	Data not available.

*Based on research and validated with The Pennsylvania State University.

TRASH 2 CASH

LOCATION:
Europe

TECHNOLOGY TYPE:
Decomposition (chemical)

STAGE OF MATURITY:
Concept

SUPPLY CHAIN:
Plastics to polymers

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Mar 21, 2019

DESCRIPTION	Trash-2-Cash is developing various chemical depolymerization technologies. One is for the de-repolymerization to obtain recycled polyester (r-PET) fibers. The other is a melt mixing process to obtain mixed-PET pellets. The output products will be converted into polyester that is the same quality as new materials and PET pellets for injection moulding.
FEEDSTOCK	Trash-2-Cash targets PET textile waste.
FACILITIES	Data not available.
PARTNERS	Trash-2-Cash is an EU funded project, with 18 partners from 10 countries. The company is part of the EU Horizon 2020 research and innovation programme. Some partners working on this project include VTT, Aalto University, Fundacion CIDETEC, The University of the Arts London, Material ConneXion Italia, VanBerlo, and RISE, Research Institutes of Sweden.
BUSINESS MODEL	Data not available.

*Based on research and validated with RISE Research Institutes of Sweden.

TYTON BioSciences

LOCATION:
Danville, Virginia, USA

TECHNOLOGY TYPE:
Decomposition (chemical)

STAGE OF MATURITY:
Lab

SUPPLY CHAIN:
Plastics to monomers

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Feb 19, 2019

DESCRIPTION	Tyton BioSciences (Tyton) uses subcritical water technology to make building blocks for PET and virgin-grade polyester. These building blocks are the PET monomers: terephthalic acid and ethylene glycol.
FEEDSTOCK	Tyton's technology accepts a broad spectrum of starting materials, including cotton. For the plastics supply chain, Tyton can accept PET plastics and polyester.
FACILITIES	Data not available.
PARTNERS	Tyton has joined the Scaling Programme by Fashion for Good in 2018.
BUSINESS MODEL	Data not available.

*Based on research only.

UMASS University of Massachusetts Lowell

LOCATION:
Massachusetts, USA

TECHNOLOGY TYPE:
Decomposition (chemical)

STAGE OF MATURITY:
Concept

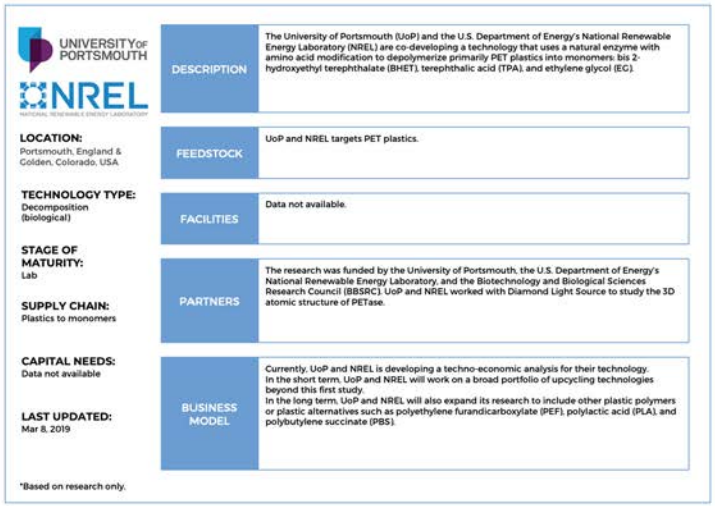
SUPPLY CHAIN:
Plastics to monomers & polymers

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Feb 19, 2019

DESCRIPTION	University of Massachusetts-Lowell (UML) will be researching recycling and recovery of plastics, specifically, scalable high shear catalyzed depolymerization of multilayer plastic packaging. The process is intended to recover monomers and/or polymers.
FEEDSTOCK	UML will target multilayer packaging/film. This includes layers of various polymer materials (e.g., PET, PP, PE, PP, PA) that are sometimes combined with paper and aluminum foil.
FACILITIES	Data not available.
PARTNERS	This research project is part of The REMADE Institute's Project Call 1.0. Partners include the Michigan State, Unilever, American Chemistry Council, and National Renewable Energy Laboratory.
BUSINESS MODEL	Data not available.

*Based on research only.


UNIVERSITY OF PORTSMOUTH
NREL
NATIONAL RENEWABLE ENERGY LABORATORY
LOCATION:
Portsmouth, England &
Golden, Colorado, USA
TECHNOLOGY TYPE:
Decomposition
(biological)
STAGE OF MATURITY:
Lab
SUPPLY CHAIN:
Plastics to monomers
CAPITAL NEEDS:
Data not available
LAST UPDATED:
Mar 8, 2019
*Based on research only.
DESCRIPTION
The University of Portsmouth (UoP) and the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) are co-developing a technology that uses a natural enzyme with amino acid modification to depolymerize primarily PET plastics into monomers: bis 2-hydroxyethyl terephthalate (BHET), terephthalic acid (TPA), and ethylene glycol (EG).
FEEDSTOCK
UoP and NREL targets PET plastics.
FACILITIES
Data not available.
PARTNERS
The research was funded by the University of Portsmouth, the U.S. Department of Energy's National Renewable Energy Laboratory, and the Biotechnology and Biological Sciences Research Council (BBSRC). UoP and NREL worked with Diamond Light Source to study the 3D atomic structure of PETase.
BUSINESS MODEL
Currently, UoP and NREL is developing a techno-economic analysis for their technology.
In the short term, UoP and NREL will work on a broad portfolio of upcycling technologies beyond this first study.
In the long term, UoP and NREL will also expand its research to include other plastic polymers or plastic alternatives such as polyethylene furandicarboxylate (PEF), polylactic acid (PLA), and polybutylene succinate (PBS).

울산대학교 UNIVERSITY OF ULSAN

LOCATION:
Ulsan, South Korea

TECHNOLOGY TYPE:
Purification

STAGE OF MATURITY:
Lab

SUPPLY CHAIN:
Plastics to polymers

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Feb 18, 2019

DESCRIPTION	University of Ulsan deploys purification to process styrene-based plastics from e-Waste and separate them into ABS and HIPS polymers. After coating with Zinc Oxide (ZnO), a 2-minute microwave treatment rearranges the molecular surfaces of the plastics blend, which eases the selective separation of ABS and HIPS.
FEEDSTOCK	University of Ulsan targets styrene-based e-Waste plastics, commonly known as WEEE (Waste Electrical and Electronic Equipment).
FACILITIES	Data not available.
PARTNERS	The research was funded by the Korea Environmental Industry and Technology Institute. ZnO coating and the floating agent were obtained from Samchun Pure Chemical Co., Ltd. and Daejung Chemicals and Metals Co., Ltd., respectively.
BUSINESS MODEL	Data not available.

*Based on research only.

VADXX
PLASTIC TO ECOFUEL

LOCATION:
Cleveland, Ohio, USA

TECHNOLOGY TYPE:
Conversion (thermal)

STAGE OF MATURITY:
Early commercial

SUPPLY CHAIN:
Plastics to fuels

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Feb 14, 2019

DESCRIPTION	Vadxx uses its proprietary continuous feed thermal process to convert plastic waste into diesel fuel, naphtha, waxes/lubes, syngas, and solid carbon products (collectively known as EcoFuels™).
FEEDSTOCK	Vadxx sources mixed waste plastics feedstock from both post-consumer and post-industrial partners via contracts. Their optimal feedstock by weight includes 70% HDPE, LDPE, and PP and 30% of other plastics (e.g. PS and other).
FACILITIES	Vadxx commissioned its first commercial facility in Akron, Ohio, USA in 2016. The plant has the capacity to process 25,000 tons/year of plastic waste.
PARTNERS	Vadxx is an active member of the American Chemistry Council (ACC) and the Plastics-to-Fuels and Petrochemistry Alliance (PFPA). The company's partners include large oil and gas companies and experienced post-consumer waste handlers. Vadxx has a close relationship with an international EPC for future construction and operation of plants around the world.
BUSINESS MODEL	Currently, Vadxx is siting facilities on multiple continents that are 10-15 times the size of the current Akron, Ohio facility. In the long term, Vadxx will own and operate plants individually or through partnerships. Vadxx will also sell their technology.

*Based on research and an interview.

worn again technologies

LOCATION:
London, UK

TECHNOLOGY TYPE:
Purification

STAGE OF MATURITY:
Pilot

SUPPLY CHAIN:
Plastics to polymers

CAPITAL NEEDS:
Data not available

LAST UPDATED:
Mar 12, 2019

DESCRIPTION	Worn Again Technologies uses a patented solvent-based polymer recycling technology to separate and decontaminate PET and cellulose from cotton using dye removal, dissolution, purification, and restoration to produce PET pellets and cellulosic pulp.
FEEDSTOCK	Worn Again Technologies processes pure and blended non-reusable polyester and cotton textiles, post-consumer PET bottles, and packaging.
FACILITIES	Worn Again Technologies is planning their first industrial demonstration plant to be built in 2020.
PARTNERS	Worn Again Technologies has partnerships with H&M, Kering, Sulzer Chemtech, Hirnes Corporation, Directex, Miroslava Duma's Future Tech Lab, and Qvartz.
BUSINESS MODEL	In the short term, Worn Again Technologies aims to establish their first industrial demonstration plant to be operational by 2021. In the long term, Worn Again Technologies will offer licenses to commercial plant operators.

*Based on research and validated with Worn Again Technologies.

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Senate Committee on Environment and Public Works
Hearing entitled, *"Responding to the Challenges Facing Recycling in the United States"*
June 17, 2020
Questions for the Record for Bridget Croke

Senator Sullivan:

1. As you know, together with Senators Whitehouse and Menendez, I sponsored the Save Our Seas 2.0 Act, which passed the Senate in January and is under consideration by the House. The bill is not a silver bullet but it is significant progress in combatting plastic pollution, and we look forward to its passage and to begin further work together after.

   Can you discuss how Save Our Seas 2.0 could help encourage recycling and therefore reduce marine debris?

   Bridget: Policy has the opportunity to incentivize the growth of circular supply chains, increasing the value of recycled material and efficient use of materials. We strongly encourage policy levers that help improve recycling infrastructure so it can become the primary feedstock for material supply chains and compete with raw material supply chains. Access to large amounts of recycled commodities reduces reliance on volatile raw commodity markets and improves supply chain resiliency.

2. It's often mentioned that funding for recycling isn't the challenge—the challenge is defining what needs to be funded. It **is** often a question of funding, though, particularly in remote communities like in Alaska. What do you see as good options for Alaska?
   Bridget: Alaska is a unique beautiful state that has significant shipping /barge traffic bringing in supplies and moving materials back to ports in the US, typically the Seattle/Vancouver area. There is strong demand for recyclable feedstock in the northwest that could benefit from increased volumes from Alaskans. Smaller mini-MRFs such as the Revolution system could help process rural Alaska materials, aggregate those materials and send them back into manufacturing supply chains that are necessary to build our circular economy.

3. Innovation in recycling is critical. Can you expand some more on what the federal government can do to help drive that innovation to make America a leader in recycling technologies?
   Bridget: We'd encourage incentives for innovative technology, business model and systems (infrastructure and supply chains) and funding of early stage research and development in how to apply technology and innovation into this sector, coordinating across departments (FDA, USAID, NSF etc) to identify the best opportunities. Tax credits for investments made in these new technologies would send the right signal to brands and investors that want to drive forward solutions that make business sense – but might be early innovations that need broader support and investment.

4. America's recycling system is primarily managed at the state and local level, but low recycling rates nationwide warrant federal participation in the improvement of the waste

management system. The EPA estimates that approximately 8% of plastic is recycled and the national recycling average across all materials hovers around 23%.

a. Could you outline what specific role the federal government should play relative to efforts of states and localities?

Bridget: The federal government could help harmonize regional recycling programs, improve data and definitions of what is recyclable and create standards to ensure recycled content can get back into packaging and products that will be used by consumers.

5. Material recovery facilities (MRFs) nationwide have struggled to generate revenue, invest in new technology, and maintain reasonable recycling standards. The wellbeing and profitability of MRFs is critical to the health of the US recycling system.

a. What suggestions do you have for addressing this challenge?
Bridget: Best in class recycling facilities continue to be revenue positive in the toughest of times. Balcones Resources, Eureka Recycling, Recology, SIMS and Pratt are just a few examples. We recommend using tax credits and incentives as a tool to enable growth and expansion of facilities focused on bringing feedstock to our manufacturing supply chain, including recycled fiber, metals and plastics

b. Would better sorting technologies at MRFs benefit the larger waste management system?
Bridget: Absolutely, we are seeing advancements in AI and robotics that will build efficiency and improve data to help improve the quality of material going through the recycling system, thereby improving the economics.

6. Consumer goods companies believe they have a role to play in the proper disposal of the products they produce and that effective recycling systems require shared responsibility. These companies endorse a variety of policies and have volunteered to make considerable investment in recycling systems worldwide. Deposit Return Systems (DRS) and Extended Producer Responsibility (EPR) are among the most common systems in which industry plays a role in the management and funding of recycling systems.

Deposit Return Systems (DRS) are touted as one of the most effective methods of managing and generating funds for recycling systems. While recycling rates of high value materials in these systems are robust, DRS does not account for all materials in the waste stream. And often, funds raised from unclaimed deposits don't in fact fund recycling improvements, but rather are put in a government's general fund.
Extended Producer Responsibility (EPR) is another popular construct for managing recycling systems. While EPR may not achieve the high recycling rates of certain materials, it addresses all materials in the waste stream, can be easier to manage than a deposit system, is easier to manage, and boasts broader support.
As conversations advance about how to address the underinvestment in recycling infrastructure in the US, new concepts in addition to deposits and EPR are being proposed

through stakeholder discussions. These build on the lessons learned (what has worked, and what hasn't) from these systems in the EU, Canada, and US states.

What, in your view, is an ideal system for the unique US market and why? Bridget: We see EPR as a policy lever that provides the right funding mechanism to accelerate recovery systems for ALL packaging and paper products Americans use every day.

We Support EPR that includes the following:

- Establish a clear measurable recovery goal of 80% with a timeline to reach goal
- Develop transparent cost principles so fees paid by brands are based on each packaging material type and the net cost to recover each. This creates a financially sustainable operating model for growing the circular system.
- Centralized management by a Producer Responsibility Organization (PRO) with a defined role for government which should include evaluation and approval of plans.

7. America's most effective recycling systems incorporate considerable industry involvement in their management and governance.

    a. Do you favor industry involvement in the management of recycling systems? Bridget: With EPR, there is a Producer Responsibilty Organization (PRO) that includes the brands that will pay the costs to recover and recycle packaging and paper products. This direct engagement gives industry not just a seat at the table but provides insights into the real cost of providing a circular system for recovery and remanufacturing of the packages industry use to deliver their products to consumers.

    b. Is partial industry governance scalable in the United States? Bridget: Of course, this is done in provinces across Canada and throughout the European Union countries. In many of these locations, there are rural populations spread over large geographies – understanding the logistics and economies of scale needed in these rural regions helps build a strong, vibrant system.

    c. What are your opinions of Producer Responsibility Organizations in the management of recycling systems? Bridget: We think PROs are critical to any EPR scheme in the US

Ranking Member Carper:

8. As you know, Extended Producer Responsibility (EPR) is a policy approach that makes the producer of the products they produce bear either a financial burden, a physical responsibility, or a combination of the two for the end-of-life management of post-consumer products. There are currently 119 EPR laws at the state and local level in the United States in 33 states and the District of Columbia for products including electronics,

pharmaceuticals, batteries, paint, and more. Canadian provinces like British Columbia have taken a step further and implemented EPR for packaging and paper products. An EPR system alleviates the waste management burden on consumers and instead places that responsibility on the producers to manage the waste management process including the collection, processing, and disposal and recycling.

a. Should the United States consider implementing a federal EPR policy for packaging and paper products? Why or why not?

Bridget: We see EPR as an important policy lever to help solve some of the market failures and help build scale in circular supply chains as well as reduce risk for investors.

b. What sorts of obstacles will need to be overcome should the United States explore implementing an EPR system?

Bridget:
The largest challenge is:
There are existing contracts for recycling services (collection and processing) that could be impacted if the US Congress adopts an EPR system. Most of these contracts are between local government and a private operator and contain specific contract language on how to change the agreement.
The biggest opportunity is:
This disruption to existing agreements could help align and standardize contracts for services, establish clarity on materials handling and help identify standard costs and quality standards across the country. This would then enable clear net costs for services with nuances for economies of scale, but would also provide manufacturers who want to utilize recycled materials consistent quality and quantities of good high quality feedstock.

9. A recent comprehensive survey of plastic waste collection in the U.S. revealed that the majority of plastic used to make our foodware and consumer packaging cannot be claimed as recyclable, per the Federal Trade Commission. Most of these items are not accepted by curbside programs or local recovery facilities, and the likelihood of being recycled into a new product is extremely low.

a. From your experience at Closed Loop Partners, what needs to be done to address this problem and what can Congress do to help? Bridget: This is an area where supporting innovation in reuse models and new materials is important. Given that many communities are considering compostable packaging and foodware, we recommend federal research dollars go toward understanding what needs to be true for compostable foodware to make sense (ie – access to composting or anaerobic digestion, optimal materials and bioavailability of nutrients in those materials etc)

b. Which technologies has Closed Loop invested in that incentivize reusing products as opposed to using single-use products? Bridget: We have invested in Algramo, a

smart refillable packaging system that makes it safe, convenient and cost effective to refill products. We are doing the first US pilot in NYC in late August.

c. Is one solution to this recycling problem switching to compostable foodware and packaging products instead? Why or why not? Bridget: While we do feel that compostable foodware COULD be a good option, we need to do research to understand how these items effect the value of the compost or energy coming out of those systems. Additionally, we need significant investment in composting and digestion infrastructure to make sure we can feasibly capture that output and that the system makes economic sense.

10. The equivalent of one full garbage truck worth of plastic waste is dumped into the ocean each minute, impacting wildlife and disrupting ocean ecosystems. 80 percent of the plastic that enters the ocean is never formally collected. As we discuss ways to improve recycling, we must also discuss ways we can better reduce and reuse our plastic items so that they no longer end up in our environment and waterways, where they threaten wildlife, navigation, recreation, water quality, and tourism.

    a. What policies and practices can help us incorporate the concepts of reduce and reuse so that we can better protect our water, oceans, and wildlife? Bridget: We recommend market incentives and research toward systems (infrastructure, supply chains, logistics, sanitation) to advance refill and reuse business models. We recommend convening regional and local government officials and experts in the field to share best practices and policies for reuse and refill within a city. We recommend working with federal agencies like the FDA to identify standards for health and safety of refillable and reusable packaging. We would be happy to help identify conveners and experts in this sector.

11. In order to solve the complex issues surrounding American recycling, the private sector and government must work together.

    a. In what ways have you seen state, local and international governments collaborate successfully with innovative business ideas to improve recycling? Bridget: Closed Loop Partners, the Recycling Partnership, Circulate Capital and others are examples of public-private partnerships to drive investment into the recycling industry to help scale economically viable solutions. We would love to see policy makers engage with investors to understand what policies would reduce risk in investments in innovation in the circular economy. We believe this direct dialogue would spur the innovation needed to spur collaborative solutions we all want.

    b. Specifically, what are the best practices and solutions that should be emulated, and where can we learn from others mistakes?

    Bridget: There is no silver bullet – it's going to take improved packaging design, better supply chains, material innovation, new recycling technologies, new ways

of delivering products without single-use packaging and culture change to solve this challenge.

We need strong collaboration across government and industry to ensure we don't create policies that create unintended consequences. While the attention on plastic waste is critical, we sometimes see it drive poor substitutions such as single use "compostable" packaging that does not add value to composting systems. This could end up with bans of compostable packaging in communities. We need to take a systems approach and incentivize a mix of solutions that build a circular economy – a new construct whereby efficient use of materials and resources makes economic sense. We need to understand what the market drivers will be to not just change the packaging used but to change how consumers use these new packaging options. While we can design and deliver the best, smart packaging, without consumer understanding and the infrastructure to capture these packages at the end of their very short life we'll have developed a "solve" that is a failure.

c. How can we apply these examples to the U.S. at a national scale? BC: Strong, specific EPR schemes that harmonize regulations, optimize solutions that are scalable in both urban, suburban and rural locations and engage citizens to embrace these changes.

d. What role should the Federal government play in helping to move these ideas along? Bridget: Circular supply chains built on recycled feedstock and efficient use of resources should make more sense. Much like how renewable energy became competitive, the federal government can extend the same tax credits and incentives it does to oil and gas to the recycling industry, so these new systems can grow to be competitive with virgin material markets.

Senator Merkley:

Does Closed Loop Partners support Extended Producer Responsibility (EPR) policies that require producers to take responsibility for post-consumer management of their products? Bridget: As stated above, we see EPR as an important policy lever to help solve some of the market failures and help build scale in circular supply chains as well as reduce risk for investors.

12. What are the most impactful actions the U.S. government can or should take to fix the current, inefficient recycling system? Bridget: As mentioned above, Circular supply chains built on recycled feedstock and efficient use of resources should make more sense. Much like how renewable energy became competitive, the federal government can extend the same tax credits and incentives it does to oil and gas to the recycling industry, so it can grow to be competitive with virgin material markets.

13. After a plastic product goes through advanced recycling, what is the lifespan of the new plastic product or fuel? Bridget: Advanced plastic recycling is a category that speaks to several technologies and outputs. The lifespan varies by technology.

14. Does fuel or products created through advanced recycling create additional GHG emissions and toxic air pollution? Bridget: Closed Loop Partners is currently studying and will release a comprehensive, public report on the environmental impacts of the various technologies this December. Note that the impact varies by technology utilized and volume of materials handled.

15. Can plastics that are recycled be recycled multiple times, or does all plastic eventually end up incinerated or in a landfill? Bridget: Plastics can be recycled several times. The number of times varies by resin type; innovation is needed to grow the number of times a resin can be recycled.

Senator Markey:

16. As awareness of the negative environmental impacts of single-use plastic continues to grow, there has been increased interest in alternatives, such as compostable plastic. While compostable plastics can deteriorate faster than conventional plastic, they can only break down under the right conditions.

    a. Noting those limitations, can you tell us more about the effectiveness of compostable plastics? BC: This is a nascent sector. We need research on various compostable materials in order to better understand this, the scale that will be needed and the specific costs of a new environmentally sound system to process and compost the material.

    b. What percentage of compostable plastics are actually composted? Bridget: While I do not know the exact answer, very few Americans have access to industrial/commercial composting today. Of those, even fewer accept packaging. We need to further study the opportunity and invest in organics recovery infrastructure to solve for food and packaging waste.

    c. How many composting facilities do we have in the United States that can compost products like compostable plastic cups and silverware? Bridget: While I don't know the actual %, its currently very small, but there is opportunity for growth with research and investment in infrastructure

17. As we heard in the hearing today, only 2.5 percent of the plastic that goes into blue recycling bins gets recycled domestically, while 62 percent is exported. Transitioning to a circular economy—where product is recycled and reused—will require innovation and new ways to clean and break down used plastics. Can you elaborate on how the transition to a circular economy for plastic can create more domestic jobs? Bridget: Recycling is regional and can be successful to create the feedstock needed for manufacturing. Jobs will be created in the collection, sorting, processing and manufacturing of packaging and

printed materials. With National Sword enacted several years ago, we have seen significant investment in recycling supply chains and markets in the US including new paper mills, plastics recycling facilities, new recycling technologies and much more.

18. In addition to innovation, recycled plastic will need to become more cost-competitive with virgin plastics. What sort of incentives and regulations would help achieve this goal?
Bridget: As mentioned above, circular supply chains built on recycled feedstock and efficient use of resources should make more sense and build greater resiliency into the system. Much like how renewable energy became competitive, the federal government can extend the same tax credits and incentives it does to oil and gas to the recycling industry, so it can grow to be competitive with virgin material markets.

Senator BARRASSO. Thank you so much for your testimony. Please hang around. I know we are going to have a chance to ask questions in a little bit.

We are going to hear from our other two witnesses first, and next is Ms. Meghan Stasz, who is the Vice President of Packaging and Sustainability at the Consumer Brands Association.

Thanks so much for joining us today.

STATEMENT OF MEGHAN STASZ, VICE PRESIDENT OF PACKAGING AND SUSTAINABILITY, CONSUMER BRANDS ASSOCIATION

Ms. STASZ. Thank you.

Good morning, and thank you Chairman Barrasso, Ranking Member Carper, and members of the Committee for the opportunity to speak to you today.

I would also like to thank Senators Sullivan and Whitehouse for your bipartisan work on the Save Our Seas 2.0 Act, as well as Ranking Member Carper and Senator Boozman for your leadership as co-chairs of the Senate Recycling Caucus. We were deeply honored and grateful for your participation at the inaugural meeting in January of the Recycling Leadership Council.

Chairman Barrasso, let me reiterate my appreciation for calling this hearing, and for the invitation to testify. The challenges that we face in resolving the barriers to a better recycling system need thoughtful leadership, and we thank you for this Committee's engagement.

As you said, I am Meghan Stasz, Vice President for Packaging and Sustainability at the Consumer Brands Association. We represent the consumer packaged goods, or CPG, industry. We make household and personal care items and food and beverage products, contributing $2 trillion to U.S. GDP and supporting more than 20 million American jobs.

The products that we make are essential to every American every day. The products that we make must also come in packaging, packaging that protects safety and quality.

But packaging can be better, and that is something the industry is actively working toward. We have made significant commitments to improving the design of packaging: Less material, fully recyclable or compostable, using more recycled content. There is tremendous momentum and innovation.

All of this momentum and innovation relies on a functioning recycling system, and today, that system is at a breaking point. Recyclable packaging ends up where it shouldn't, in landfills where it can't be reused, or even worse, as pollution.

But we can't be daunted by the challenge of fixing our broken recycling system. If anything, this is a tremendous opportunity to create something new and lasting.

To achieve that goal, there are five challenges I would like to call the Committee's attention to. The first is that there is a market opportunity that is currently going unmet. Many of the industry commitments I mentioned center on using recycled content.

Unfortunately, at present, the domestic supply of recycled plastics is only able to meet 6 percent of current demand. The market

clearly exists, and an important challenge to understand is, why is recyclable material getting landfilled?

The second challenge is that our system is far too fragmented and confusing. There are nearly 10,000 recycling systems in America, each with their different rules. Consumer Brands found that Americans think recycling is more confusing than doing their taxes.

It is getting even more confusing. We are seeing fewer materials accepted, or programs shutting down entirely because recycling was upended when it lost China as the biggest buyer of U.S. recyclables. Losing that customer exposed the need for greater innovation and investment here in the U.S. to ensure that recycling has a future.

The third challenge isn't a need for funding; it is a need to figure out what to fund. There are many ways to pay for changes.

We discussed six concepts in a policy platform that we released in April, but we will land in the same place if we don't advance smart, strategic changes to the underlying recycling system. We should use financing to drive desired behaviors, to solve specific problems, not simply to overlay additional funds on a system that isn't working.

The fourth challenge is ensuring every stakeholder is in, or recycling will be out. We believe no single industry can solve the packaging and waste crisis alone.

This year, the Consumer Brands Association launched the Recycling Leadership Council, which is a coalition of 21 stakeholders from consumer facing industries, the packaging supply chain, and NGOs. Together, we are building a public policy framework to fundamentally reimagine recycling in the U.S.

The last challenge that I will mention is really the first step we need to take. We don't have consistent, reliable recycling data that is needed to make informed decisions. There is no standardized or required reporting on recycling nationwide. There isn't even a standardized definition of recycling.

As the saying goes, you can't manage what you can't measure. Without a clear picture of what is happening in States and municipalities, we can't effectively target solutions. From what little data we have, we know one thing is clear: Recycling isn't working as it should.

We need the Federal Government's help, so two places I would flag: Require better data, building on work that has already been started by Senator Carper, and encourage recycling infrastructure and end-market development.

We really applaud the clear commitment of Chairman Barrasso and Ranking Member Carper in leading this Committee's focus on recycling, and I look forward to your questions.

[The prepared statement of Ms. Stasz follows:]



CONSUMER
BRANDS
ASSOCIATION

U.S. Senate Committee on Environment and Public Works
"Responding to the Challenges Facing Recycling in the United States"
June 17, 2020

Statement of Meghan Stasz
Vice President of Packaging and Sustainability
Consumer Brands Association

Powering every day.

Good morning and thank you, Chairman Barrasso, Ranking Member Carper and distinguished members of the committee. I am grateful for the opportunity to speak today on this important issue. In particular, I would like to thank Senators Sullivan and Whitehouse for your bipartisan work on the Save Our Seas 2.0 Act, as well as Ranking Member Carper and Sen. Boozman for your leadership as co-chairs of the Senate Recycling Caucus. We were deeply honored and grateful for your participation at the inaugural meeting in January of the Recycling Leadership Council.

My name is Meghan Stasz, and I serve as the vice president for packaging and sustainability at the Consumer Brands Association. Our organization champions the industry whose products Americans depend on every day. From household and personal care to food and beverage products, the consumer packaged goods (CPG) industry plays a vital role in powering the U.S. economy, contributing $2 trillion to U.S. GDP and providing more than 20 million American jobs.

The products we make are essential to every American, every day — a fact that has been on display throughout the COVID-19 pandemic. The products we make must also come in packaging. Packaging plays a vital role in protecting the safety and quality of those products.

But packaging can be better, something the CPG industry recognizes and is actively working toward. We play a crucial role in creating a more sustainable future and have made significant commitments to improving the design of packaging — from source reduction, to fully recyclable or compostable design, to using recycled content — the CPG industry is packaging with the planet in mind.

This packaging innovation, however, relies on a functioning recycling system. Today, that system is at a breaking point. Recyclable packaging ends up where it shouldn't — in landfills, where valuable materials are no longer available for reuse, or, worse, polluting the environment.

We cannot be daunted by the challenge of fixing our broken recycling system. Rather, this breakdown needs to be recast as a tremendous opportunity to overhaul the U.S. recycling and recovery system and create something lasting.

Let me be clear: recycling is not a silver bullet solution to all our packaging challenges, but it is a critical underpinning of a circular economy — where a package has a continuous lifecycle that doesn't involve waste. That needs to be our goal. There are many challenges that must be met to achieve that goal, but within each challenge, there is significant opportunity. Specifically, there are five key challenges to which we want to draw attention.

There is a market opportunity that is going unmet.

The CPG industry is responsible for the design of its packaging and making that continuous lifecycle possible at the beginning of the loop. To that end, all of the 25-largest CPG companies have made commitments to improving their packaging, focused on getting to fully recyclable packaging by 2030 or sooner and using a much greater percentage of recycled content. Unfortunately, the latter goal — using more recycled content — is, at present, unachievable.

Demand for recycled content far outstrips supply. In addition to CPG, a range of consumer-facing industries have made aggressive commitments to dramatically increase the use of recycled content, especially recycled plastics, in packaging, apparel and other products. Yet the domestic supply of recycled plastics is only able to meet six percent of current demand.

David Cornell, the former technical director for the Association of Plastic Recyclers, estimated that to meet future demand, the U.S. recycling rate for PET containers will need to jump to at least 70 percent. The EPA estimates plastic recycling currently stands at eight percent.

I struggle to understand why recyclable material is getting landfilled because of cost when there is a clear market need that is going unfulfilled. How is it possible that this demand signal isn't being heard?

Our system is fragmented, confusing and in need of innovation.

There are nearly 10,000 individual recycling systems in America, each with different rules about what is recyclable and where and how it can be recycled. For example, right across the bridge in Alexandria, a pizza box can be recycled, but in bordering Fairfax County, that same box isn't accepted. Here in the Dirksen Senate Office Building, that same pizza box can be recycled. A survey we conducted found that only four percent of Americans were not confused by recycling rules.

At a time when recycling should be increasing, across the U.S., it is quietly disappearing. Systems are reducing the materials they will accept or in some cases ending recycling programs altogether. The tremendous consumer confusion can be alleviated by harmonizing recycling rules across systems. But with a patchwork of rules that our research has clearly demonstrated consumers do not understand, it is unsurprising that of the material that enters our waste system, the best estimate is that only 35 percent of total waste is recycled.

These numbers, however, are likely to get dramatically worse. For decades, China served as the biggest buyer of U.S. recyclables. Since the implementation of China's National Sword policy in 2017, which functionally eliminated China as a buyer, mixed paper and plastic exports plummeted by more than 90 percent.

National Sword ultimately exposed a U.S. system that largely depended on a single customer, China, and masked the need for greater innovation and investment in domestic markets.

Without investment in recycling infrastructure, we cannot strengthen domestic end markets that support a reliable, cost-effective supply of recycled material for use in packaging and other value-added products.

Funding isn't the challenge — the challenge is defining what needs to be funded.

Too often, discussions about the recycling system default purely to funding. Many proposals at the state level are entirely about who pays but completely ignore the problems of the underlying system. We will keep coming back to the same place if we don't advance dramatic, wholesale

changes to fix the broken system. Paying for temporary, short-term fixes is the equivalent of a newspaper buying a printing press instead of investing in a website.

Funding needs to follow making the right, albeit hard, choices now. We must first determine what it will take to fix the underlying system. Financing the solution will follow. In April, the Consumer Brands Association released its policy platform, *Achieving America's Recycling Future*, that included a variety of funding options. Regardless of which options are the best choice for a particular situation or geographic area, any finance mechanism must reinforce or drive desired behaviors of all stakeholders and ensure that funding is exclusively dedicated to improving the recycling system, enhancing recycling infrastructure and educating consumers.

If every stakeholder is not all in, recycling will be on its way out.

We believe that no single industry can solve the packaging waste crisis alone. Everyone has a role if we are to make meaningful change.

From packaging suppliers to CPG companies, the waste and recycling industry to government, NGOs to consumers — each part of the recycling ecosystem must be willing to innovate, cooperate and change.

CPG companies consider environmental impact when designing new packaging and are sending a clear demand signal for recycled content to their packaging suppliers. Consumer participation is critical to getting material to the waste and recycling industry. From there, the waste and recycling industry must take a leadership role in updating equipment regularly and developing new technologies to economically recover the new forms of packaging in the marketplace today and prepare for the packaging of tomorrow. Governments can invest in or incent market-based investments in recycling infrastructure, thinking beyond municipal borders toward harmonized, scalable systems — setting up NGOs to better provide innovative thinking and implementation assistance.

The Consumer Brands Association is bringing all these stakeholders together. It created the Recycling Leadership Council, uniting a diverse group of 21 stakeholders from consumer-facing industries, the packaging supply-chain, NGOs and universities. Consumer Brands fought to create this group, knowing that without all of their voices, the objective of the RLC could not be met. RLC members include everyone from the Ocean Conservancy to the Can Manufacturers Association, from the Closed Loop Partners to the National Retail Federation.

Now, with great representation at the table, they are advancing the challenge Consumer Brands put forward: build a public policy framework to fundamentally reimagine the U.S. recycling system. This group was not convened merely to talk about problems. It exists to solve them.

The ultimate result will be *The American Recycling Roadmap*, a policy plan that represents the input and support of the RLC members to produce actionable federal-, state- or local-level policy goals that will make meaningful progress toward reducing waste and a system that works better for consumers, businesses and the environment. After producing policy solutions to address scalability, standardization, harmonization, data collection and end market creation, it will be the

task of the RLC to advocate for these policies and build a broad, bipartisan coalition of support for that fundamental change.

New ideas and scalable change were the purpose of the inaugural gathering of the Recycling Leadership Council in January. Consumer Brands Association President and CEO Geoff Freeman convened the meeting with a simple directive: "We have a responsibility to give consumers a roadmap to a system that makes a lot more sense."

We were honored to have members of the committee in attendance, including Ranking Member Carper, Sens. Sullivan and Whitehouse, as well as Senate Recycling Caucus co-chair Sen. Boozman along with Sen. Udall and Rep. Stevens.

You encouraged us to provide brainpower, leadership and collaboration in putting together a path forward for recycling while also challenging us to think big and forge unlikely alliances.

As one of the leaders of the RLC, I am proud to report that we are responding through this organization of stakeholders which share our vision of a new future for recycling.

Consistent, reliable data is needed to make informed decisions.

In our discussions with the RLC, it has become clear that every stakeholder is better positioned to educate consumers, reduce confusion and ensure investments pay off when the entire system is aligned on a national scale.

Any solutions to fix our broken recycling system must begin with data. The dearth of actionable data and vast gaps in knowledge keeps us from identifying the broken links in the recycling system itself and building a system for the 21st century.

If we are going to collect recycling data in a meaningful way, we must concurrently pursue standards and consistent definitions for that data and reporting across the 10,000 recycling systems nationwide — a number that some of our partners estimate is actually as high as 20,000 systems, which, right or wrong, shows there is a significant data issue when it is not clearly known how many systems we have.

We need consistent and standardized data so we know across the country what the rates are by material, where the success stories are so they can be replicated, where the problem spots are so they can be solved. Our ability to succeed in fixing the broken recycling system starts with data.

We appreciate the work that Ranking Member Carper is already leading to address this challenge. Focus on this issue will harmonize supply and demand into a functioning marketplace of recycled content and where targeted investments are needed that will return the most value.

From what little reliable data we have on recycling, one thing is consistently clear: it isn't working. With more than 86 percent of Americans agreeing that the world is facing a plastic and packaging crisis, there is near-universal agreement that we need bold action. In fact, when we

asked Americans whether the federal government should make tackling waste the next "moon shot," 77 percent said yes.

The federal government is a critical stakeholder in fixing the broken recycling system. Consumer Brands has identified two places where we see the greatest need for congressional action:

1) As clarified above, better data is essential to success. We ask that you further the work already started by Senator Carper in getting the metrics that will help us understand the path to a high-functioning recycling system.
2) Any efforts to develop supply chains or end markets for recycled material must expand beyond state borders. The federal government, along with state governments, can support recycling's future by creating and incenting recycling infrastructure and end-market development.

There are myriad ways Congress can be helpful in reimagining recycling. As we think through the issue today, I ask that you keep one question in the back of your minds: "If we were starting from the beginning, what would we aspire to?"

Achieving solutions will require a broad, bipartisan coalition of stakeholders willing to make the tough decisions to launch America's next moon shot. Realizing the circular economy means everyone has skin in the game, the Consumer Brands Association and its members have made clear the CPG industry stands ready to be a part of the solution. We trust that other key players will step forward as well.

We applaud the clear commitment of this committee to recycling's success and support the movement to fundamentally reimagine recycling in America and we encourage everyone involved in this process to join the push for bold, comprehensive solutions to the plastic and packaging crisis.

I look forward to your questions and appreciate the opportunity to present our perspective.

Senate Committee on Environment and Public Works
Hearing entitled, *"Responding to the Challenges Facing Recycling in the United States"*
June 17, 2020
Questions for the Record for Meghan Stasz

Senator Sullivan:

1. As you know, together with Senators Whitehouse and Menendez, I sponsored the Save Our Seas 2.0 Act, which passed the Senate in January and is under consideration by the House. The bill is not a silver bullet but it is significant progress in combatting plastic pollution, and we look forward to its passage and to begin further work together after.

   Can you discuss how Save Our Seas 2.0 could help encourage recycling and therefore reduce marine debris?

   ANSWER: Save Our Seas 2.0 is an excellent example of bipartisan leadership to advance solutions to our marine debris crisis. According to an Ocean Conservancy report, the majority of marine debris comes from just a handful of countries, all in Asia and Southeast Asia. However, everyone has a role to play in reducing marine debris and raising recycling rates of packaging. U.S. Title III of the Save Our Seas 2.0 act focuses on "improving domestic infrastructure to prevent marine debris," a critical step to preventing leakage of plastics into the environment. The legislation directs the EPA administrator to develop a comprehensive plan to improve waste and recycling infrastructure and offers funding for infrastructure improvements through state revolving funds. All of these are excellent steps to creating a 21st century recycling system in the U.S.

2. It's often mentioned that funding for recycling isn't the challenge—the challenge is defining what needs to be funded. It **is** often a question of funding, though, particularly in remote communities like in Alaska. What do you see as good options for Alaska?

   ANSWER: Rural communities should be able to access recycling as easily as their urban- or suburban-dwelling peers. However, recycling in rural communities can struggle with economies of scale. A critical step to identifying solutions for any geography, including Alaska, is to have a clear, data-driven picture of the current recycling landscape in the state. Conducting a robust infrastructure audit and understanding what varying rates of recycling and access to recycling are in the state will allow for the deployment of smart, strategic solutions that fit the region. There are a range of funding options that can generate revenue to sustainably finance recycling systems, from landfill tipping fee increases that help create price parity for recycling and landfilling to waste generator fees. The question is: What is the challenge that needs to be solved in Alaska? Better, clearer data is a necessary path to understand the landscape and the right funding solutions for the state.

3. Innovation in recycling is critical. Can you expand some more on what the federal government can do to help drive that innovation to make America a leader in recycling technologies?

ANSWER: Government has a leadership role to play in encouraging investment in, or directly investing in, recycling infrastructure in the U.S. Further, new recycling technologies are needed to manage the packaging materials not just in use today, but also in the future. Research in and development of scalable, economically viable solutions to recycling packaging will be key to achieving a circular economy. There are some promising technologies under development and achieving scale and viable economic performance will be necessary to the lasting success of these breakthrough technologies. Government can also support or incentivize research into new kinds of packaging material, with a smaller environmental footprint than some of the materials in use today.

4. America's recycling system is primarily managed at the state and local level, but low recycling rates nationwide warrant federal participation in the improvement of the waste management system. The EPA estimates that approximately 8% of plastic is recycled and the national recycling average across all materials hovers around 23%.

    a. Could you outline what specific role the federal government should play relative to efforts of states and localities?

    ANSWER: Federal and state governments have the largest role to play in creating and encouraging infrastructure and end-market development. For its part, the federal government can play a leadership role in the development of infrastructure and the collection of better, clearer data. We need consistent and standardized data to understand what the recycling rates are by material across the country, where the success stories are so they can be replicated, where the problem spots are so they can be solved. Data is critical to fixing the broken recycling system.

5. Material recovery facilities (MRFs) nationwide have struggled to generate revenue, invest in new technology, and maintain reasonable recycling standards. The wellbeing and profitability of MRFs is critical to the health of the US recycling system.

    a. What suggestions do you have for addressing this challenge?

    ANSWER: A challenge to the U.S. recycling system is the patchwork of nearly 10,000 different systems. This patchwork of rules and regulations, including what is collected, prevents economies of scale and economically viable solutions for processing recycled material here in the U.S. By harmonizing and standardizing recycling systems throughout the country, or at least regionally or state wide, we can help address consumer confusion, raise recycling rates and decrease contamination, all of which will benefit MRFs, providing better, cleaner supply of material to those facilities.

    b. Would better sorting technologies at MRFs benefit the larger waste management system?

ANSWER: Advanced technologies at MRFs are critical to managing the packaging in the marketplace today and the packaging of the future efficiently and economically. Unfortunately, some parts of the recycling system have suffered from underinvestment over the last decade, resulting in older, out-of-date facilities.

6. Consumer goods companies believe they have a role to play in the proper disposal of the products they produce and that effective recycling systems require shared responsibility. These companies endorse a variety of policies and have volunteered to make considerable investment in recycling systems worldwide. Deposit Return Systems (DRS) and Extended Producer Responsibility (EPR) are among the most common systems in which industry plays a role in the management and funding of recycling systems.

   Deposit Return Systems (DRS) are touted as one of the most effective methods of managing and generating funds for recycling systems. While recycling rates of high value materials in these systems are robust, DRS does not account for all materials in the waste stream. And often, funds raised from unclaimed deposits don't in fact fund recycling improvements, but rather are put in a government's general fund.
   Extended Producer Responsibility (EPR) is another popular construct for managing recycling systems. While EPR may not achieve the high recycling rates of certain materials, it addresses all materials in the waste stream, can be easier to manage than a deposit system, is easier to manage, and boasts broader support.
   As conversations advance about how to address the underinvestment in recycling infrastructure in the US, new concepts in addition to deposits and EPR are being proposed through stakeholder discussions. These build on the lessons learned (what has worked, and what hasn't) from these systems in the EU, Canada, and US states.

   a. What, in your view, is an ideal system for the unique US market and why?

      ANSWER: There are many models for recycling and waste management throughout the world, including EPR programs in the European Union and some Canadian provinces. These models vary greatly from country to country, with different rules and systems. The U.S. market is unique in that recycling and waste management are run at the municipal level, not state or nationwide. DRS and EPR systems are two financing concepts, each with varying degrees of success. Consumer Brands has identified six funding mechanisms that could be considered for the U.S. Critically, funding should be used as a tool to solve specific challenges in the recycling value chain, driving intended outcomes, not simply layering additional funding onto inefficient or outdated systems. Additionally, any funds raised must go to improving the recycling system, not into a state's general fund, as we've seen with many DRS schemes in the U.S.

7. America's most effective recycling systems incorporate considerable industry involvement in their management and governance.

a. Do you favor industry involvement in the management of recycling systems?

ANSWER: To truly fix our recycling system in the U.S., everyone must be at the table with solutions. No one stakeholder can solve this challenge alone. The CPG industry is committed to improving packaging and is bringing forward proactive, big-picture solutions to improve recycling in America. Our industry stands ready to be part of a solution, and it is critical that other industries such as packaging producers and the waste management industries are just as committed.

b. Is partial industry governance scalable in the United States?

ANSWER: Everyone should have a seat at the table in developing effective and efficient recycling systems in the U.S. Each stakeholder has their own area of influence and expertise. There could be a scenario in which private industry, aside from the waste and recycling sector or government, plays a leadership role in governance or partial governance of recycling systems. However, with a patchwork of 10,000 recycling systems nationwide, it remains to be seen where that would be the best model. The CPG industry is committed to improving recycling, investing in our domestic processing capabilities and advancing recycling technology in the U.S. Achieving efficient, scalable systems is critical to those efforts, however it is critical that other industries in the waste management lifecycle are equally as committed.

c. What are your opinions of Producer Responsibility Organizations in the management of recycling systems?

ANSWER: There are many models to manage and run recycling systems around the world, including a range of producer responsibility organization (PRO) types and structures. Some simply collect funds from member companies and pass those funds on to local or regional government. Others oversee the entire recycling system. It's not known which models, if any, are highly successful. What is known, however, is that any effective recycling system should have clear, standardized policies around what is recyclable, be harmonized with neighboring systems, and collect consistent, reliable data on those systems.

Ranking Member Carper:

8. As discussed at the hearing, there are many single-use products that are not recyclable today but marketed as such. From plastic bags to pizza boxes, consumers are confused about what to put in their bins and what they should leave out.

    a. From your experience and expertise, can you explain what the most problematic single-use products are to recycle?

ANSWER: With a patchwork of 10,000 unique recycling systems nationwide, each with their own rules and regulations about what can be recycled, it's challenging to point to any one material or packaging type as the most problematic because the rules vary dramatically from place to place. Technologies and programs exist to handle almost all forms of packaging material, but some of those systems may not yet be at scale or require consumers to take the materials back to a centralized drop-off location. By harmonizing and standardizing what is recyclable across the U.S., we can help educate consumers about how to properly participate in their recycling system, achieving economies of scale to keep valuable packaging out of landfills.

b. What can we in the federal government do to address the most problematic single-use products?

ANSWER: New packaging types play an important role in protecting product safety and quality and reducing overall environmental impact. However, it is critical that we have a system that can process those new materials in the U.S., keeping valuable packaging out of landfills and the environment.

9. A recent comprehensive survey of plastic waste collection in the U.S. revealed that the majority of plastic used to make our foodware and consumer packaging cannot be claimed as recyclable, per the Federal Trade Commission. Most of these items are not accepted by curbside programs or local recovery facilities, and the likelihood of being recycled into a new product is extremely low.

a. From your experience at the Consumer Brands Association, what needs to be done to address this problem and what can Congress do to help?

ANSWER: The FTC's definition is based on consumer access to recycling, as opposed to what is technically recyclable. In the U.S., recycling is run municipality by municipality, meaning there are nearly 10,000 unique recycling systems in America, according to EPA. This patchwork of programs, each with their own rules which can change frequently, causes consumer confusion and high contamination rates and prevents achieving economies of scale. Standardization and harmonization of what can be recycled nationwide, or at least at the state and regional level, can raise the recycling rates of all kinds of packaging and participation rates.

b. Is one solution to this recycling problem switching to compostable foodware and packaging products instead? Why or why not?

ANSWER: Compostability is one of a range of ways that companies may choose to meet their packaging sustainability goals. Regardless of the material type or form, however, it's critical that there be a system and infrastructure in place than can handle and process that packaging and clear, consistent standards to help consumers understand what to recycle or compost and how. For example, in

Marin County, California, residents are not allowed to put their compostable packaging in their curbside compost bin. Scenarios like this exacerbate consumer confusion and contribute to contamination of the recycling and composting streams.

10. The Consumer Brands Association launched the Recycling Leadership Council earlier this year. The RLC includes stakeholders across the industry to focus on solutions to our fraying recycling system in the United States. Since the launch, CBA unveiled a recycling policy platform that outlines recommended approaches to addressing our nation's recycling challenges. Those approaches include: Establishing national or regional recycling standards; Financing a lasting recycling system; and Strengthening end markets to meet demands.

    a. What role can members of the consumer packaged goods industry play in strengthening our recycling system?

    ANSWER: The CPG industry has a leadership role to play in improving packaging for the environment. In fact, all of the 25-largest CPG companies have made significant public commitments to packaging improvements, through creating fully recyclable or compostable packaging, increasing recycled content, switching from one material to another or even opting for reusable packaging. All stakeholders must come together to address these challenges and the CPG industry can and will lead on packaging design and send a clear demand signal for recycled content to their packaging suppliers.

11. The equivalent of one full garbage truck worth of plastic waste is dumped into the ocean each minute, impacting wildlife and disrupting ocean ecosystems. 80 percent of the plastic that enters the ocean is never formally collected. As we discuss ways to improve recycling, we must also discuss ways we can better reduce and reuse our plastic items so that they no longer end up in our environment and waterways, where they threaten wildlife, navigation, recreation, water quality, and tourism.

    a. What policies and practices can help us incorporate the concepts of reduce and reuse so that we can better protect our water, oceans, and wildlife?

    ANSWER: Source reduction is critical to achieving sustainability goals for packaging, minimizing its environmental footprint. By light-weighting packaging material, companies are avoiding the use of that material entirely, putting less into the value chain. Many companies are also exploring reusable and refillable packaging. One such example is Loop, which allows consumers to purchase products and brands they know and trust in a refillable, reusable container. Innovations like these on the front end of the supply chain are critical to a circular economy.

Senator Merkley:

12. You mentioned that there is not enough recycled material for your member companies to buy. Given the huge increases in plastic production over the past 10 years, why is there an inadequate supply of recycled material to buy?

    ANSWER: Many industries, including the CPG sector, have made significant commitments to increasing the use of recycled plastics in their packaging, apparel and other products. It's estimated that the recycling rate of plastics will need to be 70 percent to meet that demand. Right now, the U.S. is not even close. Not only is the amount of recycled material in the supply chain low, but quality is also critical. Additional restrictions also exist for food-contact packaging that contains post-consumer recycled content.

13. How does the price of plastic feedstock play into the decision about what recycled material companies are willing to buy?

    ANSWER: Price is one of many important factors in packaging design considerations. A cost competitive and reliable supply of recycled plastic is critical for meeting demand. The material also must perform, protecting product safety and quality. Many major global companies, from the CPG industry to apparel, have made commitments to using significantly more recycled plastic in their products and packaging. Sending this demand signal is an important step to realizing a reliable, cost effective supply of post-consumer recycled material.

14. How can we continue to expand and scale up our production of plastics given what we know about their contribution to the most pressing issue of our time, climate chaos?

    ANSWER: An important first step is to maximize the use of plastic already in the value chain, by raising recycling rates, keeping that valuable material out of landfills and creating a reliable, cost-effective supply of recycled plastic content.

Senator Markey:

15. As we heard in the hearing today, only 2.5 percent of plastic that goes into blue recycling bins gets recycled domestically, while 62 percent is exported. Transitioning to a circular economy—where product is recycled and reused—will require innovation and new ways to clean and break down used plastics. Can you elaborate on how the transition to a circular economy for plastic can create more domestic jobs?

    ANSWER: The plastic and packaging waste crisis is a daunting challenge, but also a tremendous opportunity. Recycling has, in many places, seen underinvestment over the last decade and an overreliance on China as a buyer for U.S. recyclables. The closing of China as a market for those materials exposes a need and opportunity to rebuild recycling infrastructure here in the U.S., creating jobs and directly investing in the American economy. For example, in North and South Carolina, where significant investment has recently been made in plastic recycling infrastructure but the facilities are running under capacity, the states' have launched consumer-education efforts to encourage more

recycling participation. According to those efforts, if North and South Carolina households recycled just two more bottles per week, it would create 300 new jobs.

16. In addition to innovation, recycled plastic will need to become more cost-competitive with virgin plastics. What sort of incentives and regulations would help to achieve this?

ANSWER: The price disparity between recycled and virgin plastics is significant. The demand signal sent by a host of global companies, from CPG to retail to apparel, to use significantly more recycled plastic in products and packaging can help spur the market for that material, increasing supply and, ideally, decreasing price. A fee on virgin resin can also be considered as a short-term tool to help put the two material sources on price parity. Finally, encouraging the use of recycled plastic through efforts like the EPA's Comprehensive Procurement Guidelines could also send a very strong demand signal from the federal government, creating more market-based incentives to produce that material.

Senator BARRASSO. Thank you so much for your helpful testimony.

We look forward to the questioning in just a few moments.

First, I would like to turn to Ms. Nina Bellucci Butler, who is here, the Chief Executive Officer of MORE Recycling.

Thank you so very much for joining us today.

STATEMENT OF NINA BELLUCCI BUTLER, CHIEF EXECUTIVE OFFICER, MORE RECYCLING

Ms. BUTLER. Thank you, Chairman Barrasso, Ranking Member Carper, and members of the Committee.

I am Nina Bellucci Butler, CEO of MORE Recycling, a business of Sena.

We as a Nation are at a great inflection point, and you have an opportunity to deploy meaningful and proven policy solutions for communities across this great Nation struggling on so many levels right now.

I am thinking about the rural communities in my birth State of Kentucky to my previous home in San Francisco, California. It is time to unlock economic drivers to manage resources sustainably and circulate capital throughout America, not just in the wealthy regions.

Until we establish policy that places the cost and benefit of a healthy environment on the balance sheets of companies and countries, we risk further erosion of the infrastructure and by extension, the environment on which our children's lives depend. I have two of them.

Recycling is not just about cutting down waste heading to landfills that our children will need to endure; it is about the dramatic energy savings we get out of recycling. Take bottles, for example, such as detergent bottles. Using recycled plastic cuts the amount of energy by almost 90 percent.

I got involved in plastics in the year 2000. I actually felt destined to go to med school and had a desire to study the threat of plastics on our health.

In 2003, I had the opportunity to travel down the amazing Amazon River, and I remember looking out in Manaus and seeing an entire layer of plastic film. The water level was low, and it was like a geologic layer, this stratum of plastic.

I was lured then by the notion that if we just implemented the best programs, we could solve the plastic waste problem. I have had 20 years of working directly with the plastics industry and the recycling industry. I have come to the very firm conclusion that we need significant policy to right our course for plastic waste, which is inextricably linked to climate change.

While the economics are straightforward, the environmental trade offs around plastics are extremely complex. Plastics are a paradox. They benefit society on so many levels.

Think about what you are not willing to give up that is plastic. Plastics have given us truly supernatural abilities, from flying, diving deep in the ocean, clear eyesight, better hearing, communicating with friends and family around the world. They got me here from Chapel Hill, North Carolina, in less than a day. That is supernatural.

However, plastics present enormous environmental challenges. Plastic scrap exists, as Senator Udall said, everywhere from the Mariana Trench to the Great Pyrenees.

It is simply unethical to make something that nature cannot absorb and not provide a system to manage it. It is imperative that we look at the problem and unlock this plastic paradox holistically. The gap between new plastic produced and plastic recovered is widening, and the recycling rates are trending downward from already a failing grade.

I have some charts. So, we can see here that we have been increasing the amount of domestic recycling for many years, and that was, in a sense, a comfort, and we were seeing a decline in export, even before the national soared. But the reality is we still are at absolute failing grades. In the last 2 years—our company tracks this data—we have actually seen a decline.

This is the real reality of putting this notion together. This is the recycling capacity in the United States right now for a major category.

That is polyolefins, and this is the production capacity for the top—just the top 10—virgin resin producers. We have 5 percent of this capacity. It is going to take a lot more than forward thinking company investment or asking people to recycle better. It costs more to recycle than to waste or use virgin plastic.

Here is the current cost of a virgin material on the spot market. Here is the cost of process to get to high quality going back into food grade.

But it doesn't have to be this way if we put value on energy savings. Just getting recycled content in trash bags, which is very common in countries throughout Europe, could have a dramatic impact. It would be more than the equivalent of 2 million tons of CO_2 savings on something that is already destined for landfills.

Instead of plastic recycling on a growth plan, we have a trickle compared to a tsunami of new plastic production. We learned from the University of Utah, as Senator Udall said, it is raining plastic, and that is a problem worse than acid rain.

With today's lifestyle in which we can get what we want when we want it from wherever, thanks largely to plastic, it is clear we have the knowhow to produce and distribute products. Therefore we surely have the skill sets to design elegant, reverse logistics to recapture the product.

It is not a moon shot; it is an Earth shot. We just need economic drivers in the right place. We need to put value on carbon.

We need the leadership and cooperation to unleash human ingenuity to design, implement, track, and optimize a sustainable resource management plan, or a North Star. Because what is equally as scary as plastic waste is the realization that if we just omit certain plastics without changing our consumption patterns and our economic model, we will quadruple the greenhouse gas emissions on a regular basis.

Leaders, even in the petrochemical companies, see policy as a means to create competitive advantage to those companies that lean all the way into the circular economy.

It is an honor to appear before you today to share my expertise on recycling and more efficient, mindful use of resources.

Thank you.
[The prepared statement of Ms. Butler follows:]

MORE RECYCLING

Testimony Presented to the Committee on Environment and Public Works
United States Senate

Hearing to examine the challenges currently facing community recycling programs and the potential solutions to these challenges

June 17, 2020

Nina Bellucci Butler
Chief Executive Officer
MORE Recycling

Chairman Barrasso, Ranking Member Carper, and Members of the Committee, I am Nina Bellucci Butler, CEO of MORE Recycling, a business of Stina Inc.

We as a nation are at a great inflection point. You have an opportunity to deploy meaningful policy solutions for communities across this great nation struggling on so many levels right now. It is time to unlock economic drivers to manage resources sustainably. Until we establish policy that places the cost and benefit of a healthy environment on the balance sheets of companies and countries, we risk further erosion of the recycling infrastructure and by extension the environment on which our children's lives depend.

My company is a mission-based company that strives to harmonize human behavior with the natural world. For more than 20 years we have honed our science-based approach to quantify material flows throughout the recycling value chain, with a particular focus on plastics and their role in environmental sustainability.

We have worked closely with the plastics and recycling industries on programs and tools to support plastic recycling as well as quantify the pounds of plastic recovered for recycling. Organizations from petrochemical companies to the EPA use the data we collect. The EPA uses the data to help measure and determine progress toward sustainable materials management, as well as to calculate recycling rates. In short, we understand recycling. We know the missing economic drivers needed to tackle the plastic waste problem.

Given our expertise and vision, we are asked to speak at global events such as the World Petrochemical Conference and the Global Plastics Summit. We understand the economic barriers facing companies attempting to pivot towards a circular system. I have interviewed dozens of CEOs, policy makers, and agency leads who have all come to terms with the fact that policy of significant proportions is needed. More and more companies throughout the value chain are seeking ways to end plastic waste and reduce greenhouse gas emissions (GHG). Economic, social, and health risks directly influence the health of our environment. We are currently allowing waste and GHG emissions to add costs to communities that they cannot shoulder and to threaten life on this most precious blue planet.

We need the leadership and cooperation to unleash human ingenuity to design, implement, track, and optimize a sustainable resource management plan, our "North Star." There are no silver bullet solutions to our waste and climate challenges, only a central guiding principle; we must transition from a linear to circular economy with value on carbon. A circular economy, according to the Ellen MacArthur

Foundation, is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems. The linear model is one of take-make-waste.

Plastics are a paradox. They do benefit society. They are light, resulting in dramatic fuel savings, and they provide protection for much of the food our growing population depends on. However, plastics present enormous environmental challenges. Plastic scrap exists literally everywhere from the Mariana Trench to the Great Pyrenees. It is simply unethical to make something nature cannot absorb and not provide a system to manage it. The financial burden on local governments of managing our waste has become too much to bear.

We have to come to terms with the socio-economic realities related to eliminating waste and getting recycled plastics back into the economy. A circular economy offers a solution to plastic waste by creating incentives to reabsorb carbon used, or scrap plastic, back into the economy. Every petrochemical company I work with is facing economic barriers in their pivot towards a circular system. This is why action is necessary to unlock the plastic paradox. I know we have the minds, technology and creativity to do it. We just need the will. It is an honor to appear before you all today to share my expertise on recycling and more efficient, mindful use of resources.

UNLOCKING THE PLASTIC PARADOX

If we eliminate plastic in critical applications, without radical shifts in our consumption patterns, we will create more demand for oil and gas and generate more GHG emissions, further exacerbating climate change; this is the plastic paradox. The United Nations Food and Agriculture Organization says 30 percent of food is wasted globally; food waste adds eight percent of total global GHG emissions. And, we consume 10 percent of the U.S. energy budget just shipping food, so it behooves us to ship with the lightest material that protects the product, to ensure it becomes nourishment rather than waste. Grapes packaged in a perforated film bag can reduce in-store waste of grapes by 20 percent as compared to selling them loose.

Almost half of all plastic production is for packaging; the trend is toward lighter packaging to reduce energy consumption and GHG emissions. Unfortunately, these highly engineered film packages along with many other ubiquitous plastic items are not yet recyclable within our system. The other half of plastic produced has given us supernatural capabilities—flying, diving, skiing, clear eyesight, receiving a new heart or joint, talking to and seeing someone thousands of miles away. Many of these plastic applications are not designed for recycling and will require alternative methods to fully capture the value of the materials after their usefulness ends. We must take action to support economic policy to balance our environmental debt sitting on the shoulders of future generations and those most at risk. Switching to a reusable water bottle or not using a straw are good steps, but for real progress we need economic reforms that reward innovators for efficiency that can scale to the scope of the problem.

The Plastic Paradox

- Oil and gas producers make money primarily through fuel production and secondarily through plastics production
- Use of plastics results in lighter products requiring less fuel use
- Energy and petrochemical companies are looking to plastics to drive the demand for oil and gas
- The plastics waste problem threatens the "social license" of the producers and whole ecosystems
- Yet, plastics packaging and products are responsible for lowering carbon impacts of society's very wide carbon footprint: from products we move around the globe, to the supernatural capabilities we gain with plastics

Valuing carbon at all stages of the plastics life cycle is the key to unlocking the plastic paradox. The marketplace for these various stages, currently, is riddled with unknowns that hinder leaders and innovative companies from turning waste into a resource. Valuing carbon creates transparency. If plastic has value across its entire life cycle it is less likely to become waste. A North Star policy would create value for carbon and encourage the shift from a linear to circular economy.

GROWING DISPARITY & MIS-ALIGNED ECONOMIC DRIVERS

It is imperative that we look at the problem and unlock this paradox holistically. How can we balance the environmental debt of the plastic waste with our current tools and keep up with the problems that compound each year? The gap between new plastic produced and plastic recovered is widening and the recycling rates are trending downward from already failing grade levels. The amount of plastic waste and its contribution to GHG emissions is a problem of epic proportions that is growing by the minute. Each minute we dump the equivalent of a dumpster truck of plastic in the ocean. Plastic recycling is a trickle compared to a tsunami of new plastic production. With today's lifestyle in which we can get what we want, when we want it, from wherever, it is clear we know how to produce and distribute products; and, therefore we surely have the skill sets to design elegant reverse logistics to recapture used products. It is not a moonshot. We just need economic drivers in the right place.

We waste a lot of plastic because it is "cheap" relative to the costs externalized to those downstream from production or near landfills. If we could see and feel the true costs of extraction, production, and waste we would innovate to create more efficiency and conserve our oil, gas, metals, trees, soil, etc. for future generations. Citizens, or their lack of recycling education, are not the problem. Yes, continuous education and outreach to citizens regarding how to recycle, and what can and cannot be recycled, should be a part of citizen education, but education alone will not be enough to solve our growing waste problem. Neither will one-time infusions of capital. Policies to reduce, reuse and recycle must be grounded on the basic principles of economics that guide our behavior.

Upstream material extraction is heavily subsidized in the U.S. and globally, and landfill costs are artificially low because their environmental costs are not considered. The recycling industry finds itself in an unsustainable middle ground, without solid, long-term demand for scrap plastics. As we continue to subsidize extraction to stimulate the American economy and create energy independence, while externalizing environmental costs, we provide disincentives for businesses or citizens to reduce waste and recycle to protect our most critical resources. Low recycling rates are not just because citizens do not recycle right. Our system is not structured to send consistent market signals to packaging and product designers required to promote a circular economy—from operations through to product and end of life management. The costs of plastic clogging water ways or littering beaches are not on producers' balance sheets, which hinders the incentive for producers to solve the plastic waste problem. It is currently twice as expensive to use recycled plastic in place of virgin in common packaging applications. There is virtually no economic incentive to use recycled plastic even though recycled plastic can cut energy consumption by 88 percent. Also, important to note when evaluating the cost benefit of solutions is the fact that a product's environmental impact is born mostly in extraction, production and shipment— before citizens like you or I decide what to do with our product or package at its end of life. There is a huge opportunity to stimulate innovation if we had a North Star guiding us.

How can we focus more on efficiency, performance and innovation rather than measuring our success based on consumption and output? How do we think about which product or action has the lowest carbon footprint and design policy that drives us towards our North Star? I was once under the illusion that if we could just set up the best recycling program, we would control the unbridled generation of

waste through support mostly by the private sector. That was before the shale gas revolution began to impact markets and recycling efforts on a large scale. Even if we are wildly successful in educating citizens to recycle, we lack the recycling capacity to absorb scrap plastic, as well as other non-plastic recyclables. The investment community does not see the return on investment for expansion of material recovery facility sorting capabilities, secondary sorting facilities, or recycling capacity. Currently, for a major category of plastics we only have the capacity to recycle five percent of the material produced by only the top 10 virgin resin producers of polyolefins. It simply costs more to use recycled plastic than virgin plastic. Publicly traded companies with commitments to use recycled content are hamstrung with their fiduciary responsibility to reduce costs. Today this is further complicated by a severe recession and the tragedy of COVID 19.

HOLISTIC SOLUTIONS

Banning plastics is not always a viable strategy, but we cannot continue to litter our world with them. Let us embrace responsible handling, starting with using less, reusing more, getting our chosen material into the appropriate bin, and buying products that contain recycled content. We must find value in recycled plastic in order for it to be reabsorbed into the economy. Otherwise, we fall short in truly achieving sustainable materials management.

Finding solutions for our own scrap materials is an essential step in curbing the global plastic marine crisis. Many have blamed China for the market challenges impacting recycling. When China needed raw materials, it made sense for China to source our scrap. That demand for scrap enabled us to forgo necessary investments in our recycling infrastructure. China no longer wants or needs it, and now we are ill prepared to absorb much of what is being produced. We need to align value chains so that those who produce materials are also creating demand for recycled materials. Our supply and demand for recycled plastic is extremely out of balance.

POLICY LEVERS: SHORT-TERM AND LONG-TERM

There is a path forward where a strong economy is not mutually exclusive from a healthy environment. Movement toward a more circular economy is anchored in the need to balance economic, environmental and social impacts. Other regions of the world are retooling and reengineering for the 21st Century in which efficiency is key. The American people need a North Star Policy especially now – setting our highest objective on sustainable materials management that will require a dedicated work force and innovation.

Tested policies like extended producer responsibility with eco-modulated fees and recycled content mandates can create the funding mechanisms necessary for the system to attract more investment and optimization. Our current "policy" of externalizing costs and subsidizing extraction of raw materials rather than recovering what already exists is completely counter to what is required to stem the tide of waste and GHG emissions. Markets are responding exactly as expected when the economic system is structured to incentivize waste.

In addition to these longer-term systemic policy levers there are a handful of short-term tools we know to be effective, for example:

- Enact bottle deposit legislation based on most cost-effective programs;
- Enact recycled content legislation on high volume, low barrier products (e.g., trash bags);

- Tax on disposal (a "7th Generation Fee");
- Enforcement of pollution prevention practices (e.g., EPA's P2 program);
- Implementation of the EPA Office of Research Development Municipal Solid Waste Decision Support Tool that provide a holistic evaluation of the life-cycle environmental tradeoffs and economics to help us transition to circular economy; and
- Establish methodology and verification of claims of recycled content.

These policy mechanisms provide directional support for a circular economy. Many businesses benefit from material generated in the few states with bottle deposit programs and minimum content legislation. Expansion of such policies with established methodology for reporting and measurement would have a significant and sustainable impact. Instead of depending on the companies with voluntary commitments we could level the playing field and eliminate the free riders. National policies could also help to rationalize where our new infrastructure is built so we can reduce cost and environmental impacts of transporting recovered materials to recycling markets.

To power the engine of a circular economy and reduce the burden of waste on local governments, however, we need "extended producer responsibility" (EPR). EPR is a way to engage all players within a packaging value chain to support not only the collection and sortation of post-use materials (including the necessary financing), but also to support the design of packaging/products with a lighter environmental footprint through the use of eco-modulated fees. These fees, set on the specific types of packaging would motivate companies to employ more efficient design, as well as recycled content. Subsequently, this also exposes the need to coalesce around a nationally agreed upon methodology to validate recycled content and associated claims. Communities are facing severe budget constraints, therefore, would dramatically benefit from EPR.

The answers to the challenges before us are not simple. They require the adoption of many policy and technological tools. And, as I work with petrochemical companies and consumer packaged goods companies in a global marketplace, I often hear pleas for the U.S. to establish policy to guide sustainable innovation. Such policies would provide competitive advantages to those companies that design for recyclability and lowest overall environmental impact for their products and packaging. Smart economic policy could provide the opportunity for petrochemical companies to invest in solutions. There are many examples of companies in other parts of the world that are investing in technology that enables them to competitively use recycled materials.

Most major sustainability innovations have been the result of investment from the private and public sectors. A North Star policy that creates value for carbon *and* waste will provide incentives for investment in the circular economy.

Thank you for the opportunity to present before the Committee today.

MORE™
RECYCLING

Current Challenges Facing Community Recycling Programs and Potential Solutions

Testimony Presented to the Committee on Environment and Public Works United States Senate

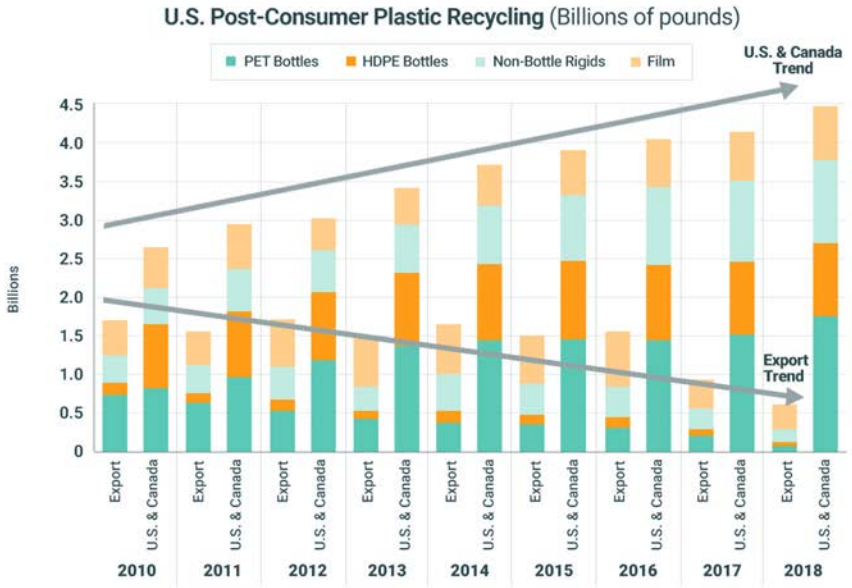
Presented by: Nina Butler - CEO More Recycling, a business of Stina

June 17, 2020

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U.S. Post-Consumer Plastic Recycling Trend



Export Percent by Category	2010	2018
PET Bottles	47%	3%
HDPE Bottles	16%	6%
Non-bottle Rigid	44%	14%
Film	47%	31%
All of the Above	39%	12%

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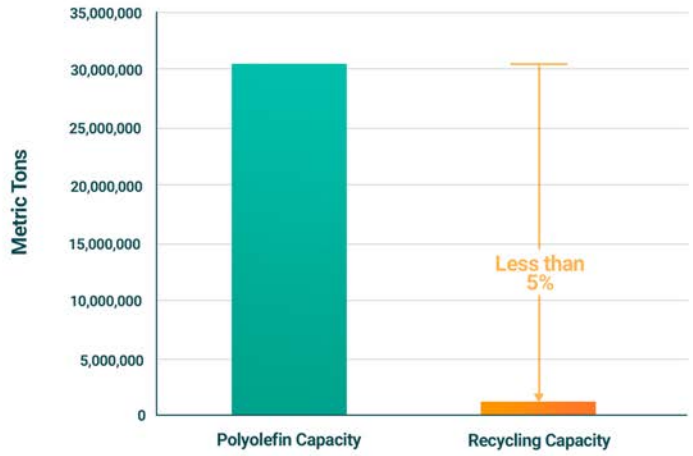
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Production Capacity: U.S. Virgin Plastic Producers vs Recyclers

U.S. Polyolefin Capacity

10 Largest Virgin Producers vs **Majority of Postconsumer Reclaimers** (Bottles, Non-Bottle Rigids & Film)

Note: Approximate figure includes existing reclamation capacity in 2019. It does not include announced future capacity.

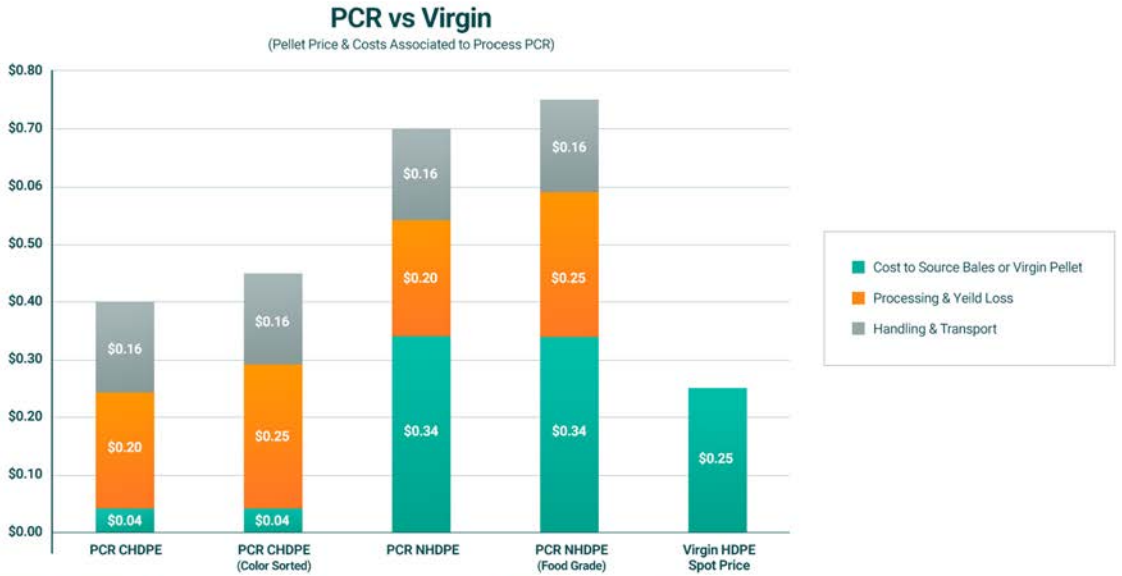


Source: IHS Markit and More Recycling

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Recycled Plastic Is More Expensive than Virgin Plastic/Resin



PCR CHDPE = Postconsumer Resin colored High Density Polyethylene
PCR NHDPE = Postconsumer Resin natural (colorless) High Density Polyethylene

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Plastic Paradox

1. The use of plastics saves resources and reduces GHG, benefiting the planet.
2. The use of plastics creates massive pollution at its end of life, severely harming the planet.



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Food Preservation – Preventing Water, Carbon, Resource Waste

Again, without a change in consumption patterns, such as expecting to get fruit from thousands of miles away or cook what we buy within days, we will have more food waste and more GHG emissions with the elimination of plastic.





Examples of Plastic Packaging Innovation

Beef Packaging



ORIGINAL
Polysterene foam tray with cling wrap

NEW
Vacuum packing in oxygen barrier film

RESULT
Shelf life extended from 4 days up to 30 days

Grapes Packaging



ORIGINAL
Sold loose

NEW
Perforated plastic bags

RESULT
Bagging leads to 20% reduction in in-store waste

Source: 2016 American Chemical Society

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Packaging Efficiency = Reduced Need for Resource Use

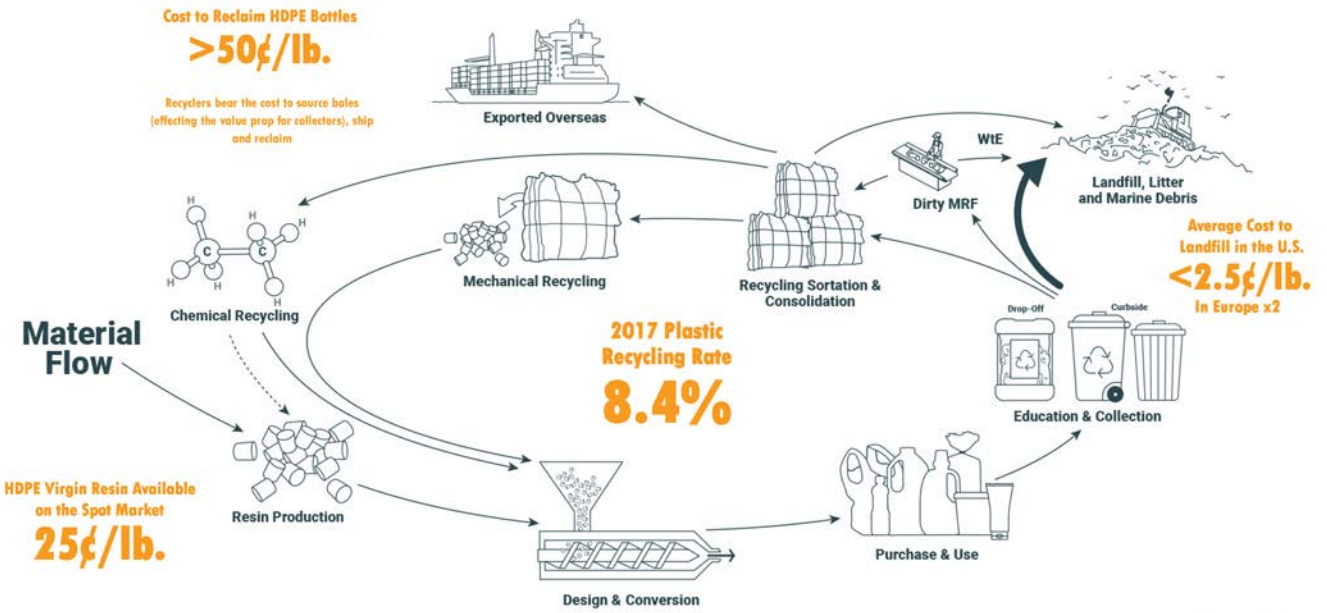
One pallet of plastic film packages the same number of diapers as 14 pallets of paper board resulting in significant energy savings.



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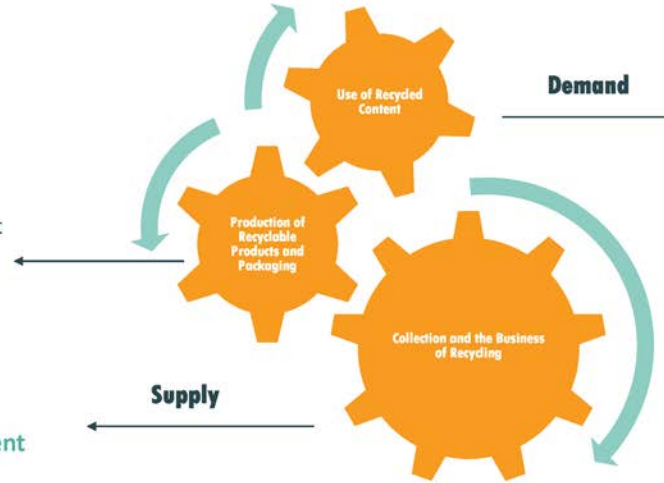
Barriers to the Circular Economy



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Recycling Actions and Drivers



Design for Recycling
Elements of Recyclability
- Market Compatibility
- Consolidation to Market
- Recycling Access

Demand

Demand Drivers
- Producers to **Use Recycled Content** in their products and packaging
- Business and Citizens to **Buy Products with Recycled Content**
- **Verification** of claims and **methodology** used to make claims of recycled content

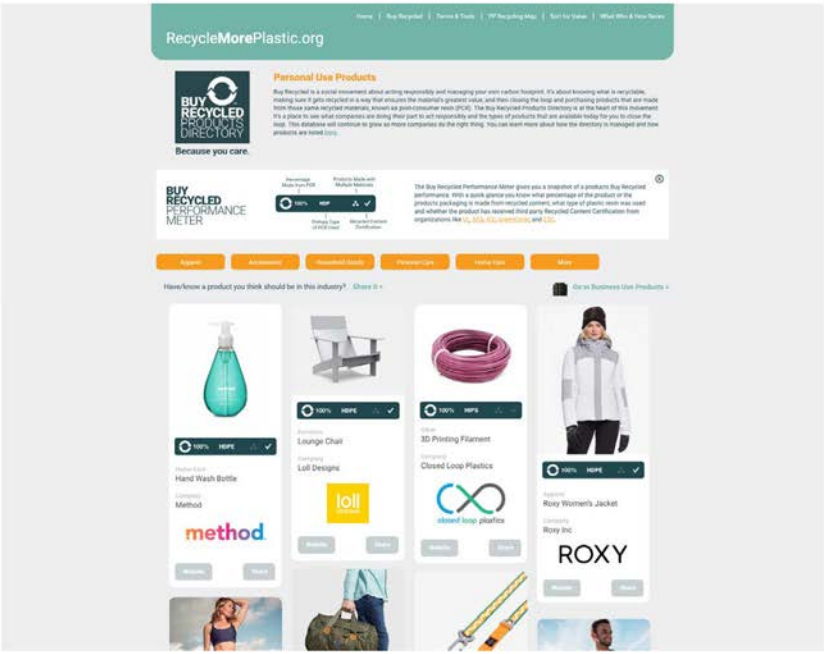
Supply

Recycle Right
Produce Recycled Content

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Tools we offer to create transparency: Buy Recycled Products Directory



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Recycling Market Development Platform – CircularityInAction.com













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Thank you

Nina Butler

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Senate Committee on Environment and Public Works Hearing - June 17, 2020 entitled,
"Responding to the Challenges Facing Recycling in the United States"
Questions for the Record for Nina Bellucci Butler

Statement:

Now is the time to create and invest in bold policies to support communities, businesses, and the environment across the United States. Congress has the opportunity to respond to recycling challenges by establishing a "North Star" to unlock economic drivers to manage all resources responsibly. Policies are needed to balance the costs and benefits of a healthy environment, via greater federal leadership coupled with corporate engagement. In line with my testimony delivered on June 17, 2020, below I further explain what is needed to move ourselves toward a successful **circular economy** that better tracks and mitigates greenhouse gas impacts associated with products and resource management, while protecting people and our environment, and improving our business acumen.

Senator Sullivan:

1. **As you know, together with Senators Whitehouse and Menendez, I sponsored the Save Our Seas 2.0 Act, which passed the Senate in January and is under consideration by the House. The bill is not a silver bullet but it is significant progress in combatting plastic pollution, and we look forward to its passage and to begin further work together after. Can you discuss how Save Our Seas 2.0 could help encourage recycling and therefore reduce marine debris?**

   Response:

   The first thing we should 'study' are standards for measurement with an urgent timeframe, since there is a need to define policy within the lens of economic recovery due to COVID. Regulation should be measurable, enforceable, and reasonably implementable by regulated parties.

   The key elements in Save our Seas 2.O are international collaboration, measurement, standards, and certification. Standards are essential in an efficient marketplace and provide the foundation for placing value on resources. **Currently the intrinsic carbon value of plastic is lost, which is why we have so much waste.** Until we have a standard and a certification system for circular polymers, market inefficiencies will stifle innovation for plastic recycling -- a key tool for preventing marine debris. Rather than merely "study" barriers, Congress needs to take further action to fund the development of national standards that align with global standards (e.g., International Sustainability and Carbon Certification). This would help create a value proposition for companies to create products and packaging that are commercially recyclable, and then recover and utilize collected plastic in new products and packaging, *before it becomes marine debris. These steps are necessary,* if we are to truly stem the tide of plastic waste that is

beginning to overwhelm our oceans and is on track to damage marine life and bankrupt fisheries. Furthermore, the market is susceptible to false marketing claims on recycled content. (The US Federal Trade Commission ***Guides for the Use of Environmental Marketing Claims*** are enforced on a very limited basis annually and greenwashing frequently goes unchecked.) True innovators that are setting goals and successfully using recycled content are failing to secure a competitive advantage. Consumers are confused about what is recyclable and how to make sustainable buying choices. The sooner we have uniform standards, the sooner we can establish policy that rewards companies that are leading the way in efficient use of resources and the circular economy. Driving demand and recovery inherently reduces needs and demands for government-funded cleanups, including marine debris pollution. Government investments in recycling and recovery infrastructure or subsidies can easily be adjusted alongside existing subsidies for oil and gas extraction; and in fact, existing subsidies can be repurposed to companies eager to demonstrate the merits of circular production and recapture. While grants deliver short-lived progress at the outset, sustained value, and corporate responsibility for mitigating the impact of waste, are powerful drivers of long-term investment in solutions for management of our plastic waste. Encouragingly, recovery of scrap plastic is an important component of the long-term plan for resource independence in the U.S.

Standards should differentiate technology that captures the value in scrap plastic with the lowest carbon footprint (i.e., mechanical recycling), and, they should also include technology that enables scrap plastic, particularly that which has degraded in the marine or land environment, to be deconstructed back into monomer form for rebuilding into high-performance polymers. Pyrolysis or gasification requires much more energy than mechanical recycling, and therefore should be used secondarily: when the application requires high-quality resin and/or the scrap plastic is unsuitable for mechanical recycling.

There are a lot of products in our daily lives often overlooked when examining how Americans interact with plastic. Plastic are used in order to meet consumer demand and most are not intended for the recycling bin (e.g., ski boots, yoga pants, surf boards, etc.). A large portion of plastic goes into packaging (~40%), and it has become highly engineered. The more complex the packaging, the more challenging to recycle. Therefore, we have a major disconnect between the technology to make plastic products and the technology to reclaim/recycle plastic. Nature cannot manage plastic, even when made from corn or cane sugar, when we are done with it; therefore, the producer has a responsibility to ensure its management, post-use (Extended Producer Responsibility).

If we are to continue to live beyond our natural limits by benefiting from and enjoying things made possible through plastic (e.g., surgery, air travel, riding a bike, clear eye sight, internet, computer, cell phone, deep sea diving, defense, etc.), we need to come to terms with what to do with this material that nature cannot manage. Access to oil

and gas and thus plastic has been an engine of U.S. economic growth for decades, particularly as the US grew to the largest producer of oil and gas in the last decade. But it's become the source of our climate and plastic waste crisis. Rather than new virgin resin production, we should create incentives for chemical recycling capacity to manage the plastic currently in circulation that cannot feasibly be mechanically recycled, thus reserving our oil and gas supplies for their most critical applications, now and for future generations.

It's one thing to give up straws or single use water bottles and another to give up our phone, computer, GORE-TEX™ winter coat, or bicycle. If we want engineered products, we need a way to turn scrap plastic back into high-quality resin. Chemical recycling, if developed within a carbon policy, will drive the transition from overproduction of virgin plastic to circularity. It provides the petrochemical industry with a bridge into circularity and enables it to become a solution provider rather than an adversary to sustainability. However, a critical caveat is that any transition from virgin production to chemical recycling must not further impact at-risk communities already struggling with environmental justice issues, including downstream impacts of oil extraction and petrochemical production.

Alaska is a critical place of measurement for the global work on reducing marine debris in Southeast Asia. Areas like Kodiak, Montague, and/or Kayak Islands could serve as benchmarks on the global action to curb marine debris. The Ocean Plastics Recovery Project (OPR) has outlined a plan to use Kayak Island in the Gulf of Alaska as a proxy measure of plastic pollution leakage from Southeast Asia, that travels by way of the Kuroshio, North Pacific, and Alaska currents, and becomes deposited on the islands and coastline of Alaska. A sample of PET bottles collected by OPR and Island Trails Network from Shuyak Island in 2019 showed that 100 percent of the bottles in which labels were intact were from Southeast Asia. Consider elements in the Blue New Deal Coalition (bluenewdeal.net) as it is also international in nature and the intent is to tackle the connected issues of climate, plastic waste and degrading biodiversity in an economic framework.

2. **It's often mentioned that funding for recycling isn't the challenge—the challenge is defining what needs to be funded. It is often a question of funding, though, particularly in remote communities like in Alaska. What do you see as good options for Alaska?**

Response:

Funding is precisely the challenge but providing it as a one-time infusion of capital in infrastructure is undesirable. Instead, the system needs a sustainable funding mechanism, to avoid wasting government resources in the long term. Instead of local, state, or federal governments covering the cost of collection, disposal and

environmental impacts of products and packaging, producers should have a vested interest in creating opportunity for that product to become another resource in the economy. A well-defined **extended producer responsibility policy** with incentives to improve design, and participation (such as container deposits/refunds), would greatly benefit Alaskan communities, and all other rural US communities as well. Incentives and easy access to recycling are critical for strong participation, as seen across select states and provinces. While extended producer responsibility (EPR) systems rely on the producers of materials to fund the collection and management of their products through end-of-life, such programs must be implemented to ensure equitable access for both urban and rural areas. Recycling targets are easier to meet in densely populated areas, but the challenge for collection, and by extension, funding, is more pressing in rural or far-afield areas. Requiring producers that sell into these areas to support the management of their products help close the gap on funding. (Further, while we are concerned with US recycling here, consider that fees to fund responsible end-of-life management of plastic packaging sold by US or multinational companies in developing countries which lack solid waste and recycling facilities, and are the source of 90 percent of marine debris, could also be addressed via effective EPR policy.)

When the price of virgin resin was higher than 75-80 cents per pound, companies made investments in recycling because value was evident. A value proposition occurs when the cost of recycling is less than the cost of disposal + the use of virgin materials. Then oil prices declined, which changed the value proposition. Marine debris and waste are now treated as byproducts and a function of the value society places on resources. **Currently we place very little value on the management of carbon, including greenhouse gas emissions created by unrecovered plastic scrap.** But that could change When material is assigned value, people and industry are less likely to waste it. Right now, we have an economic system that makes it artificially cheap to consume and dispose of virgin materials through subsidies and externalized costs. That too could change: investments in infrastructure without a value proposition will likely lead to short-term fixes. U.S. leadership is needed to correct course so that it's more expensive to waste than to protect the environment—the environment which underpins society and the economy. The right EPR policy does exactly that.

With EPR and within a broader carbon policy or a North Star policy focused on overall sustainability, the economics would become more attractive for companies to invest in chemical recycling to supplement virgin oil and gas that often get shipped long distance to US territories, such as Guam. Reducing transportation reduces wasted fuel and minimizes carbon footprints.

3. **Innovation in recycling is critical. Can you expand some more on what the federal government can do to help drive that innovation to make America a leader in recycling technologies?**

Response:

We must require the use of recycled content, or postconsumer resin (PCR) because PCR, lacks price parity with virgin resin.

The US has to date failed to provide leadership to guide marketplace innovators to support the most efficient use and recovery of resources. By assigning a value on carbon or recycled content we awaken the innovators, catalyzing step changes in technology. The most powerful thing the federal government can do to make America a leader well beyond recycling technology is lead the way to a low-carbon economy. With global trade of oil and gas and new international alliances being formed by countries such as China and Iran, the U.S.'s current competitive advantage due to cheap oil will be extinguished by China's access to cheap oil. In this race, we ALL lose. Instead, the U.S. should lead a new industrial revolution anchored in efficient use of resources. The best thing we can do is unleash the innovation of companies and other countries to join our race toward a low-carbon economy. When we value carbon and management of carbon, we increase the value of existing plastics that can be recycled and other commodities which run primarily on oil and gas. Remedies need to be in place to avoid regressive taxation, but such remedies exist and have proven effective in other countries.

4. **America's recycling system is primarily managed at the state and local level, but low recycling rates nationwide warrant federal participation in the improvement of the waste management system. The EPA estimates that approximately 8% of plastic is recycled and the national recycling average across all materials hovers around 23%.**
    a. **Could you outline what specific role the federal government should play relative to efforts of states and localities?**

    As stated in previous responses, national leadership is desired to establish policies to: set values on carbon impacts to protect the climate (including energy savings of using recycled plastics); require extended producer responsibility; and encourage public participation in waste prevention, reuse, recycling and composting, to achieve maximum environmental and economic benefits. Federal planning and incentives for critical recycling infrastructure such that we don't have to ship recovered materials long distances to reclamation mills is needed.

5. **Material recovery facilities (MRFs) nationwide have struggled to generate revenue, invest in new technology, and maintain reasonable recycling standards. The wellbeing and profitability of MRFs is critical to the health of the US recycling system.**
    1. **What suggestions do you have for addressing this challenge?**
    2. **Would better sorting technologies at MRFs benefit the larger waste management system?**

Response to the above, two questions:

1. The economics of material recovery facilities (MRFs) are tied to the value of the recycled material and the strength of the end markets -- the overall economics of

the system. The failing system economics are described in previous responses. The recycling system is highly fragmented, generally functions on the spot market, and depends on consumers to participate--mostly unattractive dynamics for investors. I believe there is a need to explore cooperatives and service business models for MRFs, secondary sorting facilities and other recovery infrastructure. Longer term contracts that involve the key stakeholders in recovery could help set recycling quality standards, disposition of unsorted materials, living wages, and benefits for workers. Cohesive US policy, established with fortitude and foresight in 2020, could set the course toward MRF prosperity, because all materials which pass through them will have known value and viable, well-planned end-markets.

2. Yes, but it is important to invest at the optimal level within the waste management system. Technology investments to improve the quality of high critical mass materials, such as paper, PET, and HDPE, makes sense at a MRF, but lower critical mass materials today such as PP, PS, and cartons could be aggregated and investments could be made to sort these materials at regional sorting facilities. Examples of advanced technology include AMP Robotics and Titus. Through better sortation we can increase the quality and thus supply of circular polymers.

   "Better sorting" could be replaced with "market harmonization" or "eco-modulation". (**Eco-modulation** is an emerging philosophy in which producers are rewarded for their efforts in designing products and packaging which mitigate their impacts on the environment (bonus) or provide disincentives for less environmentally preferred products (malus). Eco-modulation of fees is considered an instrument to putting the Circular Economy in place.) In terms of guiding MRF sorting technology improvements, reducing the influx of non-recyclable mixed materials which lack markets, and applying fees to develop recycling for now-unrecyclable materials (eco-modulation) would drive improvements.

   Further application of **The APR Design Guide For Plastics Recyclability** by the Association of Plastics Recyclers, which recommends preference for #1, #2 and #5 plastics (along with other specifications) should also guide MRF sorting efforts.

6. **Consumer goods companies believe they have a role to play in the proper disposal of the products they produce and that effective recycling systems require shared responsibility. These companies endorse a variety of policies and have volunteered to make considerable investment in recycling systems worldwide. Deposit Return Systems (DRS) and Extended Producer Responsibility (EPR) are among the most common systems in which industry plays a role in the management and funding of recycling systems.**

Deposit Return Systems (DRS) are touted as one of the most effective methods of managing and generating funds for recycling systems. While recycling rates of high value materials in these systems are robust, DRS does not account for all materials in the waste stream. And often, funds raised from unclaimed deposits don't in fact fund recycling improvements, but rather are put in a government's general fund.

Extended Producer Responsibility (EPR) is another popular construct for managing recycling systems. While EPR may not achieve the high recycling rates of certain materials, it addresses all materials in the waste stream, can be easier to manage than a deposit system, is easier to manage, and boasts broader support.

As conversations advance about how to address the underinvestment in recycling infrastructure in the US, new concepts in addition to deposits and EPR are being proposed through stakeholder discussions. These build on the lessons learned (what has worked, and what hasn't) from these systems in the EU, Canada, and US states.

a. What, in your view, is an ideal system for the unique US market and why?

Response
Policy levers needed in the U.S. are discussed in previous responses.

7. America's most effective recycling systems incorporate considerable industry involvement in their management and governance.

a. Do you favor industry involvement in the management of recycling systems?

Response:

Yes, with bold and strict goals and clearly defined oversight by the government, industry should be involved in the management of recycling systems. Industry must have the power to innovate towards the goals and be furnished with economic incentives via policy to achieve and exceed them.

b. Is partial industry governance scalable in the United States?

Response:

A federal framework is preferable. As stated by fellow Senate hearing presenter **Meghan Stasz,** VP of Packaging and Sustainability for the **Consumer Brands Association**, the need for standardized guidance for recycling facility performance, and for reporting data consistently, would greatly aid brands in building end-markets. [1]

[1] The EPA already works with the Municipal Measurement Program made available through the Recycling Partnership and Re-TRAC software, and it could be more widely adopted for effective measurement.

c. What are your opinions of Producer Responsibility Organizations in the management of recycling systems?

Response:

EPR is supported and discussed in previous responses. Competent, ethical third party organizations have proven successful in guiding the course and establishing effective government-industry partnerships to manage end-of-life materials (paints, batteries, sharps, electronics, etc.) which offer many benefits. Eco-modulation or EPR provides appropriate funding necessary to ensure the economic feasibility of recovery schemes. Producer Responsibility Organizations provide forums for stakeholders and can guide cost-effective, environmentally responsible best practices. (See more in question 14)

Ranking Member Carper:

8. At your company More Recycling, you track and monitor the sustainable use of materials over their lifecycle in an effort to reduce the use of virgin materials, specifically with respect to plastics.
   a. What are your biggest concerns with the production of virgin materials, including plastics?

Response:

1. Federal subsidies that enable artificially cheap extraction of raw material (oil, wood, minerals) and production of products and packaging that use virgin materials (plastics, paper, construction products and many other items) are an enormous ongoing obstacle to responsible sustainable materials management policy.
2. Release of methane at a significant level due to unregulated production of virgin materials and lack of market levers to incentivize use of recycled materials to reduce greenhouse gas emissions is the path to runaway climate change and must be addressed immediately by bold policy led by a forward-thinking, conscious Congress.

   b. What are your biggest concerns regarding the environmental impact of virgin materials?

Response:

Unbridled waste due to lack of assigned economic value for the postconsumer material that is already in circulation.

9. **In light of the coronavirus crisis, a number stakeholders have advocated that plastic is the safest, most viable material to protect people against the virus. Certainly, medical supplies, PPE and other lifesaving products made from plastic have been extremely critical to combatting the pandemic. However, the notion that plastic is the best material for non-COVID-related single-use purposes—such as drinking straws and plastic utensils—is not reflective of the views of local and state government that continue to move towards reducing single-use plastics, and transition to using compostable or reusable products instead.**
    a. **Looking beyond plastics that are critical in response to coronavirus, how can recycling systems and plastic producers address the manufacture, use and recyclability of single-use plastics in ways that are not only good for the planet, but also help ensure the safety and health of our communities?**

Response:
Plastics play a critical role in modern medicine—way beyond COVID related needs. Currently none of these plastics are slated to end up in the recycling stream via current infrastructure. COVID may be more deadly in areas with compromised air quality, especially in low-income areas with existing health concerns. This calls us to address greenhouse gas emissions and to recommence protection of our remaining rainforests, which replenish our air with oxygen—and our oceans, the lungs of our planet. Carbon policy that fuels a thriving circular economy is the most powerful way to discourage deforestation and overconsumption, thus mitigating our risk to future novel viruses.

Unfortunately, compostable plastic packaging does not offer a panacea.

Compostables: When a compostable plastic breaks down it offers little to no value to the soil. Instead of retaining the intrinsic carbon value in the material you lose it to the environment and then you have to recreate a new item that uses the same amount of energy to produce every time. And because many of the environmental costs of a package or product are in its creation, composting does not reduce these.

Reusables: Well before we had single-use plastic bottles, milkmen delivered milk to our doorsteps in reusable bottles. The idea of a deposit system is much older than plastic soda bottles. You paid a deposit on a container so that you had an incentive to return it for reuse. Reusable containers were sanitized and reused well before single use plastics became the norm.

Although there has been debates as to the safety of using reusable products during the pandemic, many experts, including CDC and WHO, agree that when properly washed, most reusable containers for food, drinks and groceries can be safely used. Non-profit UPSTREAM Solutions has been providing useful resources to support continued safe reuse during the pandemic:

- Health Experts Sign Statement
- The Safety of Reuse During the COVID-19 Pandemic (Fact Sheet)

10. The equivalent of one full garbage truck worth of plastic waste is dumped into the ocean each minute, impacting wildlife and disrupting ocean ecosystems. 80 percent of the plastic that enters the ocean is never formally collected. As we discuss ways to improve recycling, we must also discuss ways we can better reduce and reuse our plastic items so that they no longer end up in our environment and waterways, where they threaten wildlife, navigation, recreation, water quality, and tourism.
    a. What policies and practices can help us incorporate the concepts of reduce and reuse so that we can better protect our water, oceans, and wildlife?

    Response:

    Previously I note various policy levers to increase the materials recycled, increase system financing and increase the demand for recycled materials, thus lowering the environmental burdens associated with virgin material production.

11. The urgency of the plastics issue cannot be overstated. If we fail to act, it is possible that by 2025 as many as 250 million tons of plastic will be circulating in the ocean. We also produce more than 350 million tons of plastic each year, an estimated 40% of which is used just once and discarded. Many single-use products, many of which are made from plastics, are not designed to be recycled.
    b. What possible interventions should be taken to improve the recyclability of consumer products and the design of products so that the materials are easier to reclaim and repurpose?

    Response:

    Currently, there is an overall lack of value for recycled materials, and virgin materials are far cheaper. If there were a stronger market value for recycled materials, needed improvements to design and produce more recyclable consumer products would take place, as well as needed infrastructure improvements to collect, recycle and reprocess recycled materials. Again, addressing ocean pollution occurring in developing countries will require US leadership in establishing EPR or eco-modulation sufficient to adequately mitigate issues worldwide.

    c. What is the role of federal policy in this space and how can we in Congress help?

    Response:

Federal policy can help in both the short and the long term. In the short term the following policy would benefit the recycling ecosystem and move toward more plastics captured for recycling, as well as increasing the value of recycled plastics:

a) Enact bottle deposit legislation (aka deposit return system/DRS), modeled after the most cost-effective programs, and extend these systems to other products;
b) Enact recycled content legislation on high volume, low barrier products (e.g., trash bags);
c) Tax the disposal of material to landfills;
d) Enforce pollution prevention practices and support those companies that prioritize pollution prevention beyond what's required (e.g., EPA's P2 program);
e) Implement the EPA Office of Research and Development's Municipal Solid Waste Decision Support Tool that provides a holistic evaluation of the life-cycle environmental trade-offs and economics to help transition to a more circular economy; and, last but certainly not least,
f) Establish the methodology and verification of claims of recycled content (e.g., though mass balance certification or other means)

Longer-term, Congress and federal government staff should consider more comprehensive system levers, like extended producer responsibility (EPR) with eco-modulation and recycled content requirements, and, a value on carbon that is applicable to all materials, not just plastics. Together, these two focal points could have the effect of adequately financing the recycling system, collecting quality material, encouraging design for recyclability, assuring use of recycled content, and reducing overall environmental impacts.

Federal subsidies for oil and gas exploration and extraction has created an unlevel playing field for recycled feedstocks. Currently the economic odds are stacked against the use of recycled plastics, and part of that is due to very cheap virgin resin production. There is a great need to balance subsidies, so they drive American ingenuity towards a circular economy. Adjusting subsidies is a critical step in creating more jobs and innovation.

d. Should Congress explore extended producer responsibility laws as one form of intervention? Why or why not?

Response:

Yes. See previous answers above.

12. Building off designing for recycling, many corporations and producers are setting ambitious targets to use recycled material in the products they produce. While these

commitments are welcomed, there is currently no accountability for these commitments as they are completely voluntary.

a. Should Congress implement recycled content mandates at the federal level to ensure these groups can meet their desired goals?

Response:

Recycled content mandates, if structured correctly, do positively impact the value of recycled materials in the market. In an effort not to disrupt certain segments of the market effectively using recycled content today, and not to impede innovation by dictating recycled content across the board, it's best to focus recycled content legislation on high volume, low barrier products -- as noted previously. Policy should ramp up content requirements over time. Third-party certification and better funding of the US Federal Trade Commission to enforce Green Guides (responsible claims) will drive success toward meeting goals.

b. If yes, how should the federal government set these mandates and verify the use of such recycled content?

Response:

Recycled content mandates must be predicated by a clear, overarching methodology to track and verify claims of recycled, and particularly post-consumer recycled content. I recommend that the federal government (e.g., NIST) further define the standards, (update FTC Green Guide with additional details relative to new policies) aligned with global standards.

If not, what should be done do address this issue?

13. Greenhouse gas emissions from plastic emerge not only from the production and manufacturing of plastic itself, but from every stage in the plastic lifecycle. For example, the EPA reported that plastic waste incineration in the U.S. released 5.9 million metric tons of carbon dioxide-equivalent in 2015. The climate impact of plastic waste incineration in the U.S. is equivalent to 1.26 million passenger vehicles driven for one year, or more than half a billion gallons of gasoline consumed. And if the plastic is not incinerated, plastic waste often times finds its way to a landfill, leaking harmful greenhouse gas emissions, or floating in our oceans, breaking down into microplastics. We cannot maintain the status quo with respect to our current management, or mismanagement, of plastics.

a. What are the climate impacts of plastic after it is used, including landfilling, incineration, and dumping?

Response:

When plastics are exposed to sunlight they release a myriad of chemicals including methane (a greenhouse gas 22 times more potent than CO2).[2] (In fact, plastic release harmful chemicals from extraction to disposal.[3] The only sound solution is to reduce production while finding a purpose for plastics produced, thereby creating a circular economy. The Blue New Deal Coalition is working hard to promote this new economy through waste reduction and recirculation.

And, while there certainly are negative climate impacts of plastic after it is used and improperly disposed (landfilled, incinerated or dumped/littered) the greatest climate impacts are actually upstream. For most materials, including plastics, the greatest climate and environmental impacts related to the product and packaging are in the extraction, production, and transportation phases. In these three phases the greatest amounts of energy (e.g., oil, gas, coal, nuclear, overall GHG emissions), water, and land are used. This is why I am so strongly recommending adoption of carbon policy relative to production impacts. We use plastic packaging in large part because we ship food long distances.

Microplastics are another concern and can be added to the list of things to address in carbon-based future legislation (eco-modulation), taking into account an item's potential to contribute to microplastics generation and recommending replacements or mitigation.

b. How do we unlock the "plastics paradox" that you spoke about in your testimony?

Response:

We can unlock the "plastics paradox" by bringing together the need for solutions to climate degradation with the need for solutions to our plastic waste problem. Our North Star is the need to reduce our overall environmental footprint while preserving precious and limited resources. It is possible to bring together solutions for climate and plastics waste through the following actions:

- Adjust subsidies for oil and gas/virgin material extraction;
- Put a competitive value on carbon;
- Incentivize the use of recycled materials in the production of new products (starting with high volume low barrier products with increasing levels of recycled content required over time);
- Establish an overarching extended producer responsibility policy that incentivizes design for recyclability and the use of recycled materials, in order to

[2] https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0200574.
[3] https://www.ciel.org/wp-content/uploads/2019/02/Plastic-and-Health-The-Hidden-Costs-of-a-Plastic-Planet-February-2019.pdf

appropriately finance the recycling system. Industry must have flexibility in "how" to achieve established goals.

c. **Should Congress look into policy that would put a price on carbon in order to fully unlock this paradox to evaluate the true lifecycle of plastics?**

Response:

Yes. A price on carbon is the best option to drive innovation toward materials, products, and services with the lowest environmental footprints. A mere tax on virgin resin will not achieve this and could have the unintended consequence of forcing companies to use materials and delivery systems that are more resource intensive than plastics overall.

Senator Sanders:

14. **I am a proud cosponsor of the Break Free From Plastic Pollution Act, which would address the plastic pollution problem with a number of policy tools. During the hearing, you mentioned the need for long-term federal recycling policy that includes extended producer responsibility (EPR). A successful EPR program would require plastics manufacturers to take responsibility for their waste.**
    a. **In your opinion, is there any way to improve the EPR model in the Break Free From Plastic Pollution Act to most effectively ensure that plastics companies, and not the American people, are responsible for the costs related to solving our plastic waste problem?**

Response:

This needs to be explored in more detail. Overall, EPR models, with eco-modulation work best to incentivize a movement toward packaging with the lowest environmental footprint - lowest carbon impacts - when it encompasses all types of packaging, not just plastic packaging. We suggest you connect with firms that are experts in EPR models:

- Lorax/EPI
- Eunomia
- Reloop
- California Product Stewardship Council

b. **What are the benefits and concerns of an EPR model that requires polluters to finance *and* manage recycling programs, versus requiring producers to finance recycling programs that are managed by a public entity?**

Response:

The best way to keep costs down within EPR is to encourage efficiency in all areas—**eco-modulation** of costs of products integrated into systems benefit items that are readily recyclable in the system and/or use recycled content that creates demands for the recycled materials. Those materials that are hard to manage or recycle are most costly to producers to put into the system. On some level, consumers will pay for any model that deals with solid waste or recycling infrastructure. Even within EPR, producers will pass along some of the costs of managing the end-of-life of their products to the consumer that buys them. The best system would drive more responsible consumer purchasing.

The benefits of reusables or refillables must also be revealed and encouraged via policy and integrated systems. An eco-modulation fee paid only the first time a container or product is placed on market instead of each time a new one is produced and sold can drive reuse and refill programs which significantly reduce waste and associated greenhouse gas impacts depending on the product and shipping distance.

It is not fair to consider package producers as polluters just because they create currently unrecoverable packaging. A package delivers a product to us, and innovative, thin plastic packaging is often the most efficient way to get materials and products to consumers especially if the product is shipped any significant distance. Good packaging protects food freshness and prevents food waste, another significant greenhouse gas generator, and light weighting of packaging reduces transportation impacts. All of the benefits, as well as the impacts, can and should be accommodated via eco-modulation.

The leverage of a large entity overseeing an entire program creates efficiencies that aren't always found in the decentralized realm of many municipalities and within MRF waste sheds. Regional Professional Recycling Organizations (PRO) will drive better contract terms because they can guarantee more material than any one municipality.

EPR that is managed by producers alone has at times stifled free enterprise evident in a decentralized market with many different players. This is why many trade groups that represent private haulers are leery of EPR programs because it limits their ability to negotiate contracts with communities.

The producers don't have to actually manage a program, and in fact, many of them don't. Around the world, EPR programs are often best managed by PROs with public oversight agencies. Some programs include options for municipalities to continue running their own programs or using the services provided by the PRO. Efficiency is the key piece to positive EPR outcomes.

15. **During the hearing, you mentioned that "[single-use plastics] bans can lead to unintended consequences." To my mind, these consequences could mean an undue financial burden on low-income families. How can the federal government best simultaneously facilitate phasing out single-use plastic while ensuring low-income families are protected?**

Response:

Exempting low-income families (WIC, SNAP, etc.) from fees on bags is one way to minimize undue financial burdens of single-use plastics bans. Providing durable, reusable bags to customers can also reduce costs for both stores and consumers, while reducing costly litter impacts.

Yet, the bigger unintended consequences aren't related to financial impacts. Shifting to alternatives (e.g. switch from plastic bags to paper bags) that have higher carbon footprints because they are heavier or require more energy to produce can be the worst unintended consequence. This increases the environmental impact overall and low-income families are the hardest hit as health concerns rise due to the state of the environment and degradation of our ecosystems that are vitally important to help keep us healthy.

Bans also disincentivize retailers who no longer provide single use bags from providing recycling bins for other film packaging still present on store shelves, including toilet paper and other product wrappers. This type of packaging, being lightweight, waterproof and durable, protects thousands of consumer products in transit, on the shelf and after POS. Because it is not collected via curbside due to challenges it creates in processing and lack of markets, it's critical to have other avenues for consumers to recycle this. Between 2016 and early 2020, we tracked a loss of about 25 percent of the store drop off locations in California alone, many as a direct result of the statewide bag ban, as noted by individual stores which had removed their bins.

16. **Last year, plastics production and incineration added more than 850 million tons of carbon pollution to our atmosphere – equal to the annual emissions from 189 coal power plants. You previously spoke about the need to "...stop tracking materials so much based on pounds [diverted from a landfill], but more on CO_2 savings." What are the advantages of recycling policies that are measured by carbon pollution emissions reductions versus other methods of accounting, such as weight of waste diverted from a landfill?**

Response:

Diversion rates are only part of the metrics. You can't look at recycling of plastic in a vacuum. The inherent value of tracking carbon emissions becomes clear as you

investigate potential alternative materials to plastics.[4] The overarching goal should be to reduce our environmental footprint, not just to reduce the pounds of material going into landfills, nor to just increase recycling rates. [5]

Glass is heavy, but inert so it doesn't necessarily create a lot of emissions as it degrades. But the transport of glass both as a package and again when it's recycled creates significant emissions from the transportation requirements of the material.

Recycled materials that offset the use of virgin materials reduce carbon footprint of the package *and* divert material from the landfill.[6] Plastics are light weight so the pounds diverted don't tell the whole story of the value of keeping the material in the circular economy. Clear carbon metrics (eco-modulation) are the key to unlocking true sustainable materials management. For more on benefits of recycling and use of recycled content, visit **Circularity In Action**.

Senator Merkley:

17. What role does fracking play in the production of plastics in the U.S.?

Response:
Hydraulic fracturing for natural gas created ideal conditions for the exponential growth of plastics production in the U.S. [7], but investments are no longer paying off according a recent report by Deloitte.[8]

18. Is fracking driving increases in the supply of plastics in the US?

Response:

Yes, fracking is fueling the growth in supply/production, particularly as there is less demand for fuel as more products are designed for lightweight transport (see Plastic Paradox discussion on page 13). **As fracking production grows in the US and other countries—and if there is no policy enacted that changes the economics of oil and gas**

[4] https://plastics.americanchemistry.com/Executive-Summary-Plastics-and-Sustainability.pdf

[5] Oregon DEQ has a good example of this as it relates to concrete formulations and are encouraging producers to focus on lowest impact solutions. For concrete made in Oregon, they will require an impact assessment – like a "nutrition label" for impacts https://www.wastedive.com/news/oregon-deq-allaway-low-impact-recyclable-products/574812/

[6] https://plasticsrecycling.org/resources/life-cycle-study

[7] https://www.americanchemistry.com/Media/PressReleasesTranscripts/ACC-news-releases/US-Chemical-Industry-Investment-Linked-to-Shale-Gas-Reaches-200-Billion.html

[8] https://www.worldoil.com/news/2020/6/22/deloitte-reports-continued-strain-for-shale-producers-even-as-oil-prices-rise

use to establish a circular economy— the trend of a tsunami of plastic compared to a trickle of recycling will continue. And that will compound our already gigantic plastic waste problem.

Senator Markey:

19. The *Break Free From Plastic Pollution Act of 2020* has a four-year moratorium on the construction of new plastic facilities while the Environmental Protection Agency (EPA) creates regulations on these facilities. Please detail for the Committee why this moratorium is needed. What sort of regulations are there on plastic facilities currently?

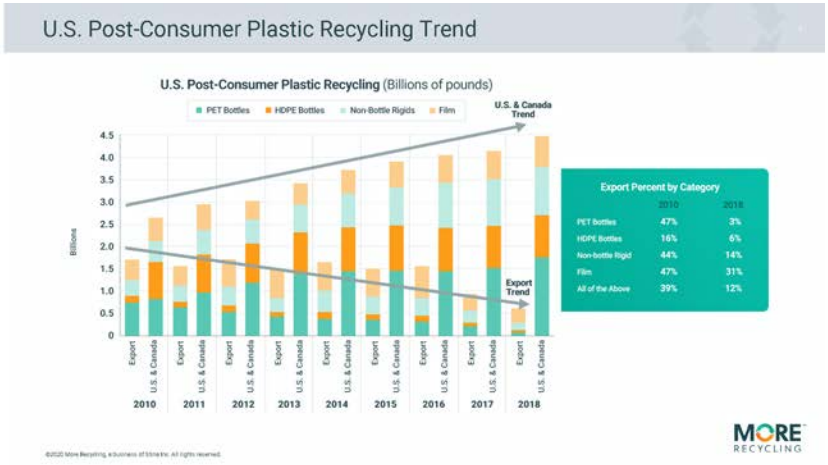
Response:

This question hits at a critical nerve. If we can't recover 92 percent of the plastic material that's produced - every year - then should even more be made knowing the material cannot be reabsorbed by nature or the economy? Even if we had investments in recycling to reach a 100 percent recycling rate for items like containers and bags, what will happen to the plastic that is found in things like most clothing, electronics, cars, building material, medical supplies, etc.? Plastics have enabled us to live as almost supernatural beings. They enable, for example, clear eyesight, flight, joint replacement, and massive communication. Virtually none of this material is considered recyclable, and few talk of giving up the wonders that plastics provide. So if we can't recycle the material should we all give up our cell phones and future knee replacement surgeries? I believe we should institute the methodology and enforcement system to require all products in a company's portfolio have TBD minimum recycled content by a specific year and then increase those percentages over time, with proper economic incentives.

20. As we heard in the hearing, only 2.5 percent of the plastic that goes into blue recycling bins gets recycled domestically, while 62 percent is exported. Transitioning to a circular economy—where product is recycled and reused—will require innovation and new ways to clean and break down used plastics. Can you elaborate on how the transition to a circular economy for plastic can create more domestic jobs?

Response:

I am not clear about the 2.5 percent figure. Exports for plastics have been on the decline and 88 percent of the major categories of plastic reported for recycling, in 2018, were reclaimed by U.S. or Canadian recyclers. Globally, overall plastics recycling remains low even in countries with EPR, which is why EPR within a carbon policy is essential.



A linear model includes jobs upstream; however, jobs diminish when materials are dumped in landfills.[9] If the materials are collected, consolidated/sorted, processed for market and made into new products, new jobs would be created. There is the potential to create additional jobs at the local level, where much of the work to collect and sort materials is done. Further incentives to use recycled content in products or mandates that require purchasing of recycled materials drive domestic innovators to start new manufacturing businesses to meet the needs put forth by the market. Evidence of this exists via the impacts of the California Rigid Plastic Packaging Container Program (RPPC), adopted in 1991.The RPPC is recognized as significant because it created market demand for recycled content in non-food rigid plastic packaging.

In addition to innovation, recycled plastic will need to become more cost-competitive with virgin plastics. What sort of incentives and regulations would help achieve this goal?

Response:

[9] "For example, while waste collection and landfill disposal creates less than one job per 1,000 tons managed, the collection, processing, and manufacturing of products with recycled materials as feedstock creates 6-13 or more jobs per 1,000 tons, depending on the material. The largest number of potential jobs are associated with recycling plastics (over 29,000), followed by paper (26,600 jobs) and lumber (17,600). The bulk of these jobs would come from manufacturing, which is more labor-intensive per ton of material than collection or processing." https://www.nrdc.org/sites/default/files/green-jobs-ca-recycling-report.pdf

Please see above response that include thoughts on eliminating federal oil and gas subsidies, EPR, and end market support through recycled content mandates.

21. During the hearing, you emphasized the need for a holistic approach to the plastic crisis. In addition to reducing our consumption of virgin plastic, greenhouse gas emissions and chemical byproducts created by the packaging sector must be taken into account. You specifically mentioned that coated paper is not necessarily a good replacement for plastic because it is a chemically intensive product. What materials and types of plastic or packaging are the hardest to recycle and result in the most greenhouse gas emissions and chemical byproducts?

Response:

Products or packaging that are multi material/multi resin ("complex packaging") are difficult and usually too costly to recycle. Paper that is coated to make it waterproof is also less desirable from a recycling perspective.

Compostable products and packaging also require further scrutiny and regulation. They rely on industrial composting systems for recovery (not what's in most backyards), and are not even available in many US regions yet. Lacking processing facilities which can accept compostable materials, many of these products are simply landfilled where they create methane, a greenhouse gas emission, during degradation. Further, persistent chemicals of concern used in creating waterproof coatings on foodservice ware (PFOS, PFAS) are undesirable by many composters.

The California bottle bill, while not perfect, is instructive: it establishes fees per unit which fluctuate based on their design and performance in the recycling system. Making a package out of something that looks like a recyclable package but is a different resin that reacts differently in the recycling process (e.g., has a different melt flow index) is a challenge and can be disincentivized through unified policy guidance. The need for design for circularity guidelines is evident.

Summary

I believe more producers throughout the value chain are willing to support carbon policies that make it economically viable to invest in a systemic solution involving recycling, recovery, reusability, and composting. A carbon tax is the most powerful tool to stimulate movement towards balance: of supply of high quality scrap materials and demand for them into circularity. Initiatives like the Ellen MacArthur Foundation have played a critical role in bringing key stakeholders to the table. The U.S. Government must also play a role. Thank you for your attention to climate change and the growing plastic waste problem.

Additional Resources to Explore:

https://time.com/5835402/green-stimulus-climate-change-coronavirus/
https://www.visualcapitalist.com/china-plastic-ban-global-recycling-industry/
https://ecwpress.com/products/the-case-for-climate-capitalism?_pos=2&_sid=4286d2b13&_ss=r
http://www.bluenewdeal.net/background.html
https://www.pewtrusts.org/en/research-and-analysis/articles/2020/05/28/countries-restarting-economies-have-rare-chance-to-solve-ocean-plastic-pollution
https://www.iswa.org/media/publications/iswa-extended-producer-responsibility-library/
https://www.oregon.gov/deq/FilterDocs/MaterialAttributes.pdf
https://institute.smartprosperity.ca/sites/default/files/report-circulareconomy-february14-final.pdf
https://climatecrisis.house.gov/report
https://kingcounty.gov/~/media/depts/dnrp/solid-waste/about/planning/documents/task-force-EPR-policy-framework.ashx?la=en
https://archive.epa.gov/wastes/conserve/tools/payt/web/html/factfin.html

Senator BARRASSO. I appreciate your testimony, and specifically the trip in 2003, the Amazon experience, which has now brought you passion as well as expertise.

There is a marvelous book, Running the Amazon, which a couple of my buddies from Wyoming have done, and this was back in the 1980s. The experience that they had; it just must have been amazing. So thank you so much for sharing with us today.

I would like to turn to Ms. Stasz. The COVID-19 pandemic has reminded us of the value of single use plastics. Single use plastics have been indispensable in protecting medical professionals, first responders, others who are on the front line caring for patients and fighting the virus.

Can you share with us some lessons about single use plastics and what States and municipalities should do to cut down on plastic pollution, and what we can learn from this pandemic and the unique situation in which we find ourselves?

Ms. STASZ. Yes, thank you, Chairman. That is an excellent question. I think the COVID pandemic has shown that there is a real need for a range of packaging materials, that packaging has this critical job to play, in particular, safety, quality, protection of product.

What it is also showing is that we need a system that can handle and process those materials. We need a 21st century recycling system that can handle the packaging that is needed today and that is in use today and the packaging that is being developed for tomorrow.

Senator BARRASSO. In 2017, China said they would restrict most of the imports of mixed paper and mixed plastic, continuing along the line of what you just talked about. So since then, the private sector has taken steps to increase the capacity to recycle these goods here at home.

What are the most noteworthy actions taken by the private sector to date?

Ms. STASZ. China closing their doors to our recyclables really exposed a shocking lack of infrastructure here, domestically. Our industry has taken aggressive commitments to improve our packaging, but we need that underlying recycling system to work.

We are still in a supply and demand break. We are still in a supply and demand challenge.

Our industry has certainly innovated, we have invested in improvements, and I think we need all stakeholders at the table to rebuild and reimagine that recycling infrastructure here domestically, creating jobs, and filling that supply for the demand that is out there.

Senator BARRASSO. Ms. Croke, I don't want you to feel lost up there in Vermont, I want you to feel engaged in all of this. I have a couple questions for you.

First, in terms of the single use plastics that we have heard are difficult to recycle, too often single use plastics end up, as we hear, in rivers, oceans, where they threaten and kill wildlife and present all sorts of problems.

What are the most promising advanced recycling technologies when it comes to single use plastics?

Ms. CROKE. Great question, and I might back up a little bit and just note that we believe that there is no one solution, there is no silver bullet. We are not going to solve this with an individual innovation.

We need to look at reduction strategies, and we need to look at ways to recover those materials at the end of life. So we are both seeing on the reduction side, refill models that make it easier and safer to use some plastic types more than once.

Then we are also seeing new advanced recycling technologies, both in terms of, as I mentioned, robotics and AI and recycling facilities to sort those materials out. But the ability to actually turn plastics into another plastic in a high value way, again and again, through some of the chemical technologies and purification technologies.

One example is a company called PureCycle, where if you have, for example, a polypropylene yogurt container that you recycle, there is very little market for that today. But if you can turn that back into a clear pellet that doesn't have smell or color in it, it can go into a new packaging just like a virgin material. That is used through an enzymatic process.

There are a lot of different technologies out there. There is no single technology within that category. As we see the conversation grow and policy grow in this space, that is a market demand driver that brings innovators to the table.

Senator BARRASSO. So, still to you, Ms. Croke, the COVID-19 pandemic has contributed to a collapse in crude oil prices. We have seen this worldwide. Lower crude oil prices make it cheaper to produce virgin materials, especially plastics.

What are the practical impacts for local recycling programs looking to sell their recyclable materials, companies looking to increase the recycled content in their products, things along those lines?

Ms. CROKE. It is a question I can't say that we have a final answer to. The markets are highly volatile right now, and we don't know exactly where they are going to go. I wish we did.

What I can say is that with COVID, we have seen that both on the fiber and plastic side, that it is clear that we need that material going into the manufacturing supply chain.

When we saw a lack of access to toilet paper and other items that typically have high recycled content in them, it showed us how critical that feedstock is, and the same thing with packaging. We know companies that couldn't make enough pumps for their cleaning products to get them out to customers, because they couldn't get that material.

If we can build the supply chains around recycled content, we know that material exists. So if we can get it collected and get it back into those products, that will help manage the supply chains.

On the plastics pricing issue and on the oil prices, it is definitely a risk, and we need companies to be able to make long term contracts, off ticket contracts, for those materials to help even out the prices so that we can scale the system where recycled content goes back into the manufacturing supply chain, so it that can compete with the raw material supply chain.

Senator BARRASSO. Thank you.

Senator Carper.

Senator CARPER. Thanks, Mr. Chairman.

Again, our thanks very much to each of our witnesses for joining us today, and it is great to be with our colleague, Tom Udall, especially.

I really appreciate what you said about Tom's family, especially his father. I know that they have a lot to be proud of. And we are proud of him as well.

I am a glass half-full guy. My colleagues would tell you, some of them say, one of them said the other day that I am the most unrelentingly optimistic person they know.

Sitting here in this hearing today, I am not feeling optimistic. I always look at problems, I think, Oh gosh, this is, in adversity lies opportunity, that is Einstein's words, and this is going to be fun. We will put together a team, and we will figure out how to address this.

But this is a daunting challenge. This is a daunting challenge. I am a big believer in not just focusing on symptoms of problems. I told the story about taking my two 45 gallon plastic bags, trash bags, and collecting litter on the on ramp to I–95; that is addressing the symptoms of the problems.

I am a big believer in addressing root causes. I am also a big believer that there is usually no silver bullet to solve most of our problems. There are a lot of silver BBs. Some of them are bigger than others, and you helped address and draw our attention to some of those.

I always like to say, I felt this way when I was Governor and wrestling with the problem in Delaware, I would always say to my cabinet when we are trying to figure out what to do on a particular issue, including recycling, and I would say, let's look at other States. Let's find out what other Governors are doing; let's find out how we can learn from them, and take their ideas, and maybe rework them and use them in our State. So I would like to find out what works and do more of that.

Right now, I would like to figure out what is our role, the role of the Federal Government.

The EPA has made an effort to bring together recycling industry stakeholders. I commend them for that. That includes municipalities, businesses, non-profits, and others to discuss how the U.S. can increase recycling rates across all 50 States.

There is a consensus that the Federal Government can play a greater role in facilitating recycling, but the details of what that role should be are subject, as you know, to debate.

A question for each of our witnesses: In your view, how can Congress best build on EPA's and stakeholders' efforts, and what should the Federal Government's role be in this challenge?

Let's just start with Senator Udall if we could, and then we will go to Bridget, Meghan, and Nina.

Tom. Is he gone? All right.

OK, Tom, you can mail it in.

We will go to Bridget, to Meghan, and to Nina. I have heard him address this enough times that I could probably do it for him, but I won't.

Bridget, you go first, please.

It is a problem when you have hearing rooms this big. It is like a football field in here.

Ms. CROKE. Thank you for the question. I think a lot of the proposals that are on the table have a lot of value in them, so again, I don't have a [indiscernible] solution to this.

I would say that we have a massive industry of raw materials, and building up a system that aggregates recycled content material and helping it compete with the raw material market requires the same incentives that the raw material markets get. Tax incentives and other ways that you can incentivize market demand for this material, so that companies can turn their commitments into actions more easily, and kind of make the economic case for that, and accelerate that.

We believe that at scale, a circular system can compete economically with a linear system where you are extracting materials, using it, and disposing of it. But we need to build up that system. So the incentives to help build that system to be on par with the raw material market would be incredible.

Senator CARPER. Thank you, ma'am.

Meghan.

Ms. STASZ. Thank you, Senator Carper. I think there are a couple of things that the Federal Government can do. I agree with you that this is daunting, but this is also an opportunity. We have an opportunity to rebuild a functioning, effective, efficient recycling system here, domestically now. I think hearings like this are such an incredible opportunity to put those big ideas on the table.

The first thing that I think Government could do, which I said in my testimony, is around standardization and data collection. We want to raise recycling rates in the States, but we don't know what the baseline is. We don't know what the recycling is in most States. So how can we get that standardized, harmonized data collection, so that we at least know where our starting point is.

The second piece, and this is part of the three part platform that Consumer Brands Association put out in April, we think there is a terrific role for the Federal Government to play in end market development. Creating this infrastructure creates jobs.

North and South Carolina is a great example. There is $250 million invested in plastics recycling infrastructure in those two States, but the State needs more supply. Those facilities are running under capacity. So North and South Carolina have launched a program called Your Bottles Mean Jobs, encouraging households to recycle just two more bottles a week, which would contribute $10 million in economic benefit and support 300 jobs.

There is opportunity here. There is a great role for the Federal Government to play in terms of leadership for incentivizing infrastructure development.

Senator CARPER. Thank you.

Nina, same question.

Ms. BUTLER. Is this very specifically about what can be done right now given current stakeholders and with the EPA, or is it something longer term? I just want to clarify between short versus long term.

Senator CARPER. Longer term. The role of the Federal Government, longer term, from this day forward.

Ms. BUTLER. Long term, I think we fundamentally have to establish North Star policy that is grounded in valuing carbon, that is a sustainable materials management plan that includes extended producer responsibility, so that we can truly level the playing field and set the right economic drivers in place.

Senator CARPER. All right, thank you ma'am.

Thank you all.

Senator BARRASSO. Thank you, Senator Carper.

Senator Inhofe.

Senator INHOFE. Thank you, Mr. Chairman. I am going to ask questions of two of the witnesses, and I will start with Ms. Stasz. And then I have a second question for you if there is time after I go to the second witness.

We are talking about, it has been introduced, a bill that would put in place a ban of many single use plastics. I would ask you, Ms. Stasz, what are some of the unintended economic or environmental impacts of the alternatives? There are alternatives that have been named, but I would like to know some of the problems that may be there for those alternatives.

Ms. STASZ. Thank you for that question, Senator. As we said, packaging has this really critical job to play. It protects the safety, quality of products, and as we just mentioned, the COVID pandemic laid bare the need for a range of packaging, including single use plastic packaging.

What we need to make sure is that we have all options on the table when it comes to packaging types, because there is a range of consumers in terms of the packaging that they need for their use. There is a range of products that need different packaging.

We have entire teams of Ph.D. packaging engineers who are spending their careers making sure that the packaging that is used for a product is the best one possible to do its job, to get the product to consumers safely and intact and with minimal environmental footprint.

What we don't want to do is take arrows out of the quiver, right? We want to make sure that we have all those options on the table, but a system that can actually process them.

Because forcing switches in packaging material, if they don't have a full life cycle analysis in mind, they can cause those unintended consequences, potentially more greenhouse gas emissions, or they might be fragile and break, and you will lose the product, and you waste food, et cetera, when I think about the role that packaging has to play.

I think we want to have a recycling system that will accept and use and keep that packaging in play, keeping it out of landfills, and absolutely keeping it out of the environment.

Senator INHOFE. That is good, I appreciate that.

Now, I wanted to ask a question of Ms. Croke, and it may sound like it is a little stretch in this Committee, but I think it is very important to me. I would like to have you share your thoughts on probably one of the most discussed recycling problems that is out there, and that is of electric car batteries. Would you share with us your knowledge on this?

Ms. CROKE. Sure. Look, I am not an expert in battery recycling, but what I can tell you is that certainly, the fact that this is an

emerging growth industry, and that [indiscernible] waste and battery waste and things adjacent to that are still emerging, that it is in early days in terms of solving some of these challenges.

So, as you can see, with the plastics issue, where there has been significant attention drawn to it over the last couple of years, when you put the microscope on something, that is when stuff happens. That is when we can actually make change.

So in order to solve getting away from some of the raw material inputs that go into that and being able to re-utilize the high value material that is coming out of that, we need to actually put attention into what the problem is and the innovation that can come around that.

I might just add to Meghan's answer on the previous question as well, it is also not binary in terms of what exists today versus solving for packaging or processing. We have to solve for both.

An example of that is we invested in a company called Cambridge Props, which has a silk protein that goes over food from meat to produce, et cetera, that helps extend the shelf life, that removes the need for as much packaging around that.

At the same time, there is critical packaging that is needed. So we need to drive innovation. We need to drive system innovation and product innovation. That is true for plastics, paper, and battery recycling.

Senator INHOFE. Let me get to the second part of the first question. That would be, and this is for Ms. Stasz, would you speak to the economic impact that a ban, such as the ban that has been discussed, would have on the cost of living for middle class Americans?

Ms. STASZ. Yes, I can, Senator, and thank you for that question. We want to make sure that the products that U.S. consumers use and rely on every single day are delivered safely, intact, and affordably. Affordability is certainly part of the decision around what is the best packaging for that product.

So for banning certain materials, or taking those arrows out of the quiver, we could, unintentionally, be driving up the cost of getting product to consumers, or creating unintended waste. That is certainly not an outcome that we want to see, and again, I think we need that underlying system that can handle the packaging that is the best for the product, the packaging that is in use for today, and the packaging that is in use for tomorrow, so that we don't see unintended consequences like increased cost to consumers.

Senator INHOFE. Very good. Thank you very much.

Thank you, Mr. Chairman.

Senator BARRASSO. Thank you, Senator Inhofe.

Senator Whitehouse.

Senator WHITEHOUSE. Thank you, Chairman, and thank you both for this hearing and for your support of our plastics efforts over time.

I see that Senator Sullivan came in, and he has been a wonderful companion working on this legislation.

It strikes me that when there is a whopping failure, and I don't think there is any way to describe recycling as anything other than a whopping failure when less that 10 percent of recyclable product

gets recycled, even when it is put in the bin by a consumer, that the problem is usually one of incentives.

It also strikes me that when the problem is one of incentives, that usually means the problem is revenue. I think the question for us here is, what is the revenue proposition for an investor in better recycling?

I remember traveling with our friend John McCain to Mali when there was extremist uprising, and we went to see the troops who were deployed there. When I drove from the airport into Bamako, I looked at the fields nearby, and I thought to myself, how could there be so many ravens, or crows? What are these fields that are just filled with black birds?

It turns out there weren't black birds at all. They were black plastic trash bags that had hooked onto a piece of ground and were flapping in the wind and looked, at first glance, like a bird. It struck me that in a country as poor as Mali, if you could just give people a penny for turning in one of those plastic bags, they would be gone.

I note that Unilever, which is probably the most forward looking company on this, has said that it is going to take a pound of plastic out of the environment for every pound of plastic it puts into the environment through its products. It is going to be a lot harder for Unilever to find that pound of plastic coming out than it is to put it in as packaging.

But when they do that work, they will end up having to pay people to get the plastic out of the environment. That creates a revenue proposition.

I am sorry that American companies aren't doing as well as Unilever on that front, and I note with some sorrow that when the American business community speaks for market solutions, their interest in market solutions usually evaporates when it comes to paying the cost of cleaning up their mess. Suddenly, that is not such a great market solution.

Then they want partnerships and programs and reimagining and public relations efforts, and anything but putting the revenue out there to create the incentive to clean up their mess.

That is the way economics is supposed to work. Senator Udall described it as Economics 101. It is Economics 101 that the cost of the mess of your products should be baked into your product.

Tell me where you disagree with me in that analysis, and tell me what you would support in terms of getting a revenue proposition out there to create what we all need, which is, we want to have 100 percent recycling. But until it pays somebody to pick up the Coca-Cola bottle and put it in a bin, and until it pays somebody to make sure that once it is in the bin, there is better than a 1 in 10 shot that what is in the bin is actually going to get recycled, this isn't going to work.

So let me start, if I may, with Ms. Stasz, because she has big Rhode Island connections.

[Laughter.]

Ms. STASZ. I do. The best State.

Senator WHITEHOUSE. The best State. Thank you.

Much better than Wyoming, all this big talk about Wind River. We got Narragansett Bay, Mr. Chairman.

[Laughter.]

Ms. STASZ. You raise a really excellent point, Senator, and I think especially around Economics 101 and what is the revenue proposition here.

As I said in my testimony, certainly for recycled plastics, the demand signal is there. It is strong. All of the 25 largest CPG companies that have made big commitments to improving their packaging somehow, largely by dramatic increases in recycled content.

But as Nina pointed out, the supply isn't there. So what is the break in the Econ 101 value proposition? I think that is a really important question for all of us to consider.

When we think about financing these systems, how do we spur investment or how do we finance recycling and improvements to recycling?

There are a number of different ways to do that. We put out six different funding concepts in the policy platform that Consumer Brands released in April.

What we wanted to do was identify not just funding ideas, but funding ideas that solve specific problems, that get to underlying problems in the recycling system and use funding to fix those problems to drive intended outcomes.

There is a range of ideas in there that get at those targeted problems, one of which is a fee on packaging. We were talking about other concepts like landfill tip fees. There is a whole host of ideas out there that can be used in the right circumstances. But any financing that goes to improve infrastructure, it has got to solve specific problems in the recycling supply chain.

Senator WHITEHOUSE. Mr. Chairman, I am over my time, so if I could invite the other two witnesses to respond to that question as a question for the record, just provide a written response per the Committee's rules, that will allow you to move on to other Senators who are present.

Senator BARRASSO. Thank you, Senator Whitehouse.

Senator Rounds.

Senator ROUNDS. Thank you, Mr. Chairman. I recognize that this discussion today is about recycling. But I am really curious because in most cases, the reason for the recycling in the first place is to try to get some of this product back out of the environment in the first place, in particular, those items that have a very long life.

In this particular case, we are talking primarily about petrochemical based products. These petrochemical based products, these polymers, have a very, very long if not indefinite lifetime. Therefore they get into the environment, and they don't leave. They just get smaller, more broken up, but they still remain there.

I haven't heard one item of discussion today about the alternative, which would be a biopolymer, rather than a petropolymer, a biopolymer made out of soy based products and so forth.

I would really like to know whether or not you see a future for our biopolymer products that are produced right now; they do not have an extended lifespan. Yet, with the research that has been going on for 30-plus years, there appears to me to be a very reasonable expectation that a biopolymer product replacing a petropolymer product should seem at least part of the discussion when we talk about trying to recycle.

I would just like, very quickly, just to kind of go down the line, and get a thought, are we missing something by not talking about the promotion of bio-based polymers in the packaging and in the short lifespan needs of so much of what we use plastics for that are petrol-based today?

Let's just start with Ms. Croke to begin with, and kind of move our way down.

Ms. CROKE. Great question. What I would like to do is just break this into two pieces that sometimes get confused, not that you are confusing this, but just in general for the broader audience.

There is a difference between bio-based polymers that turn into a polymer that acts and looks like any other polymer, and at end of life, reacts like every other polymer and can be recycled. Then there are compostable solutions that look and act like plastic, but can actually break down, at least theoretically, into a compostable solution.

So I break those into two items. I think they are both viable and on the table, especially if you think about making biopolymers that are still going to, at end of life, have to go through the same processes as regular polymers, but you extract less petrochemicals, and if you can identify sources of that biomaterial that are going to be waste products, even better.

We have seen companies like Origin Materials that use waste cellulosic material and turn that into a polymer. Super-cool, great opportunity, lot of investment going into that.

The compostable plastics are also a potential opportunity, especially for items that are unlikely to be recycled ever, because they are food contaminated or they are very small and can't go through a recycling system.

That said, if we are going down that path, we really need to think about investment in our food waste, our composting, and anaerobic digestion infrastructure, which we are investing in through and across many of our funds.

I think there is significant opportunity there. But you can't create products like that without thinking of the infrastructure and making sure that material is actually bio-available, so that when there is a product coming out of that compost facility, it is high value and can be sold, just like a recycled item.

Senator ROUNDS. Thank you.

Ms. Stasz.

Ms. STASZ. I will admit that I am not a chemist, so your knowledge on biopolymers is likely more advanced than mine.

I think what I would say to that is that we need a range of packaging materials. We need a whole suite of options in terms of what is the best material. And there are so many new materials, new innovation happening in the packaging space. And to Bridget's point, we need a system that can process and handle those.

I think another point here would be that whichever materials we use and whichever system we use to handle, process, recycle them, keep them out of landfill, as much as possible, we should have clear, harmonized standards so that consumers aren't confused about what to do with that particular container, if it is a biopolymer or a more traditional plastic. But 10,000 different recycling

systems in the U.S., every single one with their own set of rules, it is incredibly confusing.

So, regardless of which kind of material we are using, I think it is important that we have clear, consistent guidelines, harmonization, so that we can reduce consumer confusion and help consumers do the right thing with their packaging when they are done with it.

Senator ROUNDS. Thank you.

Ms. Butler, would you like to respond?

Ms. BUTLER. Sure. Yes, this is actually what my master's project was on at Duke University because I absolutely have this allure of like, why can't we just make these materials out of natural materials. This is a no brainer.

But this is the complexity of plastic. You can't have it function exactly as you need it to in the most efficient way and then poof, go away. That doesn't mean that there aren't opportunities to displace a lot of applications.

When we look at the fact that more than half of what we produce on an annual basis is not going into the packaging stream, it is going into our clothing, and all kinds of other applications, there are absolutely—but that is why I keep going back to we need that North Star policy that is based on how we value carbon. We have to align and manage all the trade offs that go back to that one piece, because we will have a lot of unintended consequences if we don't keep that clear North Star in check.

Senator ROUNDS. Thank you.

Thank you, Mr. Chairman. I just think it is important that as we talk about these polymers and the moving forward, that the bio-based products not be forgotten. I think there are years of research on it, and there are a number of ways in which soy in particular, soybeans, have been used.

The biopolymers, we have had petrochemical engineers from the different oil companies actually tell us that once you get into that position, it is very difficult to tell them apart, and a polymer engineer can use it whether it is bio-based or a petrol-based. The difference is the lifespan, and I think that is something that perhaps in the future we could explore.

Thank you, Mr. Chairman.

Senator BARRASSO. Thank you, Senator Rounds.

We do have a number of Senators who are joining us remotely, as well as, I believe Senator Merkley, is next with questions.

Senator Merkley.

Senator MERKLEY. Great. Thank you very much, Mr. Chairman. I am pleased to be able to participate in this fashion.

I wanted to start out with having gone down and gotten some breakfast this morning, and I will hold up, hopefully, you will be able to see this, the lid, the plastic lid, which has no triangle on it. Is there any way I can recycle this? If one of you can just give me a quick answer.

Ms. CROKE. I can answer that. We are actually working, it is not super quick, but we are working with Starbucks and McDonald's to find solutions with innovation and recovery solutions on that. It is a 3 year project, so not today, but give me like, a year and a half.

Senator MERKLEY. OK. Well, I also got a cup of yogurt and was handed a spoon, and this has no triangle on it either. Is this recyclable?

Ms. BUTLER. No.

Senator MERKLEY. And that spoon came in this bag, this little plastic bag. It has no triangle. Can I do anything with that?

Ms. BUTLER. Yes.

Senator MERKLEY. So. All of these are headed to the landfill or incineration, which has its own pollution problems. There's a term called wish-cycling, which is basically that we think we have this big plastic bucket that I am here next to, and I am throwing my plastic in there. I am looking for the triangles.

But then I find out in preparation for our gathering today, that right now, if it has a triangle and the number 3, 4, 5, 6, or 7, basically there is no market. Basically only number 1 and number 2 have a significant market. If I had a ton of it, a ton of number 3, say, can I sell that anywhere in Oregon?

Ms. CROKE. If you had a ton of number 5, you could, but 3, not to my knowledge.

Senator MERKLEY. No go on number 3. How about number 4?

Ms. BUTLER. There is a market for number 4. What you said is that it has to have enough volume, and it depends on where you are. It is always very regional, and as Bridget said, there is more demand for polypropylene for number 2, emerging for number 1. There are differences between bottles versus trays.

And I want to point out that from the reclamation capacity that was starting to move up and thrive, and there are companies that despite so many challenges, have really demonstrated American ingenuity. They were getting some resins back up to almost virgin quality. This is all before the Shell gas revolution when the price went down pretty dramatically, starting in around 2014 and moving down.

So all of these questions are important. Anything can be recycled if you have enough of it and there is value for it. That is the problem. Both sides of the economic equation are out of balance in terms of low disposal costs.

Senator MERKLEY. My home State, which is really all about recycling, started the first bottle bill and the first effort for massive beach cleanup, but the marketplace is not there.

There are other pieces of this puzzle that haven't been talked about. One is that a lot of plastics are made from natural gas. Natural gas is produced in a fashion that contributes a lot to global warming, the burning of plastics contributes to global warming, the leakage of methane out of the natural gas pipe system contributes a lot to global warming.

So why don't we just go with coated paper or other strategies? My colleague mentioned biopolymers. You have already responded to that, but there are a number of companies that are working on coated papers as an alternative to these uses.

Why not kind of get out of this cycle, nonrecyclable plastic and burned plastic, rather than trying to double down on a losing strategy?

I would just ask Ms. Butler, what are your thoughts on that?

Ms. BUTLER. That is an excellent question, and this is why it is so important that we keep getting back to using science to really navigate the trade offs with that North Star in place. It is such a knee jerk reaction to say, let's just use paper. But the reality is, for that paper application to function for the application we want, there are hosts of chemicals that have to be used.

The PFAS issue is serious, and in terms of the sheer volume of paper that is ending up in our landfills right now that are off-gassing methane, it is something that is not, I think, on the radar nearly enough. We are not managing and looking at all the renegade gases coming off of landfills, which is why the cost of disposal is so much lower than it should be.

I think that you can switch to paper, but we will have a much more dramatic greenhouse gas increase if we don't change consumption patterns. It is a feel good solution, but it doesn't get us to the right overall objective, which is reducing overall environmental impact.

Senator MERKLEY. Well, I do agree with that; that has to be the goal.

I wanted to mention one other thing that hasn't been raised, and that is plastic, as it deteriorates, produces chemicals that are endocrine disruptors. Study after study shows a significant impact on species, including human species and human health.

I think that is an issue that needs to enter into this discussion, that a future based on plastics is a future based on endocrine disruptors that impact human health.

We are looking at a situation where even if you breathe the air on a remote hike on a western land, we are now finding that the dust is full of plastics. We are finding that the ocean is going to have more plastic in it than fish by weight within a couple decades.

It is everywhere, and it has profound impacts. I think we have to look at every possible strategy using that science, as you noted, to compare the impacts of different pieces, different approaches. But I think we are entering deep into an issue that is deeply problematic for the human race and American health and environmental health.

I will just end it there. Thanks.

Ms. BUTLER. Thank you.

Senator BARRASSO. Senator Cardin.

Senator CARDIN. Mr. Chairman, thank you very much, and let me thank all the panelists on this hearing.

I am sorry I could not be here for the beginning part; we had another committee hearing at that time, but I thank you very much.

I am going to follow up on Senator Merkley's point in regard to plastics, specifically dealing with microplastics that end up in the Chesapeake Bay. We had a report done by the Chesapeake Bay Program Scientific and Technical Advisory Committee in 2019 that took samples and found that nine tidal stations in the Chesapeake Bay watershed, every one they tested had microplastics, which are extremely damaging to the environmental future of the Chesapeake Bay.

We also found that wastewater treatment plants were not designed to get microplastics out of the water system, so that we also

have a situation where we think we have treated wastewater successfully, where we have not in regards to microplastics.

I know we have been talking about this, but for those of us who are committed to the Chesapeake Bay Program and committed to doing everything we possibly can to preserve the Chesapeake Bay for future generations, it is a national treasure declared so by many Administrations, can you tell us how we can use the tools available through the Chesapeake Bay Program and through the efforts there and partnership effectively to deal with microplastic issues in our waters?

Ms. CROKE. I am happy to start, and I might let Nina talk a little bit more about some of the science, but I will say that if we are talking about microplastics, which you are correct, is a huge issue, we need to take a much bigger lens on industry at large. Because what we have identified is that a significant part of those microplastics are coming from the textile industry and fast fashion. The waste that is coming out of there is a quiet issue that hasn't emerged as much as the single use packaging plastics, but is polymer-based, and is creating a lot of that risk, as well as tires on the road.

So I think taking a scientific approach to understanding where microplastics are coming from, so that we can create system solutions that solve for those issues around that particular issue.

Nina, I am not sure if you have anything.

Ms. BUTLER. No, that was great, Bridget.

I am going to kind of sound like a bit of a broken record, but again, it is until we put value on plastics, and we navigate the trade offs, as Bridget said, we are going to continue to be going in the wrong direction here.

So because there is so little value, and there are immediate tools that you could look at in terms of bottle bills, do you get materials collected. But to Bridget's point, much of it is happening in applications that are not as visible, and what we see is like, well, we should just immediately eliminate or ban that.

It is fundamentally our responsibility to find a way to put value on carbon, and therefore plastic, so that it is less and less likely for someone to walk by and think it is OK to leave something sitting there. Until we do that, we are going to have more and more of both microplastic and just sheer volume plastic waste.

Ms. STASZ. If I might add on to that, I think no one wants to see pollution of any kind, which is why we are all here today. We want to talk about how we can keep packaging not just out of landfills, but out of rivers, out of lakes, out of streams, out of the Chesapeake Bay.

I think to Senator Merkley's point, this consumer confusion piece is really rampant, and that is because of these 10,000 different systems. What you do with the number 3, with the chasing arrows in your town could be different from a single family house to the apartment building next door to your office building.

It is no wonder that as some of the research that we did, we found that only 4 percent of Americans are not confused by their recycling system. So they are either wish-cycling, putting the wrongs things in the bin, hoping it gets recycled, or they are not recycling altogether.

I think addressing this patchwork of systems, getting at some more harmonized systems, helps us educate consumers better, we get better quality product in the bin, but we also get consumers to start participating in recycling, keeping packaging out of landfill, keeping plastics in particular out of landfill, or rivers, lakes, and oceans.

Senator CARDIN. Let me just make a comment if I might. The reason I asked the question, and I thank you all for your answer, is that microplastics are not seen or not known in the Chesapeake Bay. One of our great successes in cleaning up the Bay has been education, public education. The people in the watershed really want to do their share to preserve the Bay for future generations.

We need to do a better job in regard to plastics. Yes, we see the plastics in the ocean, and we see it in our waters, and we are concerned about it, and we want to do things. But what we don't see, sometimes, we don't deal with.

I thank you all for your answer. I agree we have to look at the broader issues in regard to plastics. The Chesapeake Bay is just one of the casualties from not having a policy that reflects the true cost of plastic.

So I thank you all for your answer, and I think in regard to the Chesapeake Bay Program, we have to redouble our public education efforts so that the public understands that a lot of the efforts that we are doing to clean up the Bay, we need to put an effort in regards to the microplastics.

Thank you all very much for participating in the hearing.

Senator BARRASSO. Thank you, Senator Cardin.

Senator Gillibrand.

Senator GILLIBRAND. Thank you, Mr. Chairman.

Ms. Butler, I really appreciate your testimony. We really heard how plastic pollution in our environment, both in the land and in the air and the water, is a growing problem across the country.

I want to talk a little bit about some of the activities that States like New York have engaged in. New York has enacted policies designed to significantly reduce single use plastics that are difficult to recycle, including plastic shopping bags, straws, and Styrofoam containers.

How effective have local bans been on reducing the amount of plastic consumed and discarded in communities with such policies in place?

Ms. BUTLER. Thank you for the question. It is not as straightforward as I would like to say.

Again, I keep going back to you have to navigate the trade offs. Unfortunately, when we document how much availability of recycling, when it comes to banning plastic bags, it has had a dramatic decrease in the access that citizens can find to recycle the things that are in their households that are far beyond the plastic bag. That place to receive the material is also what you can put your bathroom tissue wrap, your bread bags, all kinds of things that really do carry products and reduce food waste.

But the bigger issue looms that we don't have, the companies that take that material and have evolved over decades and really been the innovators, I think, in our economy, do not have the demand.

While there are companies that want to buy recycled content, the reality is purchasing recycled content right now does cost a lot more than virgin. So there isn't true demand that is creating value to get that material back.

So bans can lead to unintended consequences, and it really depends on what application you are talking about, whether you are talking about bags, or you are talking about straws, or you are talking about polystyrene.

With the case with bags, it has had, in some ways, a detrimental impact if it doesn't also reduce the use of paper bags that have a very heavy carbon footprint.

Senator GILLIBRAND. You testified that there are virtually no economic incentives for producers to use recycled plastic, and that producing new plastic is comparatively inexpensive. What financial incentives and/or penalties could help make it more economically desirable to shift away from new plastic production and use more recycled content and reusable products?

Ms. BUTLER. Requirements for recycled content could go a very long way. Just take the trash bag example that I gave. We don't have, to speak of, very much recycled content in an application that is destined for landfills. It is very commonplace in Europe, but we don't have it, because it's simply less expensive.

So, as a publicly traded company, you are fiduciarily irresponsible if you are taking a feedstock that is more expensive than another feedstock, and you are increasing risk because it may not be the exact same performance that you have in highly engineered virgin resin. We have both got artificially low cost on the one side of the economic equation, which is the cost to dispose, it's less than half in the United States than it is in say, Europe, and then on the other side of the equation, it's incredibly inexpensive to source virgin resin.

That really became the case, the tipping point was around 2014, 2015, where companies, for the most part, used recycled content because it was a cheaper application. There were policies such as the rigid plastic packaging law in California that really stimulated a lot of investment in the reclamation industry, getting significantly more recycled content.

But for the most part, once the price dropped below a certain kind of specific sweet spot, it became incredibly difficult for reclaimers, the recyclers, to compete with virgin. It is only those pledges that go away when we have this superstorm of low virgin prices, all of a sudden China stepping away, and now COVID.

Senator GILLIBRAND. What role do you think industry should play in bearing the cost of cleanup of plastic pollution in our environment?

Ms. BUTLER. I think we need to use the economic drivers with very well designed extended producer responsibility that is anchored, fundamentally, in the value we place on carbon, so that there would be fees that are what is called eco-modulation. The fee adjusts based on the performance of that product, and there is a feedback loop, so the better you design, the lower your fee.

What I am hearing from brand companies and even petrochemical companies as we have been working a lot more in Europe this last year, is that they are actually asking for it.

There is not a North Star to be designed toward; there is a lot of confusion in the marketplace based on what does the consumer that may not know all the trade offs, but kind of the consumer directions giving, versus what we could have through smart policy that is really anchored in looking to reduce overall environmental impact.

So I think EPR is key. I think other tools that fit well within that, a bottle bill, recycle minimum, recycle content legislation are also really important.

We can't keep our sights only set on the half-side of the equation. It is also how inexpensive it is to landfill. When we look at, if we broaden the true cost of landfilling, the price would be much higher, and that is taxing the bads, not the goods.

Senator GILLIBRAND. Thank you, Mr. Chairman. I appreciate it.

Senator BARRASSO. Thank you, Senator Gillibrand.

Senator Boozman.

Senator BOOZMAN. Thank you, Mr. Chairman, and thank you so much, you and Senator Carper, for holding this hearing. It's a real pleasure to work with Senator Carper on the Recycling Caucus, but also all of us.

This is something, the nice thing about this, this is a very bipartisan issue that just makes a lot of sense, and could be low hanging fruit that we need to take advantage of. So we do appreciate you guys so much for being here, and how you represent common sense stewards of the environment.

Tell me, one of the things that we talk about is that, it is great for the environment, we all agree with that, but tell me also about the opportunity that it does in creating jobs. I guess we could say that hundreds of thousands of good paying jobs, this and that, talk a little bit about that. That is something I think that we don't really talk enough about.

Ms. STASZ. Sure, absolutely, and thank you for the question. I agree, this is a really critical bipartisan issue, and I think that is so important to progress and to success of initiatives that we would put forward.

When China closed its doors to U.S. recyclables, it did expose or show this dramatic lack of domestic infrastructure innovation, or in many cases, investment here. But again, that provides this opportunity to rebuild that infrastructure, to rebuild those jobs, to put more money into the economy in different parts of the U.S. to be able to process recyclables here, domestically.

I think North and South Carolina, with their Bottles Mean Jobs program, is a really excellent example of that. I think another key driver or layer around how we can incentivize infrastructure or build out infrastructure in the right places, is starting with some baseline data.

If we don't know where recycling rates are high or where most of our infrastructure is, if we have the sort of black box of data or lack of data right now, it is really hard to understand where should we put our resources, right? Where should we put our resources for the best return on our investment to create those jobs?

But I think that there is real opportunity both in standardized data collection and in building that domestic infrastructure, so we can process our packaging here.

Senator BOOZMAN. No, I agree totally. In fact, the next thing I was going to bring up was the fact that with thousands of systems nationwide that nobody knows what you are supposed to do, and in fact, many of the people that are recycling don't know what to do. It is a huge problem.

I guess the question is, what specifically, what can we do as a Congress, either directly or indirectly, through legislation or incentivizing people so that we can have some sort of a better system to collect data, have a better system to standardize? What are the keys to getting there? We talked about this a lot, but how do you actually do that?

Ms. STASZ. I think standardized definitions is a really good start. From EPA's work on their America Recycles effort last year, the work of that group found that there are 18 different definitions of recycled or recyclable in the U.S., and that is just the definition of recyclable, never mind the 10,000 different systems we have to process and handle recycling.

So some standardized definitions, I think, is a really good way to start standardized data collection so that we can target our investments in the right places.

Senator BOOZMAN. You guys can jump in.

Ms. BUTLER. We have worked on this for many years, the harmonization, because we track the amount of plastic that gets recycled domestically or sold export. The ability to really triangulate that data and look for double counting is based on how companies report this data.

We have looked at harmonizing from a commodity perspective, as well as harmonizing how we communicate to the general public. We have worked with many organizations to come up with this consistent way to do that. How we do audits, coming up with consistent methodology through the Association of Plastic Recyclers, and the American Chemistry Council, there has been a tremendous amount of work on that.

Then specifically, as Meghan was saying, the question of recyclability has been completely blown up. It used to be, you had 60 percent access, and you put a recyclable on it, and we are good. That was largely because we became very complacent in sending material to China that was more difficult.

Now we are in a whole different ball game. We worked with, there has been off and on about five different brand companies that last 3 years that had a particular package that was unknown as to whether or not it was deemed recyclable or not based on the last availability of recycling study.

So we have developed this extensive decision tree to say without a doubt, if a company is going to make a claim to recyclability, you have to check all of these boxes, and it says it flows through the system, is there market for it, is there availability; it is a very complex thing.

But I almost think that this is a bit of a distraction if we don't fundamentally have value on the material and there is demand for it. What is drastically lacking, I think, from a measurement perspective is verification.

When you make a claim of recycled content, that is what creates real demand and gets it so that it is less likely to become litter.

Right now, because there is not enough clarity on how to do that, the companies that are leading in that space aren't realizing a true competitive advantage. It is a market failure right now. From a Federal Government perspective, that would be huge.

Senator BOOZMAN. Thank you very much.

And again, thank you all and our participant by phone. Thank you all so much for the great work you are doing.

Special thanks to Senator Carper and his work and his staff, we know who does all the work with these things, I know it is true in my case, but we do appreciate your efforts.

Thank you, Mr. Chairman.

Senator BARRASSO. Thank you, Senator Boozman.

Senator Carper.

Senator CARPER. I just want to say to John Boozman, thank you, it is an honor to be your wingman, and our staff and I, we love working with your folks and the other members of this Committee, and a lot of people that are not on this Committee, or in the Congress.

I want to ask a question, if I could, of Bridget, please, and that is the Closed Loop Partners mission, as I understand it, is to build a circular economy that seeks to eliminate waste and additional demand for new resources by reusing, by recycling, and repurposing materials.

However, recycling varies, as we know, in each State; we heard 10,000 different venues or sources, not sources, but places. Recycling varies in each town, city, and county across our Nation.

It varies in our own State. Products that are recycled in one city may not be recycled in another. Many types of single use plastics that are marketed or labeled as recyclable do not have end markets, as we have heard again and again here today.

This means that many municipalities are not recycling these plastics, and they are actually ending up, as we talked about, in landfills or in incinerators. This is a tremendous impediment to building a circular economy where our country can use, can reuse materials efficiently.

Question: Knowing this challenge, how can industry and government work together better, work together better, to build that circular economy that works for both our economy and for our environment, please?

Bridget.

Ms. CROKE. Thank you for the question; thank you.

I just kind of keep going back to something that has come up again and again. I would bring it back to what Nina said, in that we really need to focus on building value, more end markets. We believe, having talked to a lot of industry, big consumer product companies, retailers, petrochemical companies, who are also getting into the game, and big banks and investors, if there is opportunity, they will invest.

We don't need government to take on the lion's share of the investment in solving these issues. We need incentives to help create and drive end markets, motivate companies to design for recycling, and create an even playing field so that an investor who is looking at investing either in a recycling facility, a processing facility, or some innovation that is going to advance recovery of materials or

even new material science, they are looking at this, and they are thinking, the commodity markets are changing every year.

Right now, we see good markets, but last year, we saw bad markets, and vice versa. If they don't see a 5 year horizon of a company purchasing that output, their investment is at risk.

If we can help create an even playing field in terms of incentivizing the use of recycled content for end markets for big consumer product companies, investment will flow in the private sector.

So anything that the Federal and regional governments can do to help drive that incentive will drive capital in significant levels into the space and build scale supply chains that naturally compete with the raw material markets.

Senator CARPER. Thank you.

Let me ask my last question maybe of Meghan and Nina. When I was new in the Senate, I didn't know Ted Kennedy, and I asked if I could maybe come by his office and have a cup of coffee together. We actually had lunch together in his hideaway, which was quite an experience, quite a hideaway. My hideaway is the size of a broom closet; his was like a museum.

I said to him over lunch, I said, I have always wondered why you, a very liberal Democrat, are like the favored dance partner with a lot of Republicans when introducing legislation. Looking for a Democrat, they ask you, Ted Kennedy, one of the most liberal Democrats, to be their lead Democrat to make it a bipartisan bill. I said, Why is that?

And he said to me, he said I am always willing to compromise on policy, never willing to compromise on principle. Think about that. Always willing to compromise on policy, never willing to compromise on principles.

What are some principles that we should take to heart, embrace, and maybe be reluctant to compromise on? Principles. Not policy, but principles, please, each of you.

Nina, do you want to go first?

Ms. BUTLER. Yes. This is very near and dear to my heart, and as I said, getting into the world of plastic, it was such an unnatural step for me. But it is that basic principle that we have to look at how we reduce the most overarching threat to life on this planet, and that is climate change, and it is toxins, but it's climate change.

Going back to the microplastic, what we can't see is really dangerous, and the acidification of our oceans through unbridled use of carbon and greenhouse gas emissions is our biggest threat. We have to unlock this plastic paradox by establishing the North Star policy so that we stay true to that basic principle of protecting this planet.

Senator CARPER. Thank you.

Meghan. And then I am done.

Ms. STASZ. I think it is an excellent question. I think a foundational principle here is the need for shared responsibility. No one actor, no one industry can solve this problem alone.

We really need an environment in which all stakeholders are at the table, and all stakeholders need to be at the table bringing ideas about how to fix the piece of the recycling supply chain that they control, that they have the most influence over.

We have seen our industry, the consumer goods industry has made major commitments to packaging improvements as the piece of the recycling supply chain over which we have the most control. We need all of the other stakeholders at the table as well, bringing their ideas to the table on how to fix other elements of the packaging supply chain.

Senator CARPER. Mr. Chairman, I just note in closing, one of the things that I think has been missing here is leadership. I have found the most important ingredient to the success of any endeavor is always leadership. This is an all hands on deck moment, and the leadership has to come from a lot of sources: Business, private sector, States, local governments, EPA, us, and from the White House, from whoever is leading our country, and for us to learn from other nations that are leading.

I am delighted that we are here. I think this has been a great panel of witnesses, and we are grateful to each of them.

Thank you so much, Mr. Chairman.

I would ask unanimous consent, if I could, to submit for the record a variety of materials that includes news articles, fully recyclables, news articles, letters, statements from stakeholders, and other materials relating to today's hearing or on challenges facing recycling in the U.S.

I would ask unanimous consent for that, Mr. Chairman.

Senator BARRASSO. Without objection.

[The referenced information follows:]

June 24, 2020

Chairman John Barrasso
United States Senate
307 Dirksen Senate Office Building
Washington, D.C. 20510

Ranking Member Tom Carper
United States Senate
513 Hart Senate Office Building
Washington, D.C. 20510

RE: Testimony for Oversight Hearing entitled, "Responding to the Challenges Facing Recycling in the United States"

Dear Chairman Barrasso and Ranking Member Carper,

I write to provide testimony on behalf of Ball Corporation for the hearing entitled, "Responding to the Challenges Facing Recycling in the United States." As the largest manufacturer of aluminum beverage cans in the world, Ball Corporation has a unique perspective on the recycling industry, not just in the U.S., but worldwide.

Ball Corporation's CEO, John Hayes, recently wrote an op-ed emphasizing the need for action to address the recycling challenges facing communities across the country. In that piece he argues "…our current focus on recycling isn't working because so many products, and the packages that contain them, are designed and sold to consumers without enough knowledge as to how, or even if, they can be recycled…" He continues "if the products we are asking Americans to recycle are not worth recycling – or are impossible to recycle – we are just managing garbage."

The recent implementation of China's 'National Sword' policy to ban imports of plastic waste from overseas, along with similar actions by other countries, has brought problems with America's waste management and recycling systems into stark relief. As a direct result of this new inability to export our waste, our plastic problem is literally stacking up in warehouses and landfills right here in the U.S.

Fortunately, Congress has the power to advance pragmatic solutions that would make an impact today. From our point of view, there are three main challenges hindering progress that require attention: 1) the amorphous definition of recycling, 2) the lack of recycling education, and 3) problematic product design. Not only do all three fall squarely in the scope of authority of the Senate Environment & Public Works Committee, but policy solutions in these areas could provide results immediately.

First, the current text used to define recycling is too vague and allows many companies to claim product recyclability where there is none. In practice, to pass as "recyclable" by EPA's standards, a product simply needs to prove the material *can* be recycled. Oftentimes, however, products that consumers think will be recycled are simply thrown into a landfill or -- at best -- downcycled into inferior materials/products and still ultimately destined for a landfill. To fix the confusion, Congress should establish a clear definition that strictly designates a product as

recyclable only if it can be turned into the original product in a circular manner. For example, Rep. Lowenthal and Sen. Udall have already developed a comprehensive definition in their Break Free from Plastic Act of 2020 that we suggest the Committee consider supporting. A clearer definition would lead to a better understanding of which products can be recycled and which cannot.

Even with the clearer definition, many Americans misunderstand how to properly dispose of their waste. While the single-stream process adopted by the U.S. through the blue bin has simplified collection, it has complicated processing. Our approach has resulted in Materials Recovery Facilities (MRFs) still having to dispose of large amounts of trash once it is finally sorted, even with the best available technology. Americans toss tons of trash into the recycling bin every day that cannot be recycled, primarily because it is too contaminated. Consumers do not realize they need to prepare their waste for processing by cleaning it as much as possible. The only way to educate the country as a whole would be a nationwide education campaign that demonstrates proper recycling. There are certainly a number of NGOs that could conduct such a campaign, but they would need funding to undertake the work. Accordingly, Ball Corporation suggests funding campaigns that can broadly educate the country on proper disposal of waste.

Lastly, Americans need products that are *designed* to be recycled after their usable life. Companies need to spend time designing products that account for the full lifecycle, not single-use. For our part, Ball Corporation is proud to manufacture a product that was thoughtfully designed to fulfill its purpose yet is easily recycled after its use. We think more companies should adopt our approach, but without policy compelling action, it is unlikely many industries will take these same actions. Accordingly, Congress should authorize the promulgation of regulations to require products to be mono-material and remove separable materials.

These proposals represent good first steps, along with policies like minimum recycled content requirements and extended producer responsibility programs that have merit, even if they are difficult to advance in today's political climate. We hope that the Committee will be able to navigate such challenges and pass legislation on a strong bipartisan basis.

Whatever can be agreed to on these important issues, Ball Corporation encourages the Committee to move forward as soon as possible. Congress does not need to pass 'moon-shot' legislation to make an impact. We just need pragmatic policy changes that move our economy toward circularity.



John Campbell
Vice President, Ball Corporation

The Association of Plastic Recyclers

June 30, 2020

The Hon. John Barrasso
Chairman, Senate Committee on Environment and Public Works
U.S. Senate
410 Dirksen Senate Office Building
Washington, DC 20510

Dear Chairman Barrasso,

The Association of Plastic Recyclers (APR), the international trade organization that serves as the *Voice of Plastics Recycling*, appreciates the opportunity to provide comments to supplement the record of the June 17, 2020, full U.S. Senate Hearing on Environment and Public Works Committee hearing, "Responding to the Challenges Facing Recycling in the United States." Our goal is to work in cooperation with the Committee to ensure that any legislation and policy achieves the goals of increasing the supply of quality material, enhancing our recycling infrastructure, and expanding markets for recycled material.

APR's membership includes independent recycling companies of all sizes, processing numerous resins, as well as consumer product companies, equipment manufacturers, testing laboratories, organizations, and others committed to the success of plastics recycling. APR works to enhance quality and increase supply through technical resources, testing programs, design solutions, corporate training, regulatory leadership and education programs.

As a starting point, it is essential to remember that recycling in this country is a business. APR is intimately familiar with every aspect of this business as our members exist at every link along the chain of recycling. Consumers start the chain by putting their recyclable products in the bin and companies at the end of the chain buy and use that recycled material for new products. It is that end-of-chain demand that drives the entire system. Recycling breaks down when there is no waiting destination for the paper, plastic, glass and metal that consumers want to recycle.

The following key points outline how every link of the recycling chain could be strengthened in order to tangibly support and grow recycling in this country.

The Association of Plastic Recyclers (APR)
1776 K Street, NW
Washington, DC 20006

plasticsrecycling.org

The Association of Plastic Recyclers

Improve consumer education and behavior by better defining and labelling recyclable materials.

- In recognition of the business realities of recycling, any definition of "recyclable" must contain a market demand component. The APR definition is comprehensive and is provided below as a reference for the Committee as it discusses synchronization of what it means for an item to be "recyclable." APR's definition is also referenced as part of the Global Plastics Commitment of the Ellen MacArthur Foundation.
    - *An item is "recyclable per APR definition" when the following three conditions are met:*
        - *At least 60% of consumers or communities have access to a collection system that accepts the item.*
        - *The item is most likely sorted correctly into a market-ready bale of a particular plastic meeting industry standard specifications, through commonly used material recovery systems, including single-stream and dual stream MRFs, PRF's, systems that handle deposit system containers, grocery store rigid plastic and film collection systems.*
        - *The item can be further processed cost effectively through a typical recycling process into a postconsumer plastic feedstock suitable for use in identifiable new products.*

- APR is eager to work with the Committee to develop a labelling system for products deemed to be recyclable. A better labelling system can provide a needed level of consistency with respect to recycling programs across the country. The current overwhelming differentiation in how packaging is labeled - and what packaging materials are accepted - is a major contributor to the lack of collection and proper sortation on the system.

Enhance infrastructure to grow collection and improve sortation.

- Specific goals for recycling rates should be matched with adequate collection and sortation infrastructure development. Otherwise, we are setting ourselves up to fail.

Increase demand for recycled content by creating content minimums and other strategies.

- The issue of recycled content supply, and the alleged lack thereof, is a primary narrative used by many consumer brands to justify their inability to incorporate more recycled content in their packages. However, in many instances, there is ample supply of material available. APR's membership includes the nation's recyclers. As a result, we know what recycled material we have available to market. The fact is that many consumer brands balk at paying the market price for this material. The lack of supply is an incomplete argument; the reality appears to be there is not enough supply at the price that consumer brands are willing to pay.

The Association of Plastic Recyclers

- Recycled content requirements can increase – and, just as important, stabilize – the market for recycled material. Expanded and stable markets will also have a positive impact on the pricing of recycled material.

- Plastic bags with recycled content should be permitted under requirements similar to California SB 270, which essentially has become a national standard for the bag industry.

Again, APR appreciates the opportunity to provide clarity on issues related to the recycling of plastic packaging, and we look forward to continuing to work with the Committee. Please contact me if you have any questions.

Sincerely,

Steve Alexander
President

The Association of Plastic Recyclers (APR)
1776 K Street, NW
Washington, DC 20006

plasticsrecycling.org

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June 16, 2020

The Honorable John Barrasso
Chairman
Committee on Environment and Public Works
U.S. Senate
Washington D.C., 20510

Dear Chairman Barrasso:

The California Association of Sanitation Agencies (CASA) writes to provide written testimony in support of S. 3944, Break Free From Plastic Pollution Act of 2020, sponsored by Senator Tom Udall. We appreciate the leadership Senator Udall and this committee has taken to address the serious environmental and economic issues associated with plastic pollution.

CASA represents more than 125 public wastewater utilities across the State of California and serves as the leading voice for California clean water agencies on regulatory, legislative and legal issues. We represent our members at the State and Federal level to promote policies that protect public health and environment. The public health, economic, and environmental costs of plastic pollution can no longer be ignored. In the U.S. alone, 32 million tons of plastic waste is disposed of yearly and only about 8% of it is sorted to be recycled. Eight million tons of plastic waste escapes into the ocean every year. Studies document that plastic pollution is so pervasive that people ingest a credit card's worth of plastic every week through the presence micro-plastics. However, the detrimental impacts of plastic pollution are not confined to the environment. Local governments, which are already burdened by overstretched budgets, are routinely burdened with responsibility of managing plastic waste, despite not having the necessary monetary resources to sufficiently address the issue.

S. 3944 would directly address these and many other issues by taking a multi-pronged approach to the threats from plastic pollution. It would require plastics manufactures and businesses to be responsible for the products they create from cradle to grave; create a national beverage container refund program; establish minimum recycled-content requirements for beverage containers, packaging, and food-service products; standardize recycling and composting labeling; and, spur large-scale investment(s) in domestic recycling and composting infrastructure.

CASA supports S. 3944 and advocates for its passage in large measure because of its provisions to address a much-neglected aspect of plastic-related pollution: wipes products that contain synthetic content. Over the last year, CASA worked with Congress offering our perspective on the impacts of wipes upon the reliable operation of clean water facilities that are tasked with protecting human health and the environment. The flushing of single-use wet wipes down the drain has created significant and needless additional operating costs for our agencies, and this challenge has increased exponentially as our communities seek to protect themselves from COVID-19 through rigid adherence to sanitary health protocols. Many of these wipes contain synthetic plastic content, and such products improperly disposed of can clog sewer lines, damage

pump and treatment infrastructure, and ultimately result in increased plastic pollution in the environment.

This is an issue that has plagued not only CASA agencies, but also wastewater agencies across the country. CASA greatly appreciates that language to require commonsense labeling of these products is included in the legislation. This mandate is vital to our communities' health and to ensuring that we can control costs of collection and treatment by eliminating the inappropriate disposal of non-flushable wipes through our sewers.

Over the years, single-use wet wipes have increased in popularity. Popular examples of these products include diaper wipes, cosmetic wipes, moist towelettes, and hygiene wipes. While these products can be hygienically effective and efficient, they also cause rampant and costly adverse impacts to community sewer systems and wastewater treatment facilities. This is due to the common, but incorrect, disposal method utilized by too many consumers: flushing the wipes down the toilet. The piping and pumping infrastructure of wastewater collection systems is not designed to handle these wipes, particularly in large quantities. Instead, these wipes should be disposed of in trash bins. There is a lack of clear and effective product disposal messaging by single-use wet wipes manufacturers that directly leads to this type of consumer behavior, and proper labeling could go a long way to alleviating some of this burden on our public wastewater systems.

Despite the look and feel of wet wipes resembling cotton, many of the single-use wet wipes that are on the market are made of nonwoven synthetic materials, such as polyester, polypropylene, and regenerated cellulosic fibers. As a result, when these products are flushed down the drain, the wipes do not break down as they travel through the sewer systems to the treatment facilities, causing a multitude of undue and costly problems to sewer and treatment infrastructure, including adding to the overall burden of plastic pollution in the environment.

The Flushing of Single-Use Wet Wipes Harms Public Infrastructure

Once a person flushes a single-use wet wipe down the drain, there are three potential outcomes, none of which are beneficial. First, the wipe can cause immediate damage to the individual's plumbing by clogging the pipes and requiring expensive and intrusive repairs. Second, wipes can enter into sewer lines that connect to their community's sewer collection system and treatment facility, where the wipe can catch on tree roots and accumulate with fats, oils and grease and become large obstructions in the pipes. Further down the line, they weave together and create giant rags, which get stuck in pumps, collection systems, and motors, causing backups and equipment failures. Finally, if the wipe somehow makes it through the sewer and treatment systems, their microfiber and micro-plastic particles can still be discharged into the aquatic environment. CASA has created an easily digestible chart that explains the various problems that can arise from flushing a single wet wipe. It is attached in the appendices of our testimony.

The coronavirus pandemic has only exacerbated the wet wipe problem. As people were ordered to stay-at-home and were stressed on the importance of maintaining robust hygienic standards, certain household products became ever more crucial to have and use. At the top of the list were single-use wet wipes. Due to the uncertainty surrounding the characteristics of the coronavirus,

people wanted to ensure that their households were constantly free from harmful germs. Many of these wipes were improperly flushed down the toilet, leading to a sharp increase in issues experience by some wastewater collection and treatment agencies during the early stages of the pandemic. The result of this has been sewer systems and treatment facilities being over-run by clogged pipes and pumps, damaged infrastructure, and an overworked sanitation workforce. This has been documented in local newspapers across the country, as well as in national papers, such as the Washington Post and New York Times. The problem became so severe that at the end of March, the U.S. Environmental Protection Agency published a press release reminding the public to only flush toilet paper, specifically stating that non-flushable wet wipes should be disposed of in the trash.

The Flushing of Single-Use Wipes is a Consumer Awareness Issue

One of the main reasons single-use wet wipes are flushed down the toilet is because people do not know this is improper. There is no standard or required labeling procedure for product packaging to tell people to not flush the wipes, such as a statement of "Do Not Flush" or a moniker of a toilet with an "X" through it. While there may be instances when there is such messaging on a voluntary basis, often times it is in small print or hidden under the flaps and folds of the packaging. This voluntary, often hidden labeling is insufficient to properly inform consumers about the nature of these products and the consequences of disposing of them improperly. Wipes manufacturers have been reluctant to put anything on their product that would potentially make use of the product somehow more cumbersome or undesirable, but something must be done. Failure to address this issue means that sewer system and treatment facility infrastructure, local governments, and ratepayers will continue to bare the brunt of unnecessary repair costs and environmental consequences of improperly disposed of wipes.

How S. 3944 Addresses This Issue

Under Section 12304 of the legislation, the U.S. Environmental Protection Agency would require wipes manufacturers, in coordination with the broader supply chain, to print a statement of "Do Not Flush" that is in high color and font contrast on product packaging to ensure visibility. This moniker and symbol would be in accordance with already established voluntary guidelines for labeling practices of the nonwoven fabrics industry and European Disposables and Nonwovens Association, outlined in the 2017 second edition, 'Communicating Appropriate Disposal Pathways for Nonwoven Wipes to Protect Wastewater Systems.' Additionally, S. 3944 establishes the marketing standard that if a wet wipe product is composed of plastic and other synthetic materials, then the product is not allowed to be advertised as flushable or septic safe and it must be labeled as containing plastic or synthetic materials.

For the few wipes products that do not contain plastic or synthetic materials, and may be septic and sewer safe, the product labeling may include a 'flushable' statement or 'sewer and septic safe' statement if the wipe product meets the performance standards for dispersibility in a sewer system or septic system established by the International Water Services Flushability Group, and do not contain chemicals or additives harmful to the public wastewater infrastructure.

S. 3944 offers simple and effective solutions to help better inform the public about the true nature and proper disposal of these wipes products. It does not disallow or inhibit the manufacturing or use of synthetic wet wipes, it does not establish a new practice for disposing of the product, and it does not place cumbersome regulatory standards on manufacturers or producers. It simply makes clear to the consumer how to best use the product for its intended purpose through a printed packaging statement and moniker.

A Simple Solution to Addressing the Flushing Of Single-Use Wet Wipes

In a time when COVID-19 has highlighted the vital role that wastewater treatment professionals and infrastructure play in protecting our health and welfare, we need policies that will help local agencies ensure efficient operations while increasing the ability to use our limited resources for critical needs. Clean water agencies are already incurring significant revenue losses attributable to COVID-19, making it increasingly difficult to do more with fewer resources. Increasing maintenance costs to remove non-flushable wipes that obstruct system operations, or replacing pump and treatment infrastructure damaged by wipes products, are not a valuable use of public resources.

No justification exists to make wastewater treatment agencies, and ultimately their ratepayers, use precious public funds to manage a problem that they did not create, and which has a simple solution. S. 3944's provisions to require straightforward labeling and conformance with international standards defining the kind of wipe that is flushable will prevent many non-flushable wipes from being disposed of through sewers. CASA supports S. 3944 and urge the committee to act swiftly and approve the bill.

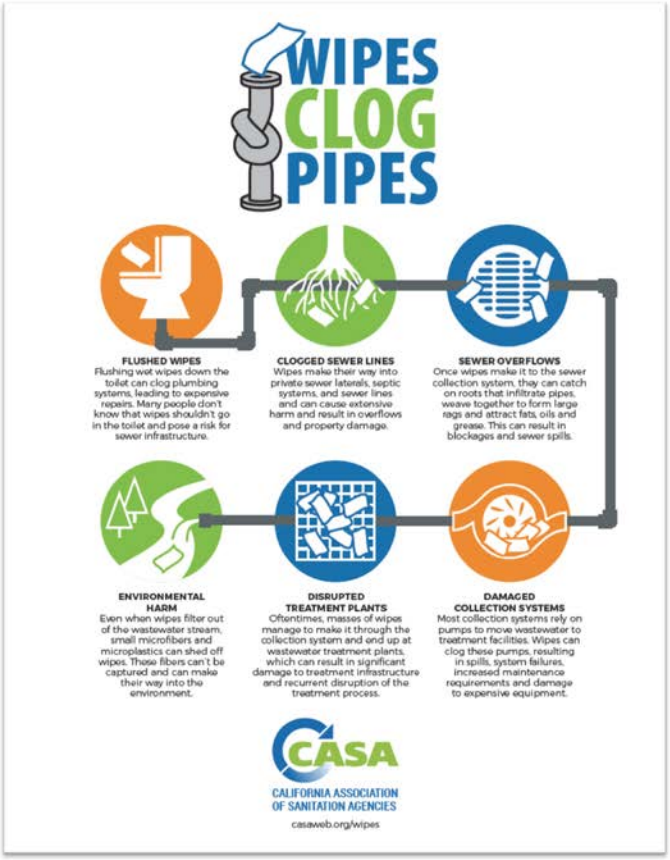
Thank you for your, and the committee's, attention to this important issue. Please do not hesitate to contact me at (916) 446-0388 or alink@casaweb.org if you need additional information regarding this topic.

Sincerely,



Adam D. Link
Executive Director

Appendix


WIPES CLOG PIPES
FLUSHED WIPES
Flushing wet wipes down the toilet can clog plumbing systems, leading to expensive repairs. Many people don't know that wipes shouldn't go in the toilet and pose a risk for sewer infrastructure.
CLOGGED SEWER LINES
Wipes make their way into private sewer laterals, septic systems, and sewer lines and can cause extensive harm and result in overflows and property damage.
SEWER OVERFLOWS
Once wipes make it to the sewer collection system, they can catch on roots that infiltrate pipes, weave together to form large rags and attract fats, oils and grease. This can result in blockages and sewer spills.
ENVIRONMENTAL HARM
Even when wipes filter out of the wastewater stream, small microfibers and microplastics can shed off wipes. These fibers can't be captured and can make their way into the environment.
DISRUPTED TREATMENT PLANTS
Oftentimes, masses of wipes manage to make it through the collection system and end up at wastewater treatment plants, which can result in significant damage to treatment infrastructure and recurrent disruption of the treatment process.
DAMAGED COLLECTION SYSTEMS
Most collection systems rely on pumps to move wastewater to treatment facilities. Wipes can clog these pumps, resulting in spills, system failures, increased maintenance requirements and damage to expensive equipment.
CASA
CALIFORNIA ASSOCIATION OF SANITATION AGENCIES
casaweb.org/wipes

June 17, 2020

The Honorable John Barrasso
Chairman

The Honorable Tom Carper
Ranking Member

U.S. Senate Committee on Environment and Public Works
410 Dirksen Senate Office Building
Washington, D.C. 20510

Dear Chairman Barrasso, Ranking Member Carper and Committee Members:

As the Committee considers the state of recycling, opportunities and challenges, I am pleased to provide the following testimony on behalf of the Glass Packaging Institute (GPI).

GPI is the North American trade association for the glass container manufacturing companies, glass recycling and other partners and suppliers to the industry. The industry works throughout the country on issues surrounding sustainability, recycling, energy and greenhouse gas emissions reduction efforts.

Glass has long been recognized as a core, and one of the original, recyclable packaging materials. For food and beverages packaging and storage, glass also enjoy "GRAS" status (Generally Recognized as Safe) within the U.S. FDA. Glass is a circular and sustainable packaging material that can be reused and infinitely recycled, back into containers with no loss of quality.

Glass Container Recycling – *Improving Energy Efficiency & Air Quality*

The glass-container manufacturing industry has a significant stake in the effectiveness of recycling programs. Recycled glass constitutes a significant part of residential curbside recycling, which by weight, is anywhere from 15-25% of a program's total volume.

It is also a key component of the manufacturing process. The US glass container industry purchases 2.3 million tons of recycled glass each year. This reduces plant GHG emissions over 800,000 tons (equivalent to taking greater than 90,000 cars off the road for a year) and negates the need for over 2.7 million tons of virgin materials use, saving natural resources.

The average glass container manufactured in the US is made with one-third recycled content. For every 10% of recycled glass re-melted to produce new bottles and jars, manufacturing energy use can be reduced 2-3%. For every three tons of recycled glass used, carbon dioxide emissions are reduced by one ton. This is because recycled glass melts at lower temperatures than raw materials alone.

Thus, the more recycled glass used translates into lower energy use and lower carbon emissions. Additionally, use of recycled glass translates into less material required overall to produce an equivalent amount of finished glass. For example, one ton of recycled glass yields

one ton of finished glass, whereas 1.2 tons of virgin materials are needed to make one ton of finished glass.

Ongoing and Significant Challenges Present in the U.S. Recycling Collection System

Over the past two years, the broader U.S. recycling system has been challenged by increasingly high recyclable export contamination standards, impacting the flow of these materials to the long-standing principle international markets. The tougher standards have resulted in fewer exports and much lower revenue received from the sale of nearly all recyclables. These realities have significantly increased the cost for local governments to provide recycling services to their constituents.

As a result, many local waste management providers have chosen to reduce the number of items residents may put out for collection—in some instances removing glass bottles and jars from curbside recycling. Others have discontinued recycling programs altogether. These difficult decisions have led to higher landfill tip fee costs for localities, and overall increased costs for disposal of glass and other recyclables.

Based on recent surveys and studies, millions of additional tons glass that could be beneficially reused are now being sent to landfills around the country, due to a lack of modern equipment at materials recovery facilities (MRFs), collection and recovery systems, or freight and other transportation barriers. Properly sorted, quality glass has always had strong end markets, and the US glass packaging industry is striving to increase the amount of recycled content in its bottles and jar production, which is primarily sourced domestically. The increased financial pressure that the industry faces due to recent international trade developments and the COVID-19 response have placed increased budget pressure on local governments. This is a pivotal point in time for the federal government to help preserve essential supply chains for sustainable packaging materials, and to help bolster the national recycling infrastructure.

Support for the RECYCLE & RECOVER Acts

GPI strongly supports legislation introduced in the Senate and House to address recyclable materials contamination, and to support the recycling supply chain and manufacturing end markets - **S. 2941**, the Recycling Enhancements to Collection and Yield through Consumer Learning and Education Act of 2020 (**RECYCLE**) **Act** (House companion **H.R. 5906)** and **H.R. 5115,** the Realizing the Economic Opportunities and Values of Expanding Recycling (**RECOVER**) **Act**.

The **RECYLCE Act** would provide grants to local governments, which would be used to educate residents on recycling programs and best practices. It would also develop a national recycling toolkit, to further assist consumers on recyclable and accepted materials for recycling programs, in an effort to reduce contamination.

On the House side, the **RECOVER Act** would provide matching grants to states and local governments, through the EPA, for specific public-private partnerships and investments to improve the collection, sorting and processing of recyclable materials. The EPA would be required to develop comprehensive reporting requirements, tied to standards, for local project recipients. Measuring results and setting standards would be key markers of the **RECOVER Act**. GPI supports the introduction of Senate companion legislation.

The **RECYCLE** and **RECOVER Acts** are complimentary bills. By addressing recycling contamination on both the front and back end of the recycling streams, increased revenue for recyclable commodities would be received, and more reasonable recycling program costs for local governments could be realized.

Both the **RECYCLE** and **RECOVER Acts** come at a critical time as recycling markets and their supply chains face historic economic pressures to improve the quality of recyclable materials, increase manufacturing efficiencies and reduce landfill disposal. We encourage all Committee members to consider co-sponsorship and support of both bills.

These federal legislative initiatives, tied in with state, local and private investments can work to improve single stream recycling collection programs, which handle the majority of American's curbside recyclables. Single stream recyclables are sorted at MRFs, sold to secondary processors and finally, manufacturing end markets. If the quality of materials coming out of the MRFs was higher, markets for these materials (both demand and cost) would improve. The quality and effectiveness of single stream systems are only as good as their collection and sorting systems—many of which are dated and inefficient.

GPI support efforts for investments and matching grants to assist MRFs in upgrading equipment and improving output quality. However, provision of these resources should be tied to measurable results and standards. These standards should meet manufacturing specifications for their end market destinations.

GPI supports investments that encourage communities to consider single stream alternatives, such as dual stream or alternative drop off collections that increase quality material. These alternatives are effective solutions in areas where waste haulers and MRFs have not upgraded equipment and facilities to meet the higher manufacturing specifications of the glass container, and other manufacturing industries.

Please contact me with any questions you may have, and to follow up.

Thank you,

Scott DeFife
President

ISRI is the voice of the recycling industry, promoting safe, economically sustainable and environmentally responsible recycling through networking, advocacy and education.

Rediscover Recycling™ It's Essential.

COMMENTS OF

THE INSTITUTE OF SCRAP RECYCLING INDUSTRIES (ISRI)

BEFORE THE SENATE ENVIRONMENT AND PUBLIC WORKS COMMITTEE

June 17, 2020

The Institute of Scrap Recycling Industries, Inc. (ISRI)[1] thanks the Senate Environment and Public Works Committee for holding its June 17th hearing on "Responding to Challenges in the U.S. Recycling System," and for accepting additional statements for inclusion in the Committee's hearing record. We are particularly grateful to Chairman Barrasso for his leadership on these issues, as well as to Senators Carper and Boozman for their leadership co-chairing the Senate Recycling Caucus.

ISRI represents the infrastructure through which the vast majority of recyclables generated in the United States flow for processing into clean, high quality, commodity grade product. This infrastructure includes companies that process, broker and industrially consume metals, paper, plastics, glass, textiles, rubber and electronics, whether sourced from commercial, residential, or industrial operations. It also includes those companies that manufacture and distribute the optical and infrared scanners, balers, shredders, conveyors and other machinery and transportation equipment that are used in all parts of the chain.

Given the complexity of the recycling system within the United States, there simply is no one single answer to the challenges facing recycling in the United States. However, there are a number of solutions that, taken together, can make a significant difference. It is with this in mind that ISRI offers its comments and suggestions, intended to help this Committee better understand Recycling as it exists within the United States today, the recent disruptions to the system and associated challenges that have resulted; as well as potential solutions.

Recycling Today in the United States

Recycling[2] is essential, representing $110 billion in economic activity and touching virtually every segment of our economy. More than 164,000 Americans are currently employed by the recycling industry, with jobs averaging $73,000 in wages and benefits annually. Worldwide, more than 800 million metric tons of recyclable materials are consumed each year by manufacturers. And just like coffee, crude oil, soy beans, and other commodities, the movement of recyclables is driven by the demand needs of consumers in the United States and around the

[1] ISRI is the Voice of the Recycling Industry™, with 1,300 member companies operating at more than 4,000 locations in the United States and across the globe. Our members present the entire recycling chain, including companies that process, broker, and consume metals, paper, plastics, glass, textiles, rubber, and electronics, whether sourced from commercial, residential, or industrial operations. Our membership also includes those companies that manufacture and distribute the optical and infrared scanners, balers, shredders, conveyors and other highly advanced and technical equipment that are used in all parts of the recycling chain.

[2] Recycling is defined as the series of activities during which obsolete, previously used, off-specification, surplus or incidentally produced materials are processed into specification-grade commodities and consumed as raw-material feedstock, in lieu of virgin materials, in the manufacturing of new products. The series of activities that make up recycling may include collection, processing, and/or brokering, and shall result in subsequent consumption by a materials manufacturer.

globe. The United States plays a major role in this global market, selling $20 billion worth of scrap to manufacturers in more than 150 different countries.

The recycling infrastructure in the United States touches almost every part of our domestic economy – from retail stores, office complexes, residential neighborhoods, and schools to factories, construction and demolition sites, and military installations. Thus, disruptions to recycling will also be visible throughout the economy and society.

The disruptions to recycling over the last several years have resulted from a number of fronts, including:

- Changes in global market demand triggered by China's imposition of import restrictions, imposed originally on lower grades of recyclables generated primarily from residential recycling operations;
- Manufacturers in the United States and worldwide demanding higher quality specification-grade materials from recycling;
- An increasing variety of products and packaging entering the recycling stream that are not recyclable;
- Mixed messaging regarding the viability and importance of recycling, undermining confidence in recycling; and
- Most recently, COVID-19 has added additional strains on manufacturing industries that both generate and purchase recyclable materials.

What all of these disruptors have in common is they undermine the two major elements needed for successful recycling: a consistent supply of quality material into the recycling stream and end market demand, as follows:

1. Successful recycling requires a **consistent supply of quality recyclables into the stream**. The vast majority of the recyclable material that is supplied into the recycling system does so without any problems, and it is transformed by recyclers into clean, high quality, commodity-grade product. This is especially true for commercial and industrial grades of scrap that enter the stream.

   However, the residential stream, which represents about 20% of supply, is where much of the disruption of the last several years has occurred in recycling as it is the lower grades of scrap that were initially targeted for import restrictions by China. And while the residential stream is subject to the same demand-driven end-market as commercial and industrial recycling, it is saddled with an ever changing and heterogeneous mix of materials on the supply side which flows into the stream whether there is a market for it or not. Therefore, as the demand dried up for the low grade scrap processed from the residential stream, the material still flowed into the stream with no end market to sell it into. And because of the visibility of the challenges being experienced in the residential recycling infrastructure, the effect reverberated throughout the system. This is where manufacturers and brand owners can play a very important role in reforming their product designs and material choices to improve the residential recycling system. In addition, consumer education will help reduce confusion at the bin and therefore reduce contamination rates.

   Once processed, recyclers sell their product according to specifications based on the quality and composition of the material. ISRI's Scrap Specifications[3] provide guidelines for the buying and selling of scrap and recyclable materials, and they are based on prevailing market conditions, including technology, consumer needs and product design. For residentially-sourced recyclables, achieving

[3] ISRI Scrap Specifications can be obtained at https://www.isri.org/recycling-commodities/scrap-specifications-circular.

"specification-grade" quality starts with all of us at home – the consumers that not only choose to purchase and place these recyclable products into the recycling bin but who also have the ability to ensure that the product is minimally contaminated. Responding to this need, ISRI recently published new "Inbound MRF Specifications" that provide guidance to communities on what they can do to ensure less contamination of recyclables, thereby increasing the opportunity for more recyclables to be recycled.

2. Successful recycling requires **market demand**. If there is no end market to utilize the recyclable materials that are being collected from homes, offices, retail stores and industrial locations, those materials will not be recycled and used again in manufacturing, regardless of the volume of material collected. In other words, a business without a customer has no business; and collection without market consumption is not recycling.

   Recyclable materials – whether called "scrap", "recyclable materials" or "secondary materials" – are valuable commodities that are sold and sought after in the global marketplace by industrial consumers – including steel mills, metal refiners, foundries, paper mills, plastic formulators, and others – for the manufacture of new consumer and industrial products. They are an integral part of the global manufacturing supply chain. The Bureau of International Recycling (BIR) estimates that more than 40% of manufacturers' raw material needs around the world are met through the recycling of obsolete, off-spec, and end-of-life products and materials.

Recycling is Not Broken

Another challenge we are facing in recycling is the false narrative that recycling is THE solution to the proliferation of plastics in our environment, which attempts to shift the focus on this environmental issue from the manufacture and consumption of plastics to end of life management through recycling. What follows from this narrative is that if the plastics are not recycled it is because the recycling system is broken. But the recycling system is not broken – it was never intended or designed to process materials that are neither technologically nor economically viable to recycle.

The proliferation of plastics in our world today is a product of over production and consumption, mismanagement at end of life and the failure to consider recycling at the initial product design stage. Recycling is only one part of the solution to the very complicated problem of plastics in our environment. It is time to delink these two issues.

Recycling During Covid-19: Recycling is Essential

During the initial stages of the COVID-19 health pandemic, the Department of Homeland Security (DHS) Cybersecurity and Infrastructure Security Agency (CISA) deemed manufacturing and its supply chain, including recycling, essential. The Federal Government – with most states following – quickly recognized that the supply of recyclable ferrous and nonferrous metals, paper, plastics, electronics, glass and rubber for the production of commodity-grade recycled materials needed in critical manufacturing is essential, enabling recycling facilities to continue operating.

Recyclers are a key component of the supply chain for critical goods needed in the fight against the pandemic, including for the manufacture of such items as hospital beds, PPE and tissue. DHS recognized that the manufacturing of materials and products is wholly dependent on manufacturers' ability to obtain the feedstock necessary to feed their operations. And they understood the dependence of U.S. manufacturing on scrap for meeting its raw material needs:

- The U.S. steel industry relies on ferrous scrap as its largest single raw material input. 70% of all U.S. produced steel and stainless steel is made from ferrous and stainless scrap supplied by recyclers. In fact, the modern U.S. steel industry has been built around the ability of scrap recyclers to process and deliver high-quality iron and steel scrap. The use of ferrous scrap reduces the steel industry's material and energy costs, thereby also keeping U.S. steel manufacturing globally competitive.
- More than 75% of U.S. paper mills depend upon recovered fiber from recycling operations for their daily production needs, and a significant number of paper mills in the United States rely on recovered fiber for 100% of their feedstock.
- Recyclers are responsible for supplying more than half of the feedstock to tissue mills throughout the United States, which are responsible for producing the toilet paper and tissues needed every day by citizens throughout the United States and which remain in limited supply in some regions.
- Aluminum producers in the United States have become increasingly dependent on recycled aluminum as their main raw material input due in part to the large energy and cost savings associated with consuming secondary aluminum scrap over primary. More than half of all aluminum consumption by manufacturers in the United States comes from scrap.
- Copper and copper alloy production in the United States is also heavily dependent on scrap as a raw material input, which requires scrap recyclers to continue operating. Copper's anti-microbial properties are a key element to reducing the spread of disease, and are widely used in hospitals and other settings to reduce transmission rates. Copper scrap provides approximately one-third of the supply of all copper, brass, and bronze produced in the United States.
- The increased demand for – and delivery of – food items are dependent on food packaging that in turn is produced using a variety of grades of recovered paper and plastics, which are made from recyclables collected and processed by the scrap recycling industry.

As offices and retail outlets closed in mid-March and many Americans stayed home, dramatic shifts occurred in sourcing and supply chains for recyclable materials. The stream of available recyclables shifted away from commercial enterprises, offices, schools, and the like towards household generation. As a result, shortages of certain secondary materials occurred, including high-quality office paper used by a number of paper mills for the production of certain paper grades at paper mills. At the same time, more cardboard packaging was shipped to residences where effective recycling was inconsistent or lacking. Without this essential supply, paper mills were forced to curtail production or seek virgin material inputs to make paper products we continued to require at home, such as bathroom tissue paper.

ISRI is grateful to the efforts of the U.S. EPA during this time, as the Agency recognized the need to bring more supply into the recycling stream. As a result, EPA produced several public service announcements (PSAs) to help make the public aware of the critical role our efforts at home are to successful recycling and to the manufacture of new products. The PSAs include guidelines for properly recycling the boxes and other packaging we are receiving at home. This example clearly demonstrates the need to protect and improve our nation's secondary materials supply chains by encouraging and educating the public about how to properly handle their recyclables so they may be returned to the manufacturing supply chain once again.

Manufacturing output has also contracted sharply during this period, with significant implications for both the supply (prime scrap) and demand for recyclables, as the majority of scrap processed in the United States is purchased by U.S. manufacturers. As a result, recyclers have been facing supply and demand pressures over the last several months. However, these pressures do appear to be easing somewhat as the economy is reopening. And as we enter a period of economic recovery, it is becoming very apparent that the continuous operations of the recycling industry were instrumental in the encouraging signs of increased activity in the U.S. manufacturing economy.

It should also be noted that while recycling operations were designated as essential by DHS, many recycling companies closed their public-facing retail operations due to health and safety concerns, reducing the supply of obsolete scrap grades from peddlers and other sources. Fortunately, those retail operations are starting to reopen again, which should help alleviate some scrap shortages. This comes just as manufacturers (*e.g.,* car manufacturers) are also restarting their operations, which should result in increased demand for scrap.

Proposed Menu of Policy Solutions to Strengthen U.S. Recycling

While there is no singular solution to the challenges we are facing in recycling, there are a number of solutions that, working together, can result in significant improvements to strengthen recycling. To that end, ISRI strongly recommends that the Committee consider the following priorities for legislative action:

1. **Design for Recycling®:** *Implemented through U.S. procurement guidelines and other purchasing and procurement requirements, ISRI supports policy tools that incentivize or require manufacturers to design their products for recycling in conjunction with including more recycled content. This initiative could be implemented through the U.S. government's procurement guidelines or possibly through other purchasing and procurement requirements, or possibly even through tax credits for those who take demonstrated steps to improve product design for purposes of increasing a product's recyclability.*

   The most important first step in the recycling process begins with the initial product design. Choosing the right materials and manufacturing processes at the design stage to ensure products are recyclable is an imperative to achieving recyclability. When recyclability is not carefully considered at the outset of product design, recycling will not occur regardless of cost or technological ingenuity. This is especially the case for the wide variety of consumer products and packaging that enter recycling through residential collections.

   More than 30 years ago, ISRI started the Design for Recycling® initiative to encourage manufacturers to consider the ultimate destiny of their products during the design-stage of a product's development. This concept continues to be more relevant today, as stakeholders throughout the recycling and manufacturing supply chains in the United States and around the globe are working hard to better manage material flows, incorporate sustainable practices and do their part for the green economy amidst an ever-changing supply and demand for recycled specification-grade commodities.

   Designing products that are designed with recyclability in mind:
   - Are easily recycled through current or newly designed recycling processes and procedures;
   - Are cost effective to recycle;
   - Are free of toxics and other materials that could impede the recycling process;
   - Maximize the use of recycled materials during manufacture and in the product itself; and
   - Help move us towards a true circular economy.

Furthermore, ISRI recently announced the start of a process to develop a recyclability protocol and certification system for paper-based packaging products entering into the recycling stream. We are working with partners inside and outside of our industry to take into consideration existing certifications and standards, the inventory of packaging that is recycled from the standpoint of materials and shape/size as well as regional variances in technology and capacity and other market data and information to develop a fully documented and transparent system for certification. Once in place, the recyclability protocol will assist packaging manufacturers in understanding what is and what is not recyclable, especially in the design stage, and we will expand the protocol to other products made from recyclable commodities.

We note and commend the growing demand for recycled content by manufacturers who are making commitments toward sustainable sourcing and choosing to incorporate more recycled content into their products. However, there is much more room for growth to help stimulate market demand.

2. **Provide funding for Education and Consumer Awareness around Recycling:** *ISRI supports addressing the education vacuum as a multi-prong and multi-stakeholder responsibility, such as through the numerous public-private partnerships that already are successfully raising the bar for consumer awareness. These efforts should be further encouraged and expanded by exploring new and effective means for connecting to consumers who are the primary source of the residential recycling stream. Accordingly, we support the bi-partisan "RECYCLE" Act introduced in both the U.S. Senate and the U.S. House of Representatives.*

   Consumer packaging is becoming increasingly complex as brand owners are under pressure to develop innovative designs that fulfill their sustainability goals. As these new packaging designs are released to the public, there is a need to ensure these materials can be collected, sorted and recycled properly. This requires education and consumer awareness. As such, the Committee should also consider the funding of EPA-led PSAs and related initiatives to raise consumer awareness.

3. **Encouraging Innovation and Investments in Recycling Activities:** *ISRI supports policies that will support broader collection and additional processing of recyclable materials through grants, loans and tax incentives for new equipment and innovation; business financial assistance programs and recycling-specific technical and financial assistance. However, such support is conditional upon a level playing field for public and private recyclers who have invested significant private capital and entrepreneurship.*

4. **Strengthening Domestic Recycling and Market Development through Government Procurement Policies and Investment in Projects that Mandate Recycled Content:** *ISRI fully supports initiatives and incentives that are designed to strengthen domestic residential recycling and markets utilizing the strength of the U.S. Government's purchasing power. We appreciate the renewed efforts by the U.S. EPA to revise the government's procurement guidelines that require recycled content in the products purchased by federal, state and local governments, and strongly encourage expansion of such mandates through legislation.*

   Additional incentives could include:

   - Commitments to use recycled materials in state and local transportation and infrastructure projects. ISRI strongly supports efforts to invest and improve in America's aging infrastructure, as the recycling industry – and manufacturing generally – needs a 21st-century transportation system to efficiently transport raw materials and feedstocks to manufacturers throughout the nation and the globe. Such needs include increased capacity and investment in all modes of transportation, covering rail, surface, and waterways. These investments in infrastructure development projects should provide specific

incentives for using products that utilize recycled and recyclable materials wherever economically and technologically possible;

- Tax credits, tax exemptions, loans, grants, and bonds for investment in recycling facilities. Recycling involves capital intensive operations that require significant investments in equipment, technology, and research and development to transport and process materials into high quality feedstocks. This has become even more apparent following the import restrictions from China;
- Dedicated recycling business development assistance;
- Minimum recycled content mandates tied to increased public education, collection and supply; and
- Policies that incentivize manufacturers to design their products for recycling, and to use greater amounts of recycled content in manufacturing. This point cannot be over-stated.

5. **Temporary Mechanisms for the Separate Collection and Processing of Difficult to Recycle Items:** *ISRI does not support product stewardship policies that disrupt the current recycling infrastructure by targeting, including, or disrupting the recycling of materials or products that are being successfully recycled and consumed in existing markets. Instead, to address facilitation of proper recycling of difficult to recycle items, ISRI supports consideration of policies that are temporary in nature to support markets for recycling of those items until the markets mature, and require manufacturers to:*
   - *Provide a separate collection mechanism for difficult to recycle items which could be accomplished through manufacturer-facilitated collection systems developed in cooperation with retailers or other entities, and/or;*
   - *Compensate municipalities/recyclers for costs associated with separate collection, transportation, and processing systems for difficult to recycle items.*

   ISRI recognizes there are certain materials and consumer products entering the residential recycling stream for which commodity markets do not currently exist, or the markets may be regional in nature and not be economically viable at the point of collection. There are also some packaging materials for which no technological process has been developed to process them. Furthermore, there are a number of recycling programs driven by government mandates or sustainability goals that are not supported solely by market values, and certain materials that were previously economical to recycle may no longer have viable end-markets due to major changes in global commodity markets. These programs and market conditions also cause items to become difficult to recycle.

6. **Support for Public-Private Partnerships That Promote Innovation in Recycling.** *The Committee's support of continued federal funding for U.S. government-led public-private partnerships focused on research and development of innovative technologies and implementation of Design for Recycling® principles would go a long way to help address the challenges facing recycling.*

   The Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E) supports a number of cutting-edge projects, including with ISRI members, to develop and commercialize advanced material-separation technologies unlocking value that would otherwise be unrealized. ISRI is also proud to be a member of the DOE's Institute for Reducing Embodied-energy and Decreasing Emissions (REMADE) in Materials Manufacturing, a five-year public-private partnership supported by federal matching funds to support industry-relevant projects that drive down the cost of technologies for reusing, recycling, and remanufacturing metals, fibers, polymers, and used electronics. These kinds of initiatives will provide new opportunities for the use of recyclable materials in manufacturing and also a greater focus on Design for Recycling ®, but they need continued financial support to survive.

Conclusion

ISRI and its members thank the Senate Environment and Public Works Committee for holding this important hearing on improving our nation's recycling programs, its recycling infrastructure and promoting markets for these materials. We sincerely hope that as America's Original Recyclers®, our observations and suggestions will help this Committee better understand that recycling is essential to manufacturing. This includes the fact that we have a collective responsibility during the various stages in the recycling system, that developing end-use markets is an imperative, and that product design is vital for recycling to succeed and deliver the vast environmental and economic benefits we all desire and expect.

It is imperative that as policymakers, industry and environmental representatives, and citizens, we work to ***rediscover*** the important aspects of recycling that help us protect the environment, conserve natural resources for future generations, save energy and put Americans to work in good paying jobs. ISRI and our member companies look forward to working with all stakeholders to find effective solutions to foster policies that encourage and improve the effectiveness of recycling.

Thank you for the opportunity to provide this statement for the record. We look forward to continuing to work with you and your staff on these and other important issues,
Sincerely,



Robin K. Wiener
President, ISRI



PLASTICS POLICY PLAYBOOK

Strategies for a Plastic-Free Ocean

Ocean Conservancy

TRASH FREE SEAS ALLIANCE



CONTENTS

Glossary of Key Terms 3
Foreword 7
Acknowledgements 10
Executive Summary 14
Chapter 1: Introduction 24
Chapter 2: Five Guiding Principles for Success 38
Chapter 3: Finance the Collection 52
Chapter 4: Reduce Problematic and Unnecessary Single-Use Plastics . . 86
Chapter 5: Design for Circularity 102
Chapter 6: Develop Recycling and Treatment Markets 114
Chapter 7: Roadmap and Call to Action 126
Appendix 134
References 155

GLOSSARY OF KEY TERMS

Acronym/Term	Definition
APEC	Asia-Pacific Economic Cooperation
CAPEX	Capital expenditure
Collection	Collection is defined as the act of on-ground collection and transport of waste to a transfer station or material recovery facility (as applicable) by local government or commercial waste collection service provider
CSR	Corporate social responsibility
DFI	Development finance institution
DFID	The Department for International Development, a United Kingdom government department responsible for administering overseas aid
Eco-modulation	Approach that accounts for an adjustment of charges, taxes or levies on plastic products based on design criteria (e.g., recyclability, reusability or recycled content)
EPS	Expanded polystyrene
Extended producer responsibility (EPR)	Policy approach whereby producers (e.g., raw material manufacturers, convertors, packers or fillers, and brands) are given a significant financial and/or physical responsibility for the end-of-life management of post-consumer products
EU	European Union
FEMSA	Fomento Económico Mexicano, S.A.B. de C.V., the largest independent bottling franchisee for Coca-Cola
Financing gap	Defined as the net deficit between revenues and cost across the plastic value chain
Focus countries	The five countries – China, Indonesia, the Philippines, Thailand and Vietnam – identified in *Stemming the Tide* (2015) to be the largest contributors to ocean plastic and on which this research is focused
GDP	Gross Domestic Product
HDPE	High-density polyethylene, a type of plastic/polymer

Acronym/Term	Definition
Improve economics of collection	Includes increasing the provision of funds to cover collection cost, reducing the supply at collection, improving the quality of input and increasing demand for post-consumer waste from recycling and treatment stages
Independent waste collectors (or informal waste collectors)	Defined in this report as a person or group of people not employed by local government or private sector waste management companies that are engaged in the collection and recovery of reusable or recyclable waste, either directly from the source where no formal collection systems exist, hauler trucks, or landfills and dumpsites, and offered for sale to recyclers directly or through intermediaries to earn a livelihood (Adopted from Solid Waste Management Rules 2016, India)
Informal sector inclusion	Refers to the economic empowerment, social inclusion and livelihood improvement for informal and independent waste collectors
Low-value plastic (LVP)	Plastic waste materials that do not have value in local recycling markets (e.g., grocery bags, thin films, composite plastics). The report considers recyclables made from PET, HDPE and PP as high-value plastics
LDPE	Low density polyethylene, a type of plastic/polymer
Material recovery facility (MRF)	Facility where recyclables are separated from the mixed solid waste stream and then sold to recyclers as feedstock (also referred to as "dirty MRF")
MoU	Memorandum of understanding
NGO	Non-governmental organization
Ocean plastic/ marine plastic	Term used to describe plastic that is found in the ocean/marine environment
OPEX	Operational expenditure
Packaging	Any product to be used for the containment, protection, handling, delivery, storage, transport and presentation of goods. This report refers to plastic packaging with references to industry variances (e.g., food, medical)
PCR	Post-consumer recycled
PET	Polyethylene terephthalate, a type of plastic/polymer

Acronym/Term	Definition
PP	Polypropylene, a type of plastic/polymer
PPP	Public-private partnerships
Private measure	Interventions which are actionable largely by the private sector with minimal government involvement
Producer responsibility organization (PRO)	A for-profit or nonprofit organization authorized or financed collectively or individually by producers to take the responsibility for collecting and managing the end-of-life (i.e., reuse, recycling, recovery and disposal) of waste on its behalf
Problematic and unnecessary single-use plastics (SUP)	The leakage-prone non-recyclable plastic products and packaging manufactured for single-use, primarily falling in the following categories: disposable plastic cutlery, plastic straws, plastic bags, cotton buds and plastic stems, plastic stirrers, expanded polystyrene packaging, PVC packaging, oxo-biodegradables and primary microplastics (adopted from the EU and WRAP definition)
PRN	Packaging recovery note
PS	Polystyrene, a type of plastic/polymer
Public measure	Interventions which are actionable largely through government led policy enforcement
PVC	Polyvinyl Chloride, a type of plastic/polymer
PWM	Plastic waste management
RDF	Refuse-derived fuel
Recycling	Recovery operation by which waste materials are reprocessed into products, materials or substances, either for the original or other purposes, excluding energy recovery and reprocessing to be used as fuels (European Waste Framework Directive definition)
Recyclable	A component is considered recyclable if its post-consumer collection, sorting and recycling is proven to work in practice and at scale (Ellen MacArthur Foundation definition)
Repurposing plastic	A specific part of recycling which involves conversion using melting and binding of post-consumer plastic into durable furniture and building materials, such as bricks and roofing sheets

Acronym/Term	Definition
Ring-fence	Refers to ensuring that a certain sum of money is used only for the specified purpose
rPET	Recycled polyethylene terephthalate
RVM	Reverse vending machine
R&D	Research and development
SME	Small and medium enterprise
SUP	Single-use plastics – see also problematic and unnecessary single-use plastics
SWM	Solid waste management
TPD	Tons per day
TSR	Thermal substitution rate
US $	United States Dollar
Waste value chain	The full range of waste activities, including collection, sorting, recycling and disposal

FOREWORD

The ocean plastic crisis has been decades in the making and is poised to get much worse if dramatic changes are not made. Governments, businesses and the environmental community have been noticing and taking action for decades, but much more is needed to end ocean plastic.

Scientists have been documenting plastic in the ocean since at least the 1970s. In 1986, Ocean Conservancy launched the International Coastal Cleanup, which has since mobilized more than 15 million volunteers to remove some 315 million pounds of trash from beaches and waterways around the world. Roughly a decade later, oceanographer and sailor Captain Charles Moore published his first report on what would eventually be known as the Great Pacific Garbage Patch. In 2002, the Government of Bangladesh became the first country to ban single-use plastic bags after the items were found to clog drainage systems during floods, and similar policies followed suit across the globe. And in 2012, Ocean Conservancy gathered a cohort of companies and NGOs to create the Trash Free Seas Alliance® to better understand and address the growing threat of plastic pollution in our ocean.

What had been missing for a long time was a shared understanding of the "how" and "why" of ocean plastic: How much is there? How is it getting into the ocean? And why? To answer this question, Ocean Conservancy convened leading scientists in the field to spur ground-breaking research that has since defined the global conversation on the issue.

In 2015 Dr. Jenna Jambeck and her colleagues published a groundbreaking paper in the journal *Science* estimating that some 8 million metric tons of plastic enters the ocean from land each year—the equivalent to a garbage truck full of plastic dumping into the ocean every minute. It was a shocking figure; but as importantly, the study began illuminating the "how" and "why" by showing that a majority of plastic entering the ocean was coming from parts

of the world where plastic waste simply had nowhere else to go—either it wasn't being collected or, if it was collected, it wasn't being adequately contained.

Shortly following the *Science* paper, Ocean Conservancy released *Stemming the Tide*, a report examining all the ways governments in these key geographies could prevent plastic from leaking into the ocean, and found that improving waste collection was an important first step to reduce plastic leakage, as well as provide a host of other important benefits. In 2017, we published *The Next Wave*, in which we homed in on overcoming barriers to investment in waste management (including collection) and put forth a series of policy and practice recommendations that have since been adopted by the 21 member economies of the Asia-Pacific Economic Cooperation (APEC) forum.

As we learn more about the ocean plastic crisis, we have been thrilled to see a growing demand and appetite for change, and the possibility of achieving a fully circular economy coming into sight. Governments at all levels all around the world are weighing policy options to address ocean plastic—from taxes to incentives and myriad options in between. Businesses are experimenting with new ways of meeting consumers' changing demands for fewer single-use plastic items while reducing impacts on the environment. And with longstanding recycling markets shocked by major demand shifts in recent years, addressing the problem of plastic waste has never been more urgent. For the first time, the challenges facing the recycling sector are reaching mainstream audiences.

As exciting as this may be, we know it can also be overwhelming. For policymakers and the private sector alike, it can be hard to know what to do next, particularly when you consider geographic differences. What works in some contexts may not work in others.

That's why we convened the talented team at Accenture and a diverse set of knowledgeable experts from the Trash Free Seas Alliance and our partner network to release *Plastics Policy Playbook: Strategies for a Plastic-Free Ocean*. The report identifies four key themes to improve the economics of collection across the value chain:

1) Financing the collection via Extended Producer Responsibility measures
2) Reducing the production and use of problematic single-use plastics
3) Designing for circularity, and
4) Increasing the demand for post-consumer plastics.

It is our hope that this document, rooted in data and research, will serve as a policy playbook for all those looking to be part of a systemic solution to ocean plastic. While this report looks at those target geographies first identified by Dr. Jenna Jambeck and her team as most vulnerable to ocean plastic leakage, we believe it can be a useful primer for other regions, as we are all connected by one ocean.

Certainly, the body of science on ocean plastic is growing, and it is important to remain open to new developments as they become available. This playbook shows there are interventions that can work now and allows decision-makers to make informed choices.



Janis Searles Jones
CEO, Ocean Conservancy

ACKNOWLEDGEMENTS

Ocean Conservancy is a non-profit environmental advocacy group, based in Washington, D.C., United States. The organization works towards science-based solutions to protect the ocean and the wildlife and communities that depend on it. From the Arctic to the Gulf of Mexico, from ocean acidification to ocean plastic, Ocean Conservancy brings people, science and policy together to champion innovative solutions to today's greatest global challenges. Ocean Conservancy founded the Trash Free Seas Alliance in 2012, which unites leaders from industry, conservation and academia to create pragmatic, real-world solutions to combat the problem of marine debris. For more information, visit www.oceanconservancy.org/our-work/trash-free-seas-alliance.

Ocean Conservancy commissioned **Accenture**, a leading global professional services company, providing a broad range of services and solutions in strategy, consulting, digital, technology and operations, to conduct a study to explore public-private policy measures to improve collection and end ocean plastic. This builds on the Trash Free Seas Alliance's previous reports *Stemming the Tide* (www.oceanconservancy.org/trash-free-seas/take-deep-dive/stemming-the-tide) and *The Next Wave* (www.oceanconservancy.org/wp-content/uploads/2017/05/the-next-wave.pdf). This report has been produced with guidance and support from a steering committee of committed partners from the Trash Free Seas Alliance. Ocean Conservancy is appreciative of their support during the drafting of this report, alongside a wide range of activities that demonstrate their commitment to finding innovative solutions to improve collection and help achieve the ambition of zero plastic in the ocean by 2030. The content of this report was also informed by the many technical advisors and organizations we consulted during its development. Their participation does not necessarily imply their full endorsement of the report's contents or its conclusion. We are greatly thankful for their contributions.

Accenture and Ocean Conservancy would like to recognize the valuable insights of the contributors to this report, as given below.

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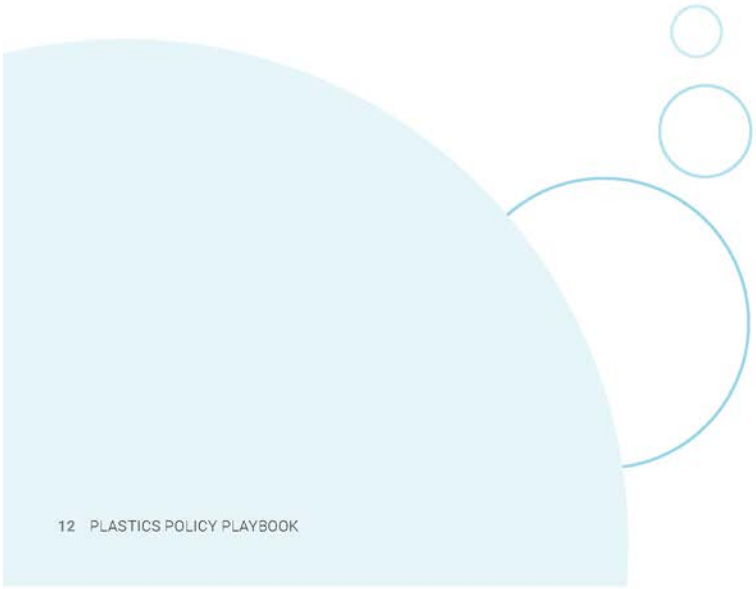
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PLASTICS POLICY PLAYBOOK 13

EXECUTIVE SUMMARY

We must act now on ocean plastics

Ocean plastic is an urgent, global challenge. If we fail to act, over 250 million tons of plastic will be circulating our ocean by 2025,[1] with widespread environmental, social and economic implications.

The quantity of plastic in the ocean is a symptom of a larger issue that is tied to our linear economic system to take, make and waste. We produce more than 350 million tons of plastic each year, and while many of these plastics offer meaningful benefits to society, an estimated 40% of plastic is used just once and discarded.[2] Without action, the global production of plastic is expected to double in the next ten years.[3] This level of production and consumption has resulted in solid waste management systems that are unable to effectively collect, recycle and dispose of the growing quantity of plastic. Its presence in the ocean is the result.

The legacy of ocean plastic will likely exist for hundreds, if not thousands, of years, and its long-term impact on our planet remains uncertain. What is certain, however, is that the more plastic that ends up in the ocean, the greater the negative impacts will be. The time to act is now.



A policy playbook to achieve zero plastic in the ocean by 2030

This playbook builds on insights from previous reports by Ocean Conservancy's Trash Free Seas Alliance[4] to develop an action-led response focused on the most systemic challenges and the most critical countries.

Stemming the Tide (2015) identified that 80% of the plastic leaking into the ocean was never collected as part of a formal waste management system[5] and 60% currently enters the ocean from five focus countries in Asia—China, Indonesia, the Philippines, Thailand and Vietnam.[6] *The Next Wave* (2017) identified that collection in these focus countries is largely underfunded and a net cost activity for most waste streams. Poor collection infrastructure, coupled with a limited budget for solid waste management and high quantities of materials with low residual economic value, results in a net deficit—a financing gap—between revenues generated and costs incurred across the plastic value chain.[6]

To achieve the **Ocean Conservancy goal of zero plastic in the ocean by 2030**, the economics of collection must improve. While there has been clear progress with widespread policy and private sector commitments to reduce ocean plastic, more effort is needed.

This playbook provides a holistic framework of the most promising public and private sector measures across the value chain to improve the economics of collection, including a set of key principles for success, as well as a roadmap to demonstrate a potential pathway that countries can follow. It targets national government, local government, corporates and non-governmental organizations (NGOs). While the research was conducted on the five focus countries, the outputs are relevant globally where similar waste management challenges exist or will likely exist because of continued economic growth, namely Africa and Latin America.

In practice, this playbook can:

- **Educate key stakeholders** on the menu of options available to improve the economics of collection and reduce ocean plastic
- **Align national or local governments on viable combinations of measures** based on a specific country context
- **Inform evidence-based policy**, sharing the trade-offs and enabling conditions to encourage proactive steps
- **Enable stakeholders to prepare for regulatory landscape** shifts
- **Support the progress of national and local roadmaps,** helping ensure key measures are included and that the principles for success are integrated

A framework of measures across the value chain can improve the economics of collection

This framework of public-private measures[1] is divided into four themes to improve the economics of collection:

I. Finance the collection

Measures that increase the provision of funding to improve waste collection

Extended Producer Responsibility (EPR), implemented using packaging material fees, is the biggest opportunity to improve collection funding. An eco-modulated EPR fee can also incentivize and accelerate the transition away from non-recyclable materials. Financial modeling shows that an EPR fee has the highest potential—up to 75% or more—in closing the value chain financing gap.

[1] Measures focused on collection can apply to all solid waste, of which plastic is a component. Other measures - notably those related to reducing the supply, improving the quality and increasing the demand of post-consumer plastic - are discussed in a context specific to plastics given the focus of this playbook

II. Reduce problematic and unnecessary single-use plastics

Measures that reduce the supply of plastic and reduce the quantity of plastic waste produced by shifting away from the production and use of problematic single-use plastics (SUPs)

Effectively enforced bans on defined problematic and unnecessary single-use plastics will be part of the solution across the focus countries. They can help to reduce the supply of these plastics to the waste management system as well as reduce their per capita consumption in the long-term.

III. Design for circularity

Measures that improve the quality of plastic in the waste stream and reduce dependence on virgin materials by adopting eco-design principles to improve reusability, recyclability and the use of recycled content

Eco-design standards can address challenges around non-recyclable or difficult to recycle plastics. National level policy, combined with private sector commitments, can standardize inputs, improve the quality of plastic entering the recycling stream and drive collection. Designing to reintegrate recycled content in plastic applications has private sector momentum that can be supported by policy.

IV. Develop recycling and treatment markets

Measures that increase the demand for post-consumer plastics, including recycling and sustainable solutions for non-recyclable and non-recoverable waste

Incentives to scale recycling infrastructure, with an initial focus on highly recycled plastics, can complement collection of post-consumer recyclable plastic. Coupled with the development of flexible end-market solutions for non-recyclable plastics, this can increase collection of such plastics and prevent resource loss.

Five guiding principles for success

Five guiding principles must be in place for the measures discussed in this playbook to have a positive impact in reducing ocean plastic:

1. **Combine measures across the value chain:** Real value lies in combining measures along the value chain, by both the public and private sectors, in new and innovative ways.
2. **Engage and invest in the informal sector:** Measures must support the human rights and livelihoods of those on the front line of collection efforts. Dignified employment with improved working conditions and leveraging the expertise of independent waste collectors can drive improvements in collection quantity and efficiency.
3. **Drive consumer awareness and behavior change:** Consumer buy-in is a critical enabler of a successful plastic waste management framework, and focus countries need targeted awareness campaigns to engage key audiences and spark behavioral change.

4. **Inspire political will:** Leaders at the national and local levels should be motivated and empowered to support solutions to reduce ocean plastic waste.

5. **Improve enforcement at a national and local level:** Measures are only as good as the ability to enforce them. Strong national policy requires a clear direction and rule of law. Policy, however, has to be enforced at the local level, which requires improved capacity for action.

A comprehensive roadmap can help achieve zero-plastic flow to the ocean by 2030

There is no single pathway to stemming the flow of plastics into the ocean. Countries must adopt a tailored approach at both the national and local level. The roadmap in this playbook (Figure 1) presents feasible combinations of measures across the four themes that can prevent plastics entering the ocean, represented across a timeline. However, action on all fronts must start now, given some measures will take longer than others to be impactful.

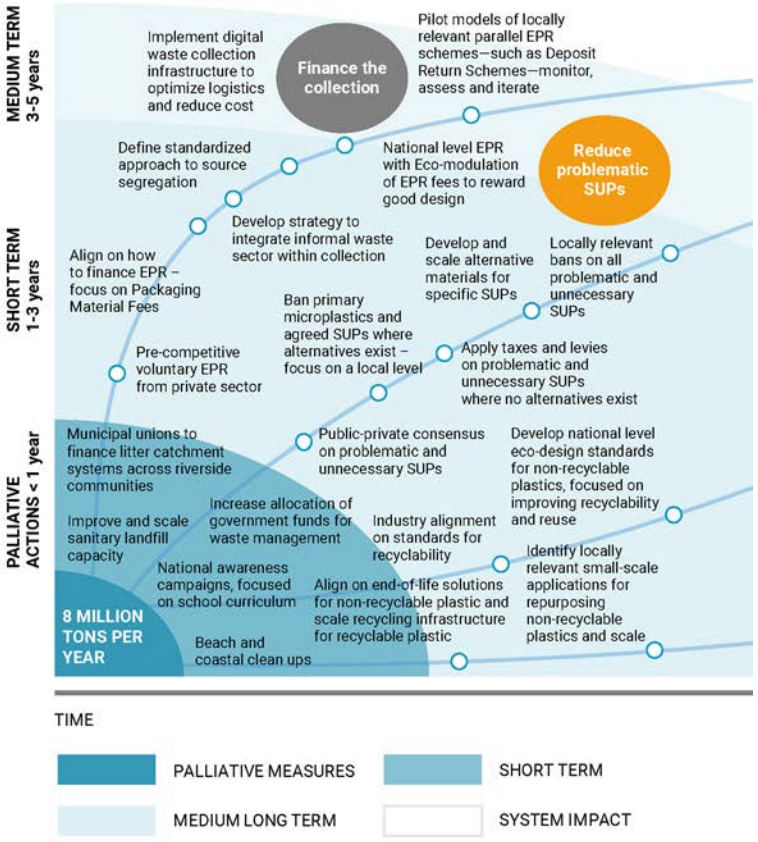
Combining measures can reduce the financing collection gap

With the use of financial modeling, this research found a net financing gap for collection of US $28-$40 per ton to manage plastic waste across the value chain,[ii] resulting in an estimated financing gap of up to US $3 billion per year across focus countries[iii] (see Appendix for details). The model demonstrated that combinations of high potential measures can, to a greater or lesser extent, have an impact on reducing this financing gap (Figure 2).

[ii] Outputs of the model align with other efforts to quantify the financing gap. Please see Appendix for further details

[iii] Calculated based on approximate figure of 77 million tons of plastic waste generated per year across the five focus countries

Figure 1: Roadmap for success across four key themes



SYSTEM IMPACT

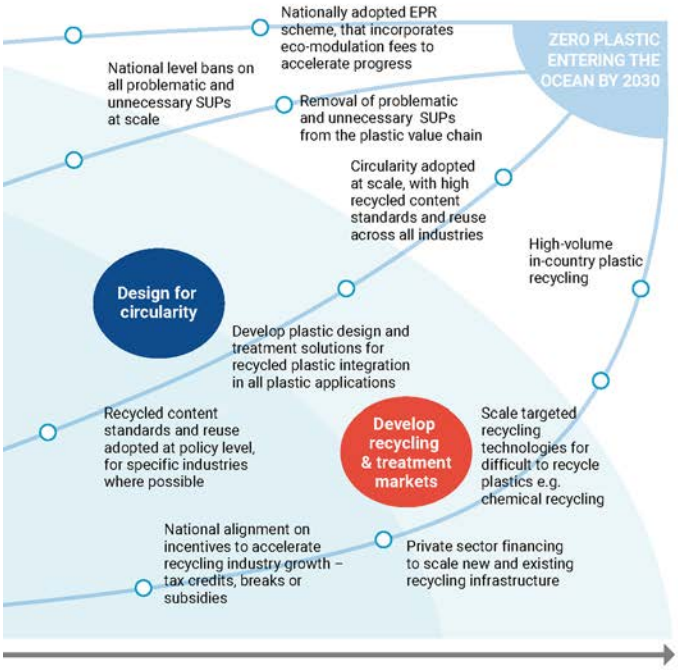
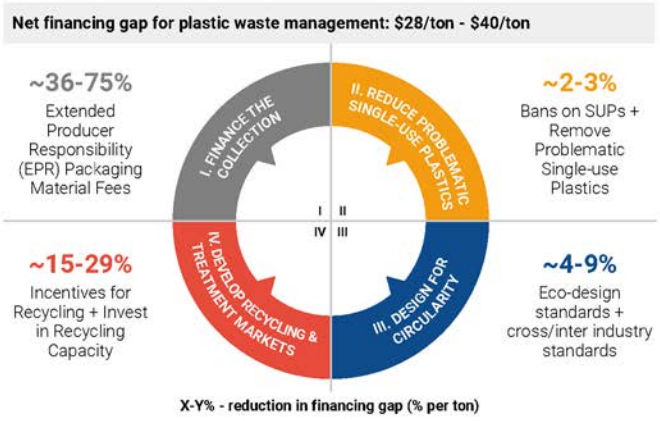


Figure 2: Analysis of changes in net cost/profit of waste value chain activities for plastic waste management[iv]



- Financing gap is defined as the net deficit of revenues and cost combined for each stage of the plastic value chain
- Analysis conducted specifically for the five focus countries; reduction in financing gap calculated by taking $40/ton as baseline
- Financing gap numbers are not additive due to overlapping assumptions

A focus on measures that finance collection has the greatest potential to reduce the financing gap. EPR, implemented through Packaging Material Fees, can have the highest potential in reducing this gap by up to 75% or more. The effectiveness of EPR in reducing the financing gap will depend on the recycling and recovery rates, the fees charged and the appropriate collection and ring-fencing of revenues for specific collection initiatives.

At the same time, combinations of measures across the value chain can improve the economics of collection. Upstream measures that reduce the supply of plastics, such as bans on SUPs, can improve the collection efficiency by reducing the contamination of post-consumer waste streams from problematic and unnecessary single-use plastics. Eco-design standards may potentially improve the quality of waste streams by increasing the amount of recyclable post-consumer plastic

[iv] The financial modelling conducted for this report was designed to focus on the costs and revenues of plastic waste management. This was based on certain considerations based on this research. (Please see appendix for further details.)

waste generated at the collection stage. Downstream measures, focused on scaling recycling capacity for recyclable plastics, and innovative new recycling and treatment solutions for plastics that are not currently recyclable, can support collection and increase the inherent value of plastics for collection by creating additional revenue streams from recycling.

Conclusion

Achieving zero plastic entering the ocean by 2030 requires the adoption of a framework of measures that increase the provision of financing for collection, reduce the supply of problematic and unnecessary plastics, and improve the quality and increase the demand for high-value, post-consumer plastics. To ensure success, these measures should be incorporated alongside the five principles and should be part of a systemic approach that embeds circular economy principles to maximize resource efficiency, reduce waste and drive end-to-end value.

This playbook provides a menu of options for key stakeholders to consider and adopt, depending on their specific country context. The roadmap presents a pragmatic guide for countries seeking to reduce plastic waste leakage and improve waste collection by adopting a complementary set of actions across the value chain. While this outlines a framework for success, there is no one pathway to reach zero plastic in the ocean. It requires a combination of measures that will vary at the national and local level.

The report's findings are based on the conditions we see today, in which the majority of plastic leaks into the ocean from uncollected waste. It is important to recognize that disruptive trends, new business models and technological advancements may mean that this situation changes in the future. As a result, solving the systemic global challenge of ocean plastic will require a flexible and adaptable approach that quickly leverages innovation and new technology. At the same time, improvements in collection must align with improvements in disposal and recycling infrastructure to ensure that solving one issue does not create another and that higher quantities of collected plastic do not lead to plastic finding new ways to enter the ocean.

The ultimate goal is to transition to a more efficient and less wasteful circular system. And the time for action is now.



COMPANIES ARE WASTING TIME WITH INADEQUATE SOLUTIONS TO THE PLASTICS CRISIS

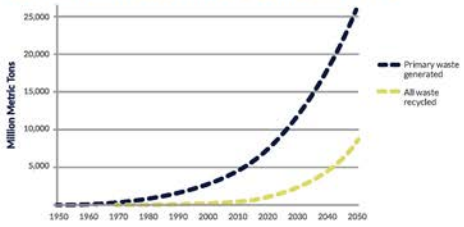
The plastics crisis continues to grow, with increasing amounts of plastic waste entering our oceans and limited capacity to keep pace managing it. To stop this flow of plastic pollution, we must reduce the amount of plastic produced at the source.

Companies must reduce the amount of single-use plastic they are putting into the market and provide consumers with plastic-free choices. Instead, they have offered inadequate solutions that give them cover to say they are helping. These will ultimately fail at protecting our oceans.

RECYCLING

While recycling is often presented as a solution to plastic pollution, it is not enough to solve the plastics crisis.

Recycling Does Not Keep Pace With Plastic Waste



Source: Adapted from Geyer et al. 2017

To learn more, visit *usa.oceana.org/plastics*

OCEANA Protecting the World's Oceans

- As of 2015, approximately 8.3 billion metric tons of plastic had been produced, of which 6.3 billion metric tons became plastic waste.
- Of all the plastic waste generated during this time, only around 9% was recycled — 12% was incinerated and 79% accumulated in landfills, on the ground or in the ocean.

THE WASTE TRADE

Wealthier nations with more robust waste-management infrastructures are sending plastic waste to developing countries with less-established systems.

- China has imported a cumulative 45% of all plastic waste since 1992. However, in 2018, China permanently banned the import of nonindustrial plastic waste.
- China's waste-import ban has resulted in plastic waste backing up or being sent straight to landfills. Some recyclables are still being exported to other countries with less-established waste infrastructures.

INCINERATION

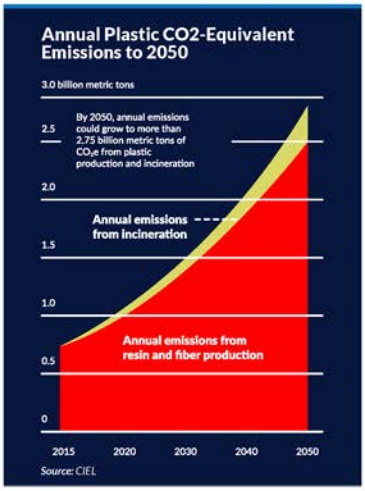
Burning plastic releases toxic emissions — including known cancer-causing agents like dioxins and furans — that contaminate our air, soil and water, and threaten the health of people living near the incinerators.

- "Waste-to-energy" plants, or incinerators with energy recovery, are often misrepresented as a source of renewable energy, but this is far from the truth. Burning municipal waste — such as plastic, paper and food waste — is an extremely inefficient means of generating energy that distracts from investing in real renewable and sustainable solutions.
- Incinerators release higher levels of greenhouse gas emissions per unit of energy produced than coal-, natural gas- and oil-fired power plants.
- Incinerators can emit up to 14 times more mercury than coal-fired power plants per unit of energy produced, according to the New York Department of Conservation.
- The limitations of incineration make it clear that we need to move toward a zero-waste system that involves waste reduction, composting, recycling, reuse and alteration in consumption habits and industrial redesign.

BIOPLASTICS

The term "bioplastics" is a broad term to describe bio-based and biodegradable plastics. Bio-based plastics can be made fully from renewable biomass — such as sugarcane and corn feedstock — or from a combination of renewable biomass and petroleum sources. One example of a bio-based plastic is bio-PET.

Biopolymers — the "truly biodegradable plastics" — are made from natural substances that are chemically modified to make the material more durable, yet they're still designed to break down into natural elements with the help of microorganisms. The most commonly produced biopolymers are polylactic acid (PLA), which is made from plants, and polyhydroxyalkanoate (PHA), which is produced by bacteria. While these materials have some advantages, they require industrial composting facilities to break down.



- "Industrially compostable" materials require industrial composting facilities. Without such facilities, compostable plastics end up in landfills, incinerators or the environment like all other plastic waste.
- There are many types of bioplastics, which can lead to confusion in the disposal process.
- Many bioplastics are only partly made from renewable feedstock and still rely on fossil fuels for production.
- The biopolymers that are meant to be composted are often disposed of improperly or end up in recycling facilities, where they contaminate the recycled product and reduce its value, making recycling even less effective.



COMPANIES NEED TO MOVE TOWARD REUSABLE, REFILLABLE AND ZERO-WASTE SYSTEMS

Recycling is often presented as a solution to our plastics crisis, but it falls short. Worldwide, only 9% of all the plastic waste ever produced has been recycled, and even with dramatic expansion, projected recycling rates are not expected to keep up with the increasing amount of plastic production.

Many innovations across multiple economic sectors will be necessary to solve the plastics problem, but one promising development is that companies are moving away from single-use plastic use and instead investing in reusable, refillable and zero-waste alternatives.

Already, many companies are trying new business models to change how we consume. Below are examples of early adopters of some of these solutions.

REUSABLE DELIVERY SYSTEMS

Reusable packaging presents a huge opportunity to reduce delivery waste at a time when online shopping is increasing.

- The Wally Shop — based in Brooklyn, New York — uses bike couriers to deliver groceries to customers in such reusable packaging as organic cotton mesh bags, resealable glass jars and totes. The Wally Shop charges a fee per piece of reusable packaging provided. The price of this deposit is deducted from the customer's next delivery, at which point old packaging is taken back to be cleaned and reused.
- Liviri plans to provide companies with reusable transport packaging for deliveries of meal kits and direct-to-consumer perishables. After delivery, the customer uses an included shipping label to return the container. The "Liviri Fresh" container not only reduces waste and lessens the recycling burden on consumers, but it also provides better insulation for perishable foods.
- RePack has created a reusable system for e-commerce packaging. On supported e-commerce sites, a customer can select to receive RePack's packaging. The packaging can be returned through the mail for free. Users are rewarded with vouchers for their next purchase to both incentivize the return of the packaging and benefit participating stores by prompting further sales. RePack found that their packaging system reduces waste by 96% when compared with cardboard.

REUSABLE PRODUCT CONTAINERS

In addition to innovative delivery systems, other companies are creating reusable product containers.

- Loop is delivering packaged consumer goods, including food, in reusable containers to customers

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for a deposit. The company offers products from dozens of brands — detergent, shampoo, mouthwash and even groceries like ice cream, peanut butter and pasta — in steel, glass and durable plastic reusable containers. The products arrive in a Loop Tote, and used containers are placed back in the tote and left on the doorstep for pickup. They are then cleaned, refilled and shipped out again. While Loop is currently only available in select ZIP codes, it is expected to expand across the U.S., U.K., Canada, Germany and Japan.

REUSABLE TAKEOUT CONTAINERS AND UTENSILS

New business models to reduce waste from to-go cups and takeout containers are also spreading. Most of these businesses operate with a subscription or deposit-based system.

- GO Box in Portland, Oregon, has customers download a mobile app and sign up for an annual or monthly subscription. Customers can check out reusable containers from participating food carts and restaurants. They can then return these containers to drop sites, from which they will be collected, cleaned and used again.
- reCIRCLE, in Switzerland, has customers pay for reusable to-go cups and containers when they order food to go. These items can be returned to any reCIRCLE restaurant partner for a full refund, at which point they'll be washed and provided to the next customer. Customers can also choose to keep the containers or take them home and reuse them before returning. The reCIRCLE system already has more than 1,000 partner restaurants across the country.
- In the U.S., OZZI partners with college and university campus dining centers, sports and entertainment venues, food courts, restaurants, hotels, supermarkets and other businesses to provide reusable food containers, cups and utensils. When customers take a clean container, they give the cashier a token or card. When the customer returns the container to an OZZI machine, they receive their token back or card credit. Already, OZZI has diverted 5 million containers from landfills, roadsides and waterways.

PRODUCT-REFILL STATIONS

Product-refill stations are an easy way to reduce waste as well — they allow customers to continue to reuse the same containers, simply refilling as they need.

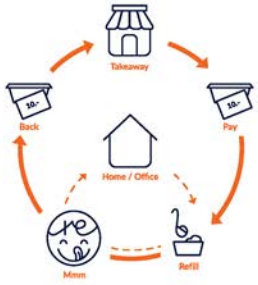
- Ecopod refill stations in Florida supply eco-friendly laundry detergent, fabric softener, liquid dish soap, dishwasher gel and all-purpose cleaner. Customers bring their empty Ecopod containers to the refill kiosks and select what they would like dispensed. Ecopod places refill kiosks in residential and retail properties that want to join the program.
- Common Good refill stations in New York allow customers to refill hand soap, dish soap, all-purpose cleaner and laundry detergent. Customers can refill plastic or glass bottles, and some stores allow customers to bring any container they want.

DITCHING WATER TO DITCH PLASTIC

Companies are also developing products that remove the water from items like shampoos, conditioners, moisturizers, body washes, mouthwash, toothpaste and even household cleaning materials. These products often consist primarily of water — for example, most bottled shampoos are 80% water, and some can be up to 95% water. With less water, the concentrated versions of these products do not require any plastic packaging.

- Lush makes shampoo and conditioner bars. The company claims that its concentrated shampoo bars can outlast two or three bottles of liquid shampoo.

reCIRCLE Model



- Bite makes toothpaste tablets that come in refillable and recyclable glass jars filled with a four months' supply. Users bite down on the tablet and start brushing.
- Ethique offers more than 40 solid "beauty bars" for everything from shampoos and conditioners to moisturizers, face scrubs, hair masks, self-tanners and body washes. The company says its conditioner bar is equal to five bottles of liquid conditioner and usually lasts six to eight months. Ethique claims to have prevented the disposal of over 3 million plastic bottles.
- Blueland produces cleaning products in the form of small tablets — buyers add water at home. Each tablet makes 20 ounces of cleaner. The company provides three spray bottles, and the customer can order tablet refills as needed.

Companies like these have provided a jumping-off point for the world's necessary switch to a zero-waste economy, creating innovative business models that prove we can move away from throwaway living. A "refill and reuse" economy is in our sights. As more corporations follow the lead of plastic-free pioneers by transitioning to new ways of packaging products, we'll finally be on the path to safeguarding this planet for future generations.



GOVERNMENTS PLAY A CRITICAL ROLE IN REDUCING PLASTIC POLLUTION

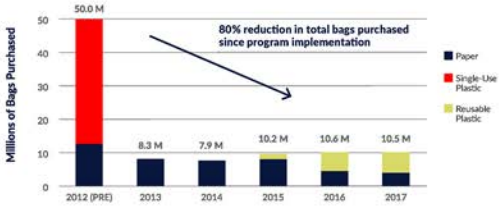
Policies governing the use of plastics are the most effective way to address the problem, and they are becoming more common from the municipal to the national level. Many counties, states and cities are banning or otherwise regulating the use of plastic.

These policies often focus on the most common waste items found in worldwide beach cleanups: utensils, food wrappers, plastic beverage bottles, plastic bottle caps, plastic grocery bags, other plastic bags, straws/stirrers, plastic containers, plastic lids and foam takeout containers. Since all of these items are used once and then thrown away, a logical starting point is to target single-use plastic items.

EXAMPLES OF EFFECTIVE POLICY SOLUTIONS

Policies like bans, taxes, deposit return systems and extended producer responsibility can be effective in encouraging single-use plastic reduction. Here are some examples of diverse approaches:

Bag Purchasing Trends in Alameda County

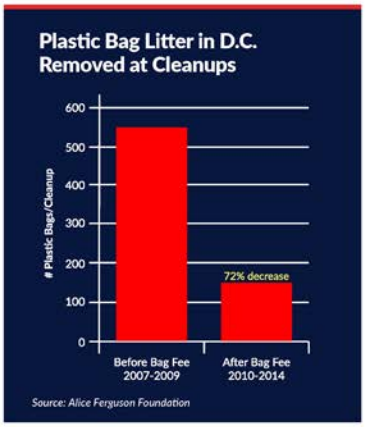


Source: *Alameda County Waste Management Authority*

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- **Alameda County, California,** passed a plastic bag ban and paper bag fee that led to an 80% decline in the use of single-use paper and plastic bags, a 200% increase in the number of shoppers bringing reusable bags or not using a bag at all, and a 44% decrease in plastic bags in county storm drains.



- **Washington, D.C.,** passed a 5-cent plastic and paper bag fee that resulted in more than a 60% reduction in single-use carryout bag consumption. This also resulted in reduced plastic bag litter in D.C.'s Anacostia River.

- **Ontario, Canada,** implemented a deposit program for all alcohol beverage containers, applying a 10-cent deposit to all non-metal containers 630 milliliters and under, and all metal cans 1 liter and under, as well as a 20-cent deposit for non-metal containers larger than 630 milliliters and metal containers larger than 1 liter. Ten years later, the average recovery rate for these containers was over 80%.

- **Maine** implemented a deposit law for all beverages with a few exceptions in 1978. This included a 15-cent deposit on spirits and wine beverage containers, and a 5-cent deposit on all other bottles. In 2017, Maine's bottle redemption rate was 84%.

- **Berkeley, California,** passed a comprehensive ordinance ultimately requiring food vendors to offer only reusables for onsite dining. In the first phase, disposable straws, lids, napkins and utensils will be available by request only. Next, all disposable foodware, including cups and containers, must be certified compostable and free of fluorinated chemicals, with a 25-cent charge for cups. Finally, only reusable foodware will be permitted for on-site dining, with a few compostable exceptions.

Some policies aim to encourage proper disposal of single-use plastics by changing consumer behavior. Others focus on increasing extended producer responsibility — they mandate that producers meet certain target recycling or collection rates, or that manufacturers ensure their products are easily recyclable, cover the cost of cleanup for the waste they generate, and raise awareness about proper waste disposal and the harm that mismanaged waste can inflict. For example, the European Union recently required that tobacco manufacturers be responsible for the cost of handling post-consumption waste of tobacco products.



While the onus to reverse the plastics crisis should primarily fall on companies, governments play a critical role in moving the world to a no-waste system when companies are not otherwise motivated to change their ways.

Policies that call for reductions in the production of plastic are moving the world in the right direction, but additional governmental involvement is needed on this issue to create the policy structure to drive reduction.



PLASTIC POLLUTION POSES A RISK TO HUMAN HEALTH

We are surrounded by plastic. We now know that our air, food and drinking water are contaminated with small bits of microplastic. They've been discovered in house dust, table salt, fish, shellfish, honey, beer and even human feces. But how these plastics are affecting our health remains in question.

One recent estimate of average exposure in Americans from all of the potential sources of plastic exposure clocked in at over 70,000 particles per year. What's more, our exposure to microplastic and its associated risks is expected to increase with the projected growth in plastic production.

WHAT ARE PLASTICS MADE OF?

Plastics are made up of tightly connected, repeating units of molecules called polymers that are very resistant to degradation. The strength of these polymers' chemical bonds is what makes plastic so persistent in the environment. But plastic materials and their additives can contain thousands of different chemicals, most of which have not even been studied for their safety.

PLASTIC IN AIR

Microplastic particles have been discovered in indoor air and dust. They've also been found in rain and outdoor air ranging from urban areas in Europe and China to remote mountaintops.

Some of the microplastic particles in air are small enough to inhale, while larger fiber particles in indoor areas settle in dust at a rate of up to 7,300 particles per square meter per day.

Plastic particles and fibers in indoor air can enter our diet when they fall on food and beverages that we then consume. Some of these particles can also contain harmful chemicals, posing a risk to small children who frequently put their hands in their mouths.

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EXPOSURE TO PLASTIC CHEMICAL ADDITIVES

Often, chemicals are added to plastics to give them desirable properties, such as flexibility or rigidity, stability and color. Because these chemical additives are not tightly bound to the polymers, they are prone to leaching out.

> **Chemicals associated with plastic polymers are found in human blood, urine and tissue.**

We know more about the potentially toxic effects of some plastic chemical additives than we know about the health effects of the plastic particles themselves.

Chemicals associated with plastic polymers are found in human blood, urine and tissue. Because people are exposed to these chemicals from multiple plastic and non-plastic sources, it is not yet possible to tie specific products to these chemical exposures.

NAME	PRODUCTS/USES	HEALTH RISKS	
Bisphenols (e.g., BPA) and phthalates	Plastics containing bisphenols and phthalates may include hard plastic containers, food packaging films, PVC pipes, plastic toys, vinyl flooring, shower curtains and window blinds.	Bisphenols are known endocrine (or hormone) disruptors. They are suspected to cause reproductive and nervous system disorders, breast and prostate cancers, obesity and diabetes.	
Vinyl chloride	Vinyl chloride is the chemical building block of polyvinyl chloride (PVC), which can be found in the plastic used to wrap meat and sandwiches, as well as in clothing, inexpensive household plumbing and kids' toys.	This is a suspected carcinogen.	
Flame-retardant chemicals (PBDE, TDCPP)	Flame-retardant chemicals are found in food packaging, furniture foam, plastic consumer electronics and textiles.	They are linked to hormone disruption, reproductive problems, developmental toxicity and cancer. Although some are not on the market anymore, they persist in the environment, in animals and in humans for years.	
Highly fluorinated, waterproof "forever" chemicals (PFAS)	PFAS are used in many consumer products due to their oil-, stain- and water-repellent properties. PFAS are found in plastic and synthetic food packaging, clothing, carpets and car seats.	These chemicals are linked to cancer, high cholesterol, reproductive and thyroid problems, and immune suppression.	
Heavy metals (e.g., cadmium and lead)	Heavy metals are added to plastic as stabilizers and for color.	They are linked to neurological disorders, including lowered IQ and behavioral problems, as well as breast, bladder and lung cancers.	
Styrene	Styrene is the major building block of polystyrene, a plastic resin that's used in food-service packaging, plastic cutlery, cups and packing peanuts.	The World Health Organization recently upgraded its rating of styrene's risk from "possibly carcinogenic" to "probably carcinogenic."	

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PLASTICS
INDUSTRY ASSOCIATION

July 1, 2020

The Honorable John Barrasso
Chairman, Environment and Public Works
United States Senate

The Honorable Thomas Carper
Ranking Member, Environment and Public Works
United States Senate

Re: June 17, 2020 Senate Environment and Public Works Committee hearing entitled, "Responding to the challenges facing recycling in the United States"

Chairman Barrasso and Ranking Member Carper,

We would like to thank you and all members of the committee for holding this important oversight hearing. We also would like to thank the witnesses who spoke at the hearing and discussed various ideas to improve today's recycling systems. The plastics industry's commitment to recycling is and will remain a priority for our manufacturers and their consumers as we face growing demand for sustainability in every product that we make.

Additionally, we applaud Chairman Barrasso's comments on how the COVID-19 pandemic is calling into question the policy of single-use product bans, particularly in light of the incredible number of positive stories being told about the role of those products during this pandemic. This worldwide crisis is reminding us of the importance of cleanliness and good hygiene which single-use plastics and packaging play a vital and sometimes lifesaving role.

At the hearing there was discussion on legislation that we feel would take the wrong approach when addressing waste and litter. Consumers rely on plastic to bring safe and affordable items into their homes and businesses. We feel bans are shortsighted and will not solve this issue and would instead do more harm than good. Any approach that does not consider the full life cycle impact of a product on our environment will lead to unintended environmental consequences. Banning plastics will ultimately increase emissions as manufacturers are forced to switch from lightweight, efficient plastics to bulky, heavier materials. "Replacing plastic with alternative materials in common consumer goods applications using current technology is unlikely to reduce environmental costs at the sector level. The environmental costs of alternatives are estimated to be almost four times that of plastics."[1]

While largely a function of state and local governments, the federal government can and should play a role in recycling success. Investment in our nation's recycling infrastructure is key in this discussion. The National Sword policy imposed by China highlighted our deficiencies when it comes

[1] https://plastics.americanchemistry.com/Plastics-and-Sustainability.pdf

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to sorting and processing our nation's recyclable materials. Frankly, we as a country failed to invest in our own systems as we relied more and more on other countries to handle our recovered materials. This has been particularly challenging during this pandemic when out of an abundance of caution many programs saw reductions in services or materials accepted. Fortunately, there are already several pieces of legislation that have been introduced that would help. Specifically, PLASTICS supports H.R. 5115, the RECOVER Act that, as introduced in the House, would create a grant program run by the Environmental Protection Agency that would help fund recycling infrastructure projects within the states. We additionally support S.2941 the RECYCLE Act, which will fund consumer education programs to be sure we all know what can and cannot be recycled. Knowing what stays out of the bin is as important as what goes in if we want successful, cost-effective recycling programs. Legislation we support and that was passed by this committee, S.1982, the Save our Seas 2.0 Act also provides for funding of some recycling infrastructure and we thank you again for your committee's action on this important piece of legislation. We also support the recently introduced H.R. 7228, the Plastic Waste Reduction and Recycling Act which would focus resources within the federal government on finding practical solutions for improving recycling.

Investments in new and innovative approaches to recycling will be key to solving this crisis. Advanced recycling must be part of the solution and companies are investing substantial amounts of capital to develop those technologies. Traditional mechanical recycling will continue to play a major role in handling the plastic material on the market today though investments in new equipment such as optical sorters will greatly increase efficiencies of Material Recovery Facilities (MRFs) and the quality of the material they sort.

We at PLASTICS are also supportive of new and innovative approaches to recycling. Last year, we completed a secondary sorting demonstration project in Portland, Oregon that showed an estimated 50,000 tons per year of additional recyclable material could be recovered in the region through the utilization of additional mechanical sorting equipment. Members of PLASTICS also support the Berks County, Pennsylvania, Material Recovery for the Future research program that is on track to produce 6,000,000 pounds of recycled flexible plastic packaging from the consumer waste stream – extending the useful life of this very innovative material.

Part of any solution to improving recycling must also address end markets for recovered materials. The Plastics Industry Association is leading in this area working with a variety of partners with our New End Market Opportunities (NEMO) program. This program develops and promotes various projects to explore innovative and new uses for typically harder to recycle material such as film.

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One promising project is showing recovered plastic film can be used as a binder in asphalt for roads and parking lots. Initial results have been extremely promising with improving the overall durability of the asphalt which has potentially exciting implications. More demonstration projects are in the works so that more data can be collected.

During the hearing there were questions that expressed interest in bioplastics, a growing part of the plastics industry. Bioplastics can be biobased, or in some way biodegradable - such as by industrial composting. Biobased plastics come from renewable materials such as corn, soy, by-products from other processes such as saw dust, and even algae. These can provide an improved environmental footprint, such as reduction in carbon dioxide emissions. Industrial compostable products are a great solution for helping divert food waste from landfills to industrial composters, or for products that cannot be readily recycled in the current stream. Both types of bioplastics are tools, not silver bullets, with specific applications and benefits. Additional support would help these types of plastics continue to grow, such as promoting education, supporting programs like the USDA BioPreferred Program or the Department of Energy Bioenergy Technology Office, or investing in infrastructure like MRFs, industrial composters, and anaerobic digesters. PLASTICS would be happy to engage with additional specifics on how to support bioplastics upon inquiry.

More research is needed to address many issues discussed at the hearing such as microplastics. We need and support a better understanding of the sources and impact on humans and the environment. Save our Seas 2.0 would provide for studies on this and other valuable areas to give us a better understanding of the problems which can then guide our approach to finding solutions.

Once again, we want to thank you for holding this hearing on such an important topic.
The Plastics Industry Association stands ready to work with this committee and all members of Congress to work towards real solutions. We would be happy to discuss any of these matters further if members of the committee have questions.

This issue is impacted by and effects everyone. We must all be part of the solution.

Thank you,

Matt Seaholm
Vice President, Government Affairs

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STATEMENT FOR THE RECORD
OF THE
PAPER RECYCLING COALITION

SENATE COMMITTEE ON THE ENVIRONMENT & PUBLIC WORKS

"RESPONDING TO THE CHALLENGES FACING RECYCLING IN THE UNITED STATES"

JUNE 17, 2020

Dear Chairman Barrasso and Ranking Member Carper,

The Paper Recycling Coalition (PRC) is pleased to submit this statement for inclusion in the Committee's hearing record and looks forward to serving as a resource to the Committee as it evaluates the challenges and opportunities facing the U.S. recycling system.

The PRC's eight member companies represent the interests of the 100% recycled paperboard and containerboard industries.[1] Our members operate 500 facilities in 44 states and support over 50,000 well-paid jobs with competitive benefits throughout the United States. PRC members manufacture 100% recycled paper products that are ubiquitous in American commerce, such as cereal and pizza boxes, Amazon cartons, and other shipping containers and packaging critical to today's growing e-commerce and circular economy. Further, the essential nature of our industry has been underscored during the recent Covid-19 pandemic.

Paper Recycling Drives Economic Growth & Innovation

The paperboard and containerboard manufacturing sectors are among the country's greatest economic and environmental success stories. The amount of used paper recovered for recycling has nearly doubled since 1990. In 2019, over 66% of all paper used by Americans was recovered to be recycled into new products, marking the 10th consecutive year with a rate above 60%.

As rates of paper recycling rise, they will compound the significant economic and employment benefits of paper recycling. In addition to the 50,000 direct jobs PRC members support, the paper recycling sector influences another 615,000 jobs, totaling 665,000 jobs nationwide. The annual economic impact of paper recycling amounts to a staggering $150 billion throughout the paper and packaging supply chain.

[1] Our members include Pratt Industries, Inc., Graphic Packaging Int'l, LLC, WestRock, Greif, Inc., Cascades Containerboard Packaging, Newman & Company, Ox Industries, and PaperWorks Industries, Inc.

The impressive economic benefits of paper recycling are directly tied to the availability of a reliable supply of recovered paper fiber collected for recycling. For that reason, the PRC's mission is to promote recycling education and to protect the domestic recyclable paper supply from market-distorting government subsidies that divert recyclable paper from the supply chain. Diverting this feedstock to landfills or for waste-to-energy eliminates opportunities to recycle these materials and turn them into valuable paper and packaging products.

Paper Recycling Provides Environmental & Climate Benefits

Paper recycling is not only an economic driver, it also has real environmental benefits for the American people. By recycling paper and turning it into new 100% recycled paper products, PRC members prevent it from being landfilled where it degrades, producing methane, a potent greenhouse gas. Paper recycling also leaves more trees standing, and it is less energy intensive to produce a recycled paper product than its virgin equivalent. Indeed, a Life-Cycle Inventory (LCI) the PRC commissioned in 2014 to evaluate the emissions profile of paperboard concluded that there is a total reduction of 3.17 tons of CO_2e for every ton of 100% recycled paperboard produced. The PRC has commissioned an updated LCI expected to be completed in the coming months. We will share the updated information with the Committee when it becomes available.

State of Domestic Recycling Markets after China's National Sword Policy

China's National Sword policy, which imposed stricter import contamination requirements for recyclable commodities, temporarily rattled domestic recycling markets in 2017 and 2018. However, these markets are bouncing back.

The domestic recycled paper sector in particular is witnessing significant growth. Indeed, US recovered fiber investment is estimated to top $4 billion between 2018-2022, according to The Recycling Partnership. These investments will add 7 million tons of additional US manufacturing capacity in the form of new mills, new paper machines, paper machine conversions and the re-starting of idle mills.

As such, the PRC cautions against any federal intervention to respond to National Sword that may undermine this ongoing market self-correction and the resulting renaissance in domestic recycling manufacturing.

Paper Recycling as Essential During the Covid-19 Pandemic

The Department of Homeland Security – through its Cybersecurity and Infrastructure Security Agency (CISA) – issued "Guidance on the Essential Critical Infrastructure Workforce: Ensuring Community and National Resilience in COVID-19 Response." The guidance recognizes recycling operations and workers – including collection, processing, and manufacturing – as essential to the Nation's critical manufacturing supply chain and to the production of critical packaging and shipping products.

Manufacturers of recycled paper products, especially 100 percent recyclers, rely on a stable supply of clean recovered paper from industrial, commercial, and residential sources. This feedstock is turned into 100 percent recycled paper products that are essential during the pandemic. PPE, food and produce, hygiene products, and other goods are packaged in products we make. They are then delivered to hospitals, homes, grocery stores, and pharmacies across the country in shipping containers and cartons also manufactured by PRC members.

With the nation-wide closure of thousands of industrial and commercial operations, the paper recycling sector is increasingly reliant on household recycling and municipal recycling programs to provide our mills with recyclable paper. This reliance continues to grow as e-commerce has surged during the pandemic, which has increased demand for paper packaging and shipping products. But this growth also has put significant pressure on the supply of recyclable paper.

Absent a robust supply of recyclable paper, the movement of goods could come to a grinding halt, as a shortage of paperboard and containerboard will make it logistically impossible to package and ship products to markets. This supply chain cannot be halted and restarted without significant supply disruptions that would ripple throughout the entire U.S. manufacturing chain. Without the role of households and community recycling programs, these valuable raw materials would be lost to manufacturers and the country's already fragile manufacturing supply chain would be jeopardized.

Congressional Efforts to Address Domestic Recycling Issues

Several recycling bills are under development in both the House and Senate. These efforts are intended to resolve marine debris issues and respond to China's National Sword policy that imposed stricter import contamination requirements on recyclable commodities. More recently, some of these legislative efforts have been tied to the Covid-19 pandemic.

The PRC provides the below comments outlining the priorities that we see as being the most cost-effective and appropriate use of taxpayer dollars.

Education as a Tool to Increase Recycling Rates and Reduce Contamination

The availability of a separated, clean stream of commonly recycled paper is vital to sustaining and growing this essential American industry.

Contamination, which occurs when trash and other commodities are commingled with paper, is one of the biggest challenges to increased paper recycling. This challenge has worsened in recent years as a result of paper increasingly being collected together with other materials, like plastics and glass and, in some cases, ordinary household garbage. Unfortunately, once paper is contaminated, it is worthless as a recyclable commodity and instead this "raw material" goes to a landfill or a waste-to-energy facility.

The simple answer is to keep paper and other recyclables clean. Helping municipalities educate residents on best recycling practices geared toward reducing curbside contamination and raising awareness of recycling's many economic and environmental benefits would be a simple, cost-effective solution.

This is why the PRC supports S. 2941 and H.R. 5906, the "Recycling Enhancements to Collection and Yield through Consumer Learning and Education Act of 2019" (RECYCLE Act). The bill wisely deploys federal assistance to provide targeted grants to help local communities improve the effectiveness of residential recycling programs through public education and outreach.

This proposal will enhance the nation's recycling record by providing important educational information about recycling that will help to increase residential collection rates and decrease contamination in residential recycling programs. To be sure, EPA Administrator Wheeler recently demonstrated the importance of recycling education with a series of public service announcements encouraging the public to "Recycle More and Recycle Right."

Help Municipal Recycling Programs Protect their Workers

PRC member companies have always prioritized worker safety and have an outstanding record demonstrating that commitment. The Covid-19 pandemic is no different – our members are supplying their employees with the necessary PPE and following the relevant CDC, OSHA, and state guidance and protocols. Many of these efforts were in place pre-pandemic. Our member companies also are donating surplus PPE supplies to health care providers and first responders throughout the U.S.

Nevertheless, we respectfully request that Congress prioritize PPE funding for municipal collection services and processing facilities. Health care providers and other frontline workers should receive top consideration, followed by all workers essential to the Nation's critical manufacturing supply chain, including those involved in recycling collection, processing, and manufacturing.

Concerns with Other Federal Legislative Approaches to Recycling

Other recycling legislative efforts to date have offered a range of solutions, including government-funded grants and loans for recycling-related infrastructure, measures to create end-use markets for recyclable products, recycled content mandates, product bans and taxes, and a federal enhanced producer responsibility (EPR) program. The PRC believes these efforts are problematic, imposing unnecessary federal intervention in domestic and international recycling markets.

We agree that plastics present unique challenges and should be an important focus for any federal recycling-related legislation. However, many of the proposed solutions go well beyond what the PRC believes is necessary or appropriate to resolve the problem or "fix" the nation's recycling challenges. As discussed above, media coverage surrounding the "demise" of recycling has been overstated, particularly as it relates to paper recycling – a sector that is expanding.

Alternatives to plastic packaging are being developed by PRC members. From a market perspective, such alternatives are what consumers increasingly want and PRC member companies are responding. And because the market is responding, the PRC believes that taxing or banning plastic products is too heavy-handed. In fact, the PRC has long opposed product bans or taxes of any kind. We would prefer instead to see programs that facilitate the development of plastic packaging alternatives, rather than outright bans or taxes.

The same is true for minimum recycled content standards. It has been our experience that when you set minimums, people stop at the minimum. In other words, minimums become maximums. Contrast that with the 100% recycled paper sector – an entire industry was born and has continued to thrive based on market demand, not mandates.

Some interests have suggested that America's recycling infrastructure is "outdated" or "broken" and the only way to fix it is through a $1 billion federal cash infusion. We take issue with the suggestion that America's recycling system is broken and that direct taxpayer-backed support to the private sector is the solution. If infrastructure is indeed the answer, then private companies are capable of making such investments – and do so without federal subsidies that could put taxpayers on the hook for new infrastructure that is not supported by market principles. Indeed, the paper recycling sector has invested billions of private capital to develop demand for our products and establish robust and modern infrastructure.

The more prudent approach is to support community recycling programs through outreach and improved education, as contemplated in the RECYCLE Act. To be sure, no amount of infrastructure spending can clean up contaminated recyclables entering the supply stream – that starts at the household and only improves with a vigorous consumer education effort.

Any Extension of Clean Energy Credits Must Protect Recyclable Paper

Both the Senate and the House are considering extending the section 45 production tax credits, including the waste-to-energy (WtE) credit. If Congress decides to extend the WtE tax credit, we respectfully request it incorporate the modifications included in the bipartisan PAPER Act (S. 1396) to protect recyclable paper. This bill clarifies that WtE facilities may not claim the credit for energy produced from burning commonly recycled paper that has been segregated from solid waste or that has been deliberately mixed with garbage. Absent this clarification, section 45 will continue to provide an incentive to destroy the raw material that PRC members are entirely dependent upon – recyclable paper.

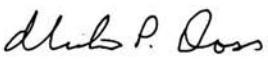
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Thank you for the opportunity to provide this statement for the record and we look forward to working with you and your talented staff on these important issues.

Sincerely,



Brian McPheely
Chairman, Paper Recycling Coalition, Inc.
Global CEO, Pratt Industries



Michael P. Doss
Vice Chairman, Paper Recycling Coalition, Inc.
President/CEO, Graphic Packaging Int'l, LLC



Terese Colling
President, Paper Recycling Coalition, Inc.

PRODUCT STEWARDSHIP INSTITUTE

Extended Producer Responsibility for Packaging and Paper Products (PPP)

National Briefing Summary [updated April 2020]

The Problem: Packaging and Paper Products Recycling in Crisis

The U.S. generates more than a ***quarter of a billion tons of municipal solid waste*** annually.[i] More than **40 percent** of that waste (more than 100 million tons) is **composed of product packaging and paper products** (or "PPP")[ii], including plastic containers, steel and aluminum cans, plastic film, glass bottles, newspaper, and cardboard. PPP includes all of the materials brand owners use to package everything from cereal and cleaning supplies to bottled water and shampoo, as well as junk mail and grocery bags. While the amount of paper waste has declined in recent years, the amount of plastic waste is climbing.

About 50 percent of PPP is recycled – a rate well below many other nations – and the **recycling rate** in the U.S. has been **stagnant for nearly two decades**.[iii] In the past two years, **recycling costs have skyrocketed**, driven by the loss of markets (due to policy changes in China that limit recyclable material imports), as well as inherent flaws in a system that has long needed updating. In some cases, cities and towns that used to rely on recycling as a revenue stream are now ***facing bills in the hundreds of thousands or even millions of dollars***. As local leaders around the country struggle to operate in an inefficient and underfunded environment, they are being forced to make difficult choices on where to spend scarce resources. In the wake of these severe market challenges, communities are stockpiling recyclable materials, changing what their recycling program will accept, raising taxpayer fees, or ***suspending recycling programs altogether***. Such changes threaten the public's already fragile understanding of recycling and could **erode much of progress made over the last three decades**.

Flaws in the Current Recycling System

The problems with the U.S. recycling system for PPP are much more fundamental than the recent loss of export markets. The current system places **unreasonable burdens on individual municipalities** to collect, manage, and market recyclable materials; materials which they had **no control or input** on creating in the first place. The **system is a highly fragmented** arrangement that lacks adequate infrastructure investment, confuses consumers with disparate messages about what materials are recyclable, provides little consistency from place-to-place, and often fails to reach economies of scale to make recycling more cost effective.

Product producers, meanwhile, have no incentives to reduce the amount of packaging they produce or to use materials that are easy to recycle – in fact, the trend is for companies to use ever-more complex materials that are more difficult and more costly to recycle. By failing to recycle a large portion of PPP materials, we incur **lost economic value, lost jobs, and an enormous cost to human and environmental health**.

Brand owners (or producers) are losing out too, because they require recycled material as raw feedstock for production. Many well-known corporations have made public commitments to produce packaging with a significant recycled content percentage. With the current fragmented system and high contamination rates, we are far from being able to produce the quality and quantity of material needed. Without a clean, consistent, reliable supply, **brand owners will be unable to reach their targets**.

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PSI is an equal opportunity provider and employer.

The Solution: Extended Producer Responsibility

Product stewardship is the act of minimizing the health, safety, environmental, and social impacts of products *and* packaging throughout all lifecycle stages, while also maximizing economic benefits. Producers are in the best position recover PPP materials, incorporate them back into the economy, and minimize adverse impacts. ***Extended producer responsibility*** (EPR) is a mandatory type of product stewardship that requires manufacturer responsibility to extend to post-consumer management of products and packaging. There are two important features of EPR policy:

(1) Shifting financial and management responsibility – with government oversight – upstream to the manufacturer and away from the public sector; and

(2) Providing incentives to manufacturers to incorporate environmental considerations into the design of their products and packaging.

EPR is a game changer for PPP reduction, recovery, and recycling. Other strategies, including voluntary product stewardship efforts, effect small, incremental changes in attempts to optimize the current system. EPR is the only large-scale solution that takes an entirely different approach to create a much-needed, significant transformation in the entire system.

Benefits of EPR for Packaging

EPR programs provide dedicated, non-taxpayer funding to sustainably support recovery and recycling. In the case of PPP, which makes up a substantial percentage of the municipal solid waste stream, there is an enormous opportunity for increased recycling. Fewer materials in the waste stream translate to municipal savings. **With local budgets under strain, EPR for PPP can provide much-needed relief to taxpayers.** Furthermore, with a consistent and predictable system, **states and regions can take a more unified approach to strategic planning around waste, including investment in new technology.**

When producers internalize the cost of managing the full lifecycle of their products and packaging, they have new incentives to make decisions that are better for taxpayers, our environment, and the overall economy. **EPR for PPP creates incentives for brand owners to improve packaging design, reduce the amount of materials used, reduce toxicity in packaging, and improve recyclability.**

Proven Precedents

Across the U.S., there are currently 119 EPR laws at the state and local level in 33 states and the District of Columbia, covering 14 product areas, including electronics, pharmaceuticals, batteries, paint, carpet, mercury-containing thermostats and lamps, and mattresses. Such laws have saved local governments millions of dollars, reduced greenhouse gas emissions, created jobs, and ensured that millions of tons of materials were recycled or safely disposed.

EPR for packaging and paper products is common in other parts of the world. In Canada, British Columbia, Québec, Manitoba, Saskatchewan, and Ontario each have robust PPP programs that **achieve higher recovery rates than the U.S.**[iv] EPR laws are in place throughout Europe, with the highest packaging **recycling rate topping 80 percent**.[v] In these systems, EPR relieves municipalities of the financial burden of collecting and recycling or properly disposing of materials. **The cost and responsibility falls to producers and their customers, rather than all taxpayers and governments, creating a fairer system.**

Complementary systems have also proven effective. For example, states with beverage container deposit legislation (known as "bottle bills") have recycling rates for those containers up to three times higher than states without. Recycled content standards create demand for recycled materials, which can spur infrastructure development. Each of these legislated programs can work hand-in-hand with EPR.

How Does It Work?

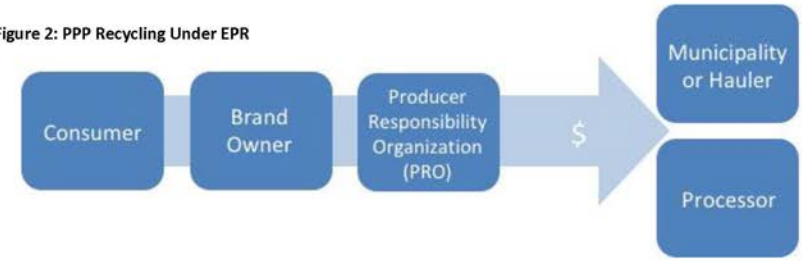
Under the current system (Figure 1), brand owners sell products to consumers but have no responsibility for recovering or recycling products or packaging. **All taxpayers share the burden** for managing waste, including the cost of recycling, regardless of how much they produce. The result is a disjointed system where **brand owners have no direct connection to recycling or end-of-life management**.

Under an EPR system (Figure 2), consumers purchase from brand owners, and then brand owners finance and manage recycling through a Producer Responsibility Organization (PRO). Depending on how a system is designed, the PRO may contract with a municipality, which has the option to continue to collect materials as it had previously (and receive funding from the PRO) or to allow the PRO's haulers to collect on its behalf. The PRO pays the processor to handle collected materials. The PRO has incentive to use existing infrastructure. **Municipalities' recycling investments and achievements are built upon and the state government provides oversight, but producers shoulder the financial and managerial responsibility for recycling.**

Figure 1: Current PPP Recycling System



Figure 2: PPP Recycling Under EPR



Opportunities to Explore EPR for PPP in the U.S.

Municipalities have been doing their best within the limits of their individual jurisdictions, but their efforts are not enough in the face of growing plastics pollution, increasing complexity in packaging, and shrinking export markets for recyclables. Without carefully planned, significant change in product stewardship policies and practices for packaging, citizens, local governments, recyclers, and brand owners will not achieve their goals.

States throughout the U.S. are actively exploring and learning about EPR solutions and strategies for PPP. Several have introduced legislation in their 2019 or 2020 sessions, or are continuing to develop legislation to introduce in 2021 and beyond. Major issues under consideration include:

- Defining what materials are covered;
- Determining how the system is structured (from collection methods to the financial structure); and
- Setting performance measures and incentives.

One of the key barriers to passing and implementing EPR for PPP legislation is a general lack of understanding about EPR programs and, more specifically, EPR for PPP. **The best possible EPR solutions are created when all affected parties come to the table to work through key issues in a way that meets everyone's needs.** Using insights from its experience creating successful models, the Product Stewardship Institute (PSI) is currently providing technical assistance to state and local government members regarding critical elements of EPR for PPP legislation.

Learn More

The Product Stewardship Institute (PSI) is a national, membership-based nonprofit committed to reducing the health, safety, and environmental impacts of consumer products across their lifecycle with a strong focus on sustainable end-of-life management. PSI provides access to webinars, information on successful PPP EPR programs, and more. To learn more about packaging, please contact PSI's Kristin Aldred Cheek at 617-236-8293 or kristin@productstewardship.us and visit productstewardship.us/Packaging.

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[i] U.S. Environmental Protection Agency, "Advancing Sustainable Materials Management: 2017 Fact Sheet," November 2019. https://www.epa.gov/sites/production/files/2019-11/documents/2017_facts_and_figures_fact_sheet_final.pdf

[ii] *Ibid.*

[iii] *Ibid.*

[iv] See for example, "Annual Report," Recycle B.C., 2018. https://recyclebc.ca/2018-annual-report/

[v] "Inspiring Packaging Recycling," Extended Producer Responsibility Alliance (EXPRA), 2018. http://www.expra.eu/uploads/Brochure-Expra-2018F3.pdf

PRODUCT STEWARDSHIP INSTITUTE

Extended Producer Responsibility for Packaging and Paper Products: Policies, Practices, and Performance

March 17, 2020



Prepared by the Product Stewardship Institute, Inc.

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The Product Stewardship Institute

The Product Stewardship Institute (PSI) is a national nonprofit working to reduce the health and environmental impacts of consumer products from design and production through end-of-life. PSI takes a unique approach to solving environmental problems by bringing key stakeholders together in well-designed dialogues to forge lasting agreements rooted in producer responsibility and sustainable materials management. The organization has built capacity for product stewardship in the U.S. for the past 20 years, conducting both voluntary and legislative product stewardship initiatives. PSI works closely with 47 state environmental agency members, hundreds of local government members, and over 120 partners from businesses, universities, organizations, and international governments.

Acknowledgements

PSI prepared this report for Metro regional government in Oregon. PSI would like to thank Metro's Scott Klag for research direction and guidance. We also thank Catherine Abel, Bridget Anderson, Meegan Armstrong, Victor Bell, Elena Bertocci, Mary Cummins, Andrew Doi, Carmelo Freda, Normand Gadoury, Mathieu Guillemette, Garth Hickle, Sego Jackson, Kate Kitchener, Allen Langdon, Sophie Langlois-Blouin, Patrick Leavers, Dave Lefebvre, Tom Metzner, Tom Outerbridge, Dominique Potelle, Joachim Quoden, Geoff Rathbone, Lisa Sepanski, and the many staff members at Metro Oregon who provided comments, technical information, and insight.

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Contents

Executive Summary v

1. Introduction 1

The Problem: PPP Recycling in Crisis 2

The Solution: Extended Producer Responsibility 2

Aims of this Paper 3

2. EPR for PPP: Around the World 4

Origin and Evolution of EPR for PPP in Europe 4

Adoption of EPR for PPP in Canada 6

Spreading Worldwide 7

EPR in the U.S. 7

3. EPR for PPP: The Fundamentals 8

EPR for PPP: Basic Approaches 9

Key Elements of EPR for PPP 10

Producer Responsibility Organizations (PROs) 10

Stewardship Plans 11

Covered Materials 11

Internalized Costs 12

Material Fees 13

Recycling Access 14

Performance Standards 14

Education & Outreach 15

EPR for PPP in Canada: A Review of Four Programs 15

Ontario 16

Québec 19

Manitoba 20

British Columbia 22

4. British Columbia: A Case Study 26

Governing Structure 26

Producer Responsibility Organization (PRO) 26
Investments in Infrastructure 27
Stewardship Plan 28
Collected Materials 29
Internalized Costs 31
Modulated Fees 32
Performance Standards 32
Recycling Access 36
Education & Outreach 36
Adoption & Adaptation 37
Locating and Developing Markets 37
Program Results 38
Summary 39
5. Conclusion and Recommendations 41
Appendix A: The PPP Recovery Rate in Each Canadian Province 43
Appendix B: Fee Schedules for Canadian EPR Programs 46
Appendix C: Packaging and Paper Definitions in British Columbia 50
Appendix D: British Columbia's Pollution Prevention Hierarchy 53

Executive Summary

Communities throughout the United States are facing an unprecedented challenge for managing packaging and paper products (PPP) in the municipal waste stream. Currently, around 50% of residential PPP is recycled in the U.S. – far less than in many other countries – and this rate has been stagnant for nearly two decades.[1] What was already a strained, fragmented system has been further impeded over the last two years by extreme market disruptions brought on by restrictions in international export markets (starting with the "China Sword"). Widespread use of single-stream recycling, which increases contamination across collected materials, has exacerbated these issues. Extended Producer Responsibility (EPR), which is common throughout much of the world, has gained increasing support in the U.S. over the past decade as a critical solution to PPP recycling challenges.

EPR shifts the responsibility for end-of-life management of products and packaging upstream to producers – rather than the public sector – and creates incentives for producers to incorporate environmental considerations into the design of their products and packaging.

Well-designed EPR systems increase recovery and recycling of PPP, reduce contamination, and develop markets for difficult-to-recycle materials. EPR not only provides sustainable financing for recycling by placing financial responsibility for the system on producers; it can also transition legal responsibility for recycling performance and the burden of day-to-day recycling management away from the public sector, allowing limited public resources to be directed toward other priorities. Many existing EPR for PPP programs are beginning to incorporate "eco-modulated fees" that incentivize producers to reduce the end-of-life impacts of their packaging by using more recyclable or reusable materials, and to consider other environmental factors such as greenhouse gas (GHG) emissions in packaging design. **In short, EPR fundamentally changes the landscape of PPP reduction and recycling.**

Striking the right balance between *government oversight and control* of system outcomes on the one hand, and *producer flexibility and control* over system implementation on the other is key to the success of EPR programs. In addition, local governments seek options that are both suited to their unique circumstances *and* achieve regional harmonization. Producers, for their part, need flexibility to reach performance goals. They also seek control over how their financial contributions are spent to ensure efficiency and effectiveness. Experience has shown that more successful programs achieve a healthy balance between government and producer interests, while also addressing the needs of waste management companies, environmental groups, and other key stakeholders.

The most successful programs to date place full responsibility on the producers to achieve results, but also provide municipalities the option to continue collecting recyclable materials and educating residents. Many communities have taken advantage of the opportunity to shift collection and education activities to producers. One of the most transformative benefits of existing programs has been the standardization of collected materials across jurisdictions, reducing resident confusion and contamination at regional or

even national levels. In Europe, where EPR has been established for decades, many countries have PPP recycling rates above 70% or 80%.[2]

EPR for PPP can also restore public faith in recycling during a time of unprecedented global uncertainty and skepticism. Although no U.S. states currently have EPR for PPP systems in place, multiple states have introduced legislation over the past several years. As plastics, packaging, and the plight of municipal recycling programs continue to be topics of great interest for U.S. decision-makers, states will continue to introduce EPR for PPP legislation in 2020 and beyond.

This report provides a brief history of EPR for PPP and gives an overview of the key elements of existing EPR for PPP programs around the world. Two fundamental approaches to EPR for PPP are defined:

1. Full Producer Responsibility. Under this approach, PPP recycling is entirely financed and operated by producers. Local governments choose their degree of involvement – they can either fully or partially opt into the EPR system, or they can opt out altogether.
2. Municipal Reimbursement. In this approach, local governments retain responsibility for the collection and processing of PPP materials. Producers typically reimburse municipalities for a majority of their costs, but do not cover costs entirely.

To illustrate these approaches, this report summarizes and compares four provincial EPR for PPP programs that have been operational in Canada for up to 15 years. The report also includes a detailed case study of the full producer responsibility system in British Columbia (B.C.), which is one of the more recently established programs in Canada and was the country's first full producer responsibility program for packaging. Full producer responsibility has transformed the recycling landscape in B.C., offering flexibility for local governments to either fully or partially opt into the system and enabling them to opt out altogether if they choose. The B.C. Government and producers were able to implement the program without stranding assets or otherwise seriously impacting local haulers and recovery facilities. Small businesses are exempt or pay a flat fee that relieves them of administrative burdens. At present, Recycle BC (the producer responsibility organization in B.C.) reports a 78% recovery rate and an 87% recycling rate.[3]

EPR systems can buffer states and local governments from disruptions to the global recycling market, reduce taxpayer spending on recycling infrastructure, increase material recovery rates, and help to generate local markets where they are needed for emerging and difficult-to-recycle materials. As public pressure to solve the global plastic pollution crisis grows and companies continue to commit to design and use more eco-friendly, sustainable packaging, U.S. producers have recognized that they cannot reach their sustainable packaging goals without significant improvements to the recycling system.[4] ***Producers are ready for a harmonized system that can help them achieve a circular economy and meet their sustainability goals – and EPR provides a path to building this system.*** PSI has already developed model legislation and guidance on the key elements of EPR for PPP, which can be applied to a spectrum of EPR approaches.

Key Terms

CCME: Canadian Council of Ministers of the Environment: An intergovernmental forum in Canada focused on environmental issues of national and international concern. The Council is led by the environment ministers from the federal, provincial, and territorial governments.

CSSA: The Canadian Stewardship Services Alliance: A national, not-for-profit organization founded in 2013 to provide administrative and management services to product stewardship programs, including program design and implementation, compliance, reporting, call center support, IT systems, data analytics, financial services support, and supply chain consulting. CSSA serves four of the five existing Canadian EPR for PPP programs – Ontario, Manitoba, British Columbia, and Saskatchewan (the exception is Québec). CSSA also serves Stewardship Ontario's Household Hazardous Waste and Special Waste Program and the Ontario-based Automotive Materials Stewardship Program.

Composting: Composting is the process by which organic solid waste is decomposed. Throughout this document, composting primarily refers to the decomposition of compostable packaging. According to the Ellen Macarthur Foundation's *New Plastics Economy* report, "packaging or a packaging component is compostable if it is in compliance with relevant international compostability standards and if its successful post-consumer collection, sorting, and composting is proven to work in practice and at scale."

Contamination: Oregon's Department of Environmental Quality (DEQ) defines contamination in recycling as "any items that are not accepted for recycling in a particular recycling program or don't belong in materials being recycled. Contaminants include both non-recyclable items and recyclable items that are dirty or unsuitable for a particular recycling stream." For the purposes of this report, contamination is primarily any material put into the recycling system that is not a program material, and therefore not accepted. Where contamination is discussed in the context of the Recycle BC program, the term is further clarified.

ÉEQ: Éco Entreprises Québec: The Product Stewardship Organization (referred to as a PRO in this report) in Québec for packaging and printed paper. ÉEQ is a private non-profit organization representing the companies that place PPP materials onto the market in Québec in their responsibilities to finance the cost of effective and efficient municipal curbside recycling services. ÉEQ's mission is to optimize the curbside recycling value chain and implement innovative approaches to recycling with a view to sustainable development and the creation of a circular economy.

MMSM: Multi-Materials Stewardship Manitoba: The Product Stewardship Organization (referred to as a PRO in this report) in Manitoba for packaging and printed paper. MMSM is a not-for-profit, industry-funded organization that funds and provides support for the province's residential recycling programs for PPP. Producers in Manitoba currently reimburse municipalities for up to 80% of the net cost of the residential recycling system through MMSM. MMSM's mission is to promote the reduction, reuse, and recycling of covered materials.

MRF: Material Recovery Facility: A MRF is a plant that separates single-stream recycling materials after they are collected from residential bins and prepares them to be sold to market buyers.

Net Cost: Throughout this document, the net cost of recycling or net cost of managing PPP materials refers to the operational costs to collect, sort, and transport materials minus the revenue earned from selling these materials.

Net Reasonable Costs: In discussions of Canadian EPR for PPP, the term net reasonable costs refers to the portion of municipal recycling costs reimbursed by producers under municipal reimbursement programs. Each provincial EPR for PPP program includes a set of criteria for costs that are eligible to be reimbursed (i.e., net reasonable costs). Producers are required to reimburse the net reasonable costs of municipal programs, rather than actual costs, to account for differences in operating costs among municipalities resulting from autonomous decision-making by local governments.

PPP: Packaging and Paper Products: PPP includes all the materials brand owners use to package everything from cereal and cleaning supplies to bottled water and shampoo, as well as junk mail and grocery bags. PPP materials are the focus of the EPR programs covered in this report. EPR for PPP programs referred to throughout this report cover residential PPP materials – i.e., PPP materials that are designed to be disposed or recycled at home by consumers.

PRO: Producer Responsibility Organization: PROs are organizations created by producers to fulfill EPR requirements on their behalf. Names for such organizations vary by country – in Canada, for example, they are primarily referred to as Product Stewardship Organizations. For consistency, this report uses PRO.

Recovery: In Oregon, material recovery includes "all materials collected for recycling or composting, and for a subset of materials, incineration with energy recovery."[5] Canadian and European provincial programs vary significantly in their definitions of recovery. Definitions for the four Canadian programs discussed in this report are described in Appendix A. Throughout this report, the term recovery will refer to all materials that are collected in the recycling stream, regardless of their end-of-life management. Composting is excluded from this definition. Where certain EPR programs use the term recovery in a different way, the alternative definition is noted in the text.

Recyclable: For the purposes of this report, recyclable refers to materials that can be successfully collected, sorted, and delivered to viable end markets. Materials that are technically recyclable (i.e., technology capable of recycling these materials exists), but are not practical to recycle either because the necessary technology is not widely available or the cost of recycling them is prohibitive, are not defined as recyclable in this document.

Recycling: According to the U.S. Environmental Protection Agency, recycling refers to the series of activities by which discarded materials are collected, sorted, processed, and converted into raw materials and used in the production of new products. Recycling excludes the use of these materials as a fuel substitute or for energy production. This report adheres to the U.S. EPA's definition.

Reusable/Reuse: The terms reuse and reusable throughout this report refer to packaging or paper products that are used multiple times by the consumer (reuse) or can be used multiple times (reusable) after their initial intended purpose has been fulfilled. This definition also includes returnable items that are or can be used multiple times by producers to fulfill the same purpose (e.g., glass milk bottles).

SMM: Sustainable Materials Management: According to the U.S. Environmental Protection Agency, sustainable materials management is a systemic approach to using and reusing materials more productively over their entire life cycle. "An SSM approach seeks to:

- Use materials in the most productive way with an emphasis on using less.
- Reduce toxic chemicals and environmental impacts throughout the material life cycle.
- Assure we have sufficient resources to meet today's needs and those of the future."

WTE: Waste to Energy: The conversion of solid waste into fuel through direct combustion. In Oregon, this process is also referred to as energy recovery.[6] In B.C., producers refer to this process as conversion to engineered fuel, where engineered fuel is "an engineered energy product that is a direct replacement for traditional non-renewable resources, such as coal."[7]





1. Introduction

Communities throughout the United States are facing an unprecedented challenge for managing packaging and paper products (PPP) in the municipal waste stream. What was already a strained, fragmented system with stagnant recycling rates has been further impeded over the last two years by extreme market disruptions brought on by restrictions in international export markets. Widespread use of single-stream recycling, which increases contamination across collected materials, has exacerbated these issues. Municipalities struggling with budget shortfalls in the thousands or millions of dollars must now make difficult choices about whether to eliminate costly materials from their programs, or even whether to recycle at all. At the same time, public pressure to address both climate change and marine litter, particularly plastics, continues to grow. Many states and municipalities have adopted sustainability and greenhouse gas (GHG) reduction goals for which recycling is critical. The need to reduce contamination in the recycling stream and develop markets to ensure collected materials are returned to the circular economy is more urgent than ever.

Extended Producer Responsibility (EPR), which is common throughout much of the world, has gained increasing support in the U.S. over the past decade as a solution to these challenges. EPR is a mandatory type of product stewardship that includes, at a minimum, the requirement that the manufacturer's responsibility for its product extends to post-consumer management of that product and its packaging.[8] EPR provides a sustained financing stream for recycling and has vast potential to increase collection, reduce contamination, and develop markets through efficiencies gained by operating at a large scale. EPR for PPP is prevalent throughout Canada and the European Union (EU) and has arisen in many South American and Asian nations as well. While EPR for PPP is not yet required in the U.S., there are currently 119 U.S. EPR laws regulating 14 products in 33 states.[9] Many of these states have begun – and continue – to introduce legislation targeting PPP.

The Problem: PPP Recycling in Crisis

The U.S. generates more than a quarter of a billion tons of municipal solid waste annually, which is about one ton per person per year.[10] More than 40% of that waste (over 100 million tons) is composed of PPP,[11] including plastic containers, steel and aluminum cans, plastic film, glass bottles, newspaper, and cardboard. PPP includes all the materials brand owners use to package everything from cereal and cleaning supplies to bottled water and shampoo, as well as junk mail and grocery bags. While the amount of paper waste has declined over the last two decades,[12] the amount of plastic waste has climbed.[13] Packaging materials are also growing increasingly complex, with multi-material packaging and multi-layer flexible packaging becoming more common. These materials pose new challenges to recycling in the U.S., causing significant disruptions at material recovery facilities (MRFs), as they are often beyond the capabilities of existing technology to process and recycle.

About 50% of residential PPP in the U.S. is recycled– far less than in many other nations that have implemented EPR – and this rate has been stagnant for nearly two decades.[14] Over the past two years, recycling costs have skyrocketed, driven primarily by the loss of international markets due to policy changes in China that limit recyclable material imports (the "China Sword"),[15] as well as inherent flaws in a disjointed system that has long needed updating. In some cases, cities and towns are facing costs in the hundreds of thousands, or even millions, of dollars to maintain their recycling programs.[16]

One of the main underlying challenges to recycling in the U.S. is that municipalities and MRFs are tasked with collecting, processing, and marketing materials over which they have no design input or control. As new types of packaging continue to emerge, often designed without knowledge of the recycling system in mind, recyclers must manage these materials with limited public funds. As local leaders around the country struggle to operate in an inefficient and underfunded environment, they are forced to make difficult choices on where to spend scarce resources.

In the wake of the recent international market setbacks, communities are stockpiling previously recyclable materials, changing what their recycling programs will accept, raising taxpayer fees, or suspending recycling altogether. Upstream benefits from recycling, such as greenhouse gas reductions, are lost as programs shutter or shrink. Such changes threaten the public's already fragile understanding of, and confidence in, recycling and could erode much of the progress made over the last three decades.

The Solution: Extended Producer Responsibility

In the face of mounting public pressure to solve the plastic pollution crisis, corporations around the world have announced voluntary commitments to design and use more eco-friendly, sustainable packaging. For example, General Mills has pledged that its packaging will be 100% recyclable by 2030;[17] Procter & Gamble pledged to have 90% recyclable packaging by 2030;[18] and Coca-Cola pledged to manufacture

bottles with an average of 50% recycled content by 2030, as well as to collect and recycle the equivalent of 100% of the packaging it produces.[19] However, these brands have publicly recognized that they cannot reach their sustainable packaging goals without significant improvements to the recycling system in the U.S.[20] For materials to be truly recyclable, comprehensive collection systems, efficient processing facilities, and viable end markets are all needed. Companies also need a steady supply of recycled feedstock to meet their recycled content goals.[21]

Producers are in the best position to recover PPP materials, incorporate them back into the economy, and minimize their adverse impacts because they directly control the packaging materials they put onto the market. Thus, in many countries around the world, producers have supported product stewardship programs that enable them to meet their sustainability goals and draw value from recycled materials.

Product stewardship is the act of minimizing the health, safety, environmental, and social impacts of products and packaging throughout their life cycle, while also maximizing economic benefits.[22] EPR is a legislated type of product stewardship that requires manufacturer responsibility to extend to post-consumer management of products and packaging. There are two important features of EPR policy:

(1) Shifting primary financial – and sometimes management – responsibility upstream to the product manufacturer (typically referred to as the producer) and away from the public sector, with government oversight; and

(2) Incentivizing producers to incorporate environmental considerations into the design of their products and packaging.

EPR is a game-changer for PPP reduction and recycling. Other strategies, including voluntary product stewardship efforts and local government education, result in small, incremental changes to the current system. EPR takes a systemic policy approach to create a much-needed, significant transformation from the current state of disparate and fragmented recycling programs operated by local governments to a comprehensive statewide or even nationwide system. When designed well, an EPR for PPP program can optimize material collection, weather market challenges, and restore public trust in recycling. In Europe, where EPR has been established for decades, many countries have PPP recycling rates above 70% and even 80%,[23] whereas rates in the U.S. are 50% across all PPP materials and as low as 8% in key categories, such as plastics.[24] Meanwhile, British Columbia's (B.C.'s) EPR for PPP program in Canada has achieved a contamination rate of just 8%,[25] while it is common to find rates upwards of 25% in the U.S.[26]

Aims of this Paper

This report summarizes the application of EPR policies and practices around the world as a management solution for PPP, with a focus on Canada and the EU. It describes key aspects of EPR for PPP, including program costs, materials typically covered by programs, performance goals, fee structures to incentivize

design changes and address collection challenges, contamination and recycling rates, consumer convenience, and municipal cost savings. Additionally, this report provides a detailed case study of the EPR for PPP program in B.C., which is one of the more recently established programs in Canada and was the country's first full producer responsibility program for packaging. The B.C. program, along with EPR for PPP programs in other Canadian provinces and EU member states, serves as a potential model for the adoption of EPR for PPP in Oregon.

2. EPR for PPP: Around the World

Over the past 35 years, a global product stewardship movement has arisen to address the impacts of products and their packaging on the environment. Governments have adopted EPR programs for a range of products, most notably for packaging, electronics, and tires, but also for paint, pharmaceuticals, batteries, mattresses, and other common household items. There are now well over 350 EPR programs worldwide.[27]

The first EPR for PPP laws emerged in Europe in the early 1990s and have since spread around the world. Under these systems, EPR relieves municipalities of the financial and/or operational burdens of collecting and recycling (or safely disposing of) packaging and paper products. Instead, these costs and responsibilities fall to producers and their retail customers in the supply chain, creating a more sustainable and equitable system. Producer responsibility for packaging recycling has also created a stable environment for investment, leading to advancements in hauling, processing, and recycling infrastructure. Once in place, EPR for PPP programs are typically adjusted over time to increase recycling rates and optimize performance. EPR for PPP continues to spread around the world because it is recognized as an effective means for end-of-life management of PPP, and increasingly as a tool for reducing PPP generation.

Origin and Evolution of EPR for PPP in Europe

Long before the China Sword, countries in Europe recognized the benefits of EPR for PPP and incorporated these systems into their overarching waste policies to reach ambitious waste diversion and recycling targets. Germany became the first country in the world to implement an EPR program in 1991,[28] which soon influenced comprehensive regional legislation through the EU's *Directive on Packaging and Packaging Waste* (the *Packaging Directive,* 1994).[29] The *Packaging Directive* set all EU member states on a path to target significant portions of packaging for recycling.

The *Packaging Directive* has been updated several times (2004, 2005, 2013, 2015, and 2018), with the most recent update setting a goal of 65% of all household, industrial, and commercial packaging by weight recycled by the end of 2025, increasing to 75% by the end of 2030.[30] While EU member states were initially presented with a range of policy options for compliance with the *Packaging Directive*, EPR

emerged as the frontrunner due to the success of the established program in Germany. Many member states began passing EPR laws shortly after the *Packaging Directive* took effect.

Germany's Green Dot program, which was an early version of EPR, required producers to pay fees on packaging to defray the costs of municipal collection and recycling programs. The Green Dot symbol was placed on all participating packaging on the market for which producers had contributed recycling funds, although the symbol did not reflect whether the packages themselves were recyclable. The introduction of fees on packaging incentivized producers to use less packaging overall and has resulted in industry contributions to local systems of approximately $13 USD per inhabitant per year as of 2020.[31]



Figure 1: Germany's Green Dot symbol, which was placed on packaging when producers contributed to recycling costs.

Based on Germany's success with the Green Dot, other countries across Europe either directly adopted the program or began enacting their own EPR laws. Some programs offered producers flexibility to decide how best to organize and handle recycling (e.g., Spain),[32] but ultimately every program made producers responsible for meeting the recycling targets mandated by the *Packaging Directive.* One of the most widely acclaimed systems was introduced in Belgium in 1994.[33] This program required producers to form one central organization to handle the collection, sorting, and recycling of household packaging across all three regions of the country (Fost Plus), and a second organization to do the same for industrial packaging (VALIPAC). Both organizations cover a portion of commercial and institutional packaging as well.[34] Belgium's program currently leads others in the EU with a packaging recycling rate of 83% and contamination rates below 10%.[35]

Since the original *Packaging Directive* was enacted in 2004, the EU has passed increasingly prescriptive laws on EPR for PPP, driven largely by calls from producers and member states to create a level playing field across all EU countries, and by broader sustainability goals such as the establishment of a circular economy for plastics and other materials. In 2015, the EU introduced the *Circular Economy Package (CEP)*[36] and the *Circular Economy Action Plan (CEAP).*[37] These were followed in 2018 by the EU's *Strategy for Plastics in the Circular Economy.*[38] The *CEP* and *CEAP* have been vehicles for governments to shift from the "take-make-dispose" economy (also known as a linear economy) to one in which waste and resource use are minimized – a circular economy. Under a circular economy, the value of materials is kept within the economy for as long as possible beyond the end of an initial product's useful life. In the *CEP,* the *CEAP,* and the *Strategy for Plastics,* EPR for PPP is framed as the centerpiece of a circular economy for Europe.

The latest update to the EU's *Packaging Directive* (2018) mandated that EU countries adopt EPR programs for all packaging by December 31, 2024.[39] Packaging is defined in the *Directive* as "all products made of any materials of any nature to be used for the containment, protection, handling, delivery, and

presentation of goods, from raw materials to processed goods, from the producer to the user or the consumer."[40] The new rule formalized and standardized EPR across the EU by introducing minimum EPR requirements, as well as clarifying that producers must accept returned products, take management and financial responsibility for post-consumer waste, and provide consumer education on reusability and recyclability of packaging materials.[41] The *Directive* also emphasized that EPR programs "should help incentivise packaging that is designed, produced, and commercialised in a way that allows its reuse or recovery and that has minimal impact on the environment."[42] For the majority of EU countries that had already implemented EPR for PPP frameworks, the requirement ensured that EPR for PPP would continue to mature and improve with the advent of consistent programs across Europe. In 2021, the EU is expected to amend its EPR requirements to mandate that all plastic packaging is reusable, or is collected, sorted, and sold to existing end markets by 2030.[43]

EPR for PPP has significantly increased recycling rates and reduced public spending on waste management throughout Europe.[44] For example, in Ireland, recycling rates for PPP jumped from 19% in 2000 to 65% in 2017.[45] Over the same timeframe, rates in Spain increased from 40% to 68%, and in Italy from 38% to 67%.[46] Nearly all participating EU countries have achieved PPP recycling rates of at least 60%, with many reaching 70% to 80%.[47] Today, industry is contributing approximately $5.5 billion USD per year for the collection, sorting, and recycling of packaging across Europe, mainly from households.[48]

Adoption of EPR for PPP in Canada

With EPR programs already in place for several products, including tires, electronics, and household hazardous waste (HHW), the concept of EPR for PPP was introduced in Canada in 1996 by the federal government's *Guiding Principles for Packaging Stewardship*,[49] written by the Canadian Council of Ministers of the Environment (CCME). By the early 2000s, Ontario had passed provincial legislation requiring producers to fund 50% of the net reasonable costs (see Key Terms) to operate residential recycling programs. Québec and Manitoba soon followed suit with their own programs partially funded by producers. By 2009, Canada's *Action Plan for Producer Responsibility*[50] had committed (though not legally required) the country to implement EPR for PPP in all provinces by 2015, catalyzing programs in B.C. (2014) and Saskatchewan (2016). Interest in EPR for PPP legislation has also been expressed by municipalities in both Alberta[51] and the Atlantic Provinces.[52]

The 2009 *Action Plan for Producer Responsibility*, adopted by the CCME, was aimed at increasing stagnant recycling rates across many priority product categories (e.g., mercury-containing lamps, HHW, construction and demolition materials, and automotive products).[53] Packaging and printed materials were identified as high-priority products ripe for immediate action, and thus became a primary focus nationwide. A *Canada-Wide Strategy for Sustainable Packaging* was also released by the CCME in 2009.[54] The *Strategy* called for harmonization of EPR for PPP programs across the country and provided guidance on best practices for implementation. More recently, in 2019, the CCME published its *Zero Plastic Waste*

Action Plan,[55] which commits to creating a harmonized approach to EPR throughout Canada. The Canadian Government has highlighted EPR for packaging as a key element in its overarching strategy for addressing plastic pollution.[56]

Spreading Worldwide

Following the success of EPR for PPP in Europe and Canada, similar frameworks have been enacted in countries around the globe (Figure 2). Japan, Brazil, Russia, Chile, Colombia, and Israel have all adopted EPR for various priority products, usually starting with packaging and electronics.[57] Countries continue to adopt EPR for packaging, including China, which recently passed legislation and will implement a program by 2025.[58] India has also passed EPR legislation for PPP, which will take effect in 2020 followed by an expected ban on single-use plastics nationwide in 2022.[59] Some elements of global EPR programs for PPP are unique to developing economies, such as meeting the needs of an informal labor force and lack of capacity for enforcement against producers that violate EPR laws. Nevertheless, in addition to Europe and Canada, EPR for PPP has been operational within Asia, South America, and the Middle East for years, realizing cost savings for municipalities and improved recycling rates.

EPR in the U.S.

In the U.S., there are currently 119 EPR laws in 33 states and the District of Columbia covering 14 products, including electronics, batteries, paint, mattresses, thermostats, and pharmaceuticals. Additionally, laws passed in the 1980s and 1990s require producers in 10 states to manage beverage containers (called "bottle bills" or container deposit laws). These systems are effective at recovering beverage containers and providing high-quality materials to recycling markets. Oregon's beverage deposit system is considered one of the best in the country, reporting return rates of 90%.[60]

Although no U.S. states currently have EPR for PPP programs, legislation has been introduced in multiple states over the past seven years and continues to be a topic of strong interest in state legislatures. EPR for PPP bills have been introduced in the following states in the 2019 and 2020 sessions, with more activity expected:

- Maine passed a "Resolve" in 2019 that required the state's Department of Environmental Protection to propose legislation for EPR for PPP, which has been introduced in the 2020 legislative session.
- New York has introduced bills in both the state senate and state assembly in 2020.
- Massachusetts introduced two bills in its 2019-2020 session, one of which is still being considered in committee.

- Vermont passed a bill that included bans on certain single-use plastics and led to the formation of a Single-Use Products Working Group, which recently published a report recommending that the state consider EPR and other solutions for reducing packaging waste.[61]
- A strong EPR for plastics bill was amended and passed as a study bill in Washington state in 2019, requiring the study back to the legislature in 2020.[62] Washington state also passed a bill in 2019 that created the Recycling Development Center, a new state program focused on policy and other avenues for improving the recycling system.[63]
- California's EPR for PPP bill introduced in 2019 was transformed into recycled content mandates for packaging and ultimately vetoed by the Governor.
- Additional EPR for PPP bills were introduced in Connecticut and Indiana in 2019.

On the national level, U.S. Senator Tom Udall of New Mexico and U.S. Congressman Alan Lowenthal of California have introduced comprehensive legislation with EPR for packaging at its core.[64] As plastics, packaging, and the plight of municipal recycling programs continue to be topics of great interest for U.S. decision-makers, states will continue to introduce EPR for PPP legislation in 2020 and beyond.



Figure 2: Countries that have enacted EPR for PPP laws around the world (in green). (Map adapted from Environmental Packaging International Lorax)[65]

3. EPR for PPP: The Fundamentals

All EPR systems for PPP share the same fundamental principles. Producers take responsibility for the post-consumer management of their products financially and/or operationally. The role of state, national, or regional governments is to set, monitor, and enforce a level playing field among producers. Local governments tend to continue to play a key role as the collection interface with residents, depending on

their capacity and desired outcomes. Under all EPR for PPP systems, municipalities continue serving their residents, for example by providing complementary services such as waste and organics collection, and often providing education and processing.

EPR for PPP is a pillar of waste management around which many complementary policies can be built. Recycled content standards for packaging, ingredient and/or product bans, pay-as-you-throw recycling and disposal programs, and container deposit laws are all complementary programs that can enhance EPR systems. For example, Oregon's statewide *2050 Vision and Framework for Sustainable Materials Management*[66] prescribes a life cycle approach to setting targets for waste reduction and prioritizing various end-of-life management methods. This approach could serve Oregon as an overarching framework within which EPR programs function. Similarly, financial incentives for sustainable design (eco-modulated fees) are an emerging element of EPR for PPP programs that influence upstream decisions to optimize environmental outcomes and minimize impacts.

EPR for PPP: Basic Approaches

EPR for PPP takes many forms as it is adapted for local conditions.[67] However, there are two basic approaches policy makers around the world use to craft EPR for PPP systems: Full Producer Responsibility and Municipal Reimbursement.[68] The primary dimension along which these two approaches vary is the degree to which producers assume financial and operational responsibility for elements of the system.

- *Full Producer Responsibility.* These programs are entirely financed and operated by producers, from collection through the processing and marketing of materials. Under full producer responsibility, vertical integration is built into the value chain. Producers manage the production, distribution, collection, and recycling of their packaging, which tends to result in greater investments in recycling capacity and overall efficiency. Municipalities continue to collect other solid waste, including non-PPP materials, unless industry manages certain materials under other product stewardship programs. Although producers have significant control, local governments may be provided with choices as to the degree of involvement they prefer, such as the following:
  - Full Opt-in: Producers assume full control over the day-to-day operations of the recycling system, including collection, processing, and sale to market buyers. In this case, local governments choose to no longer directly manage PPP recycling services or resident education, although municipalities may choose to partner with producers on outreach and education to residents.
  - Partial Opt-in: Municipalities could choose to continue running collection services, but do so as contractors to a centralized Producer Responsibility Organization (a PRO) under consistent, jurisdiction-wide requirements such as maximum contamination levels and minimum levels of service. In this system, the PRO might offer municipalities a standard payment for

collection services. Payments are often based on data reflecting the average cost for collection services and may not entirely cover a given municipality's expenses.

- **Opt-out:** Municipalities may choose *not* to participate *at all* in the EPR system, even if EPR is implemented within the region and neighboring local governments opt in. If this is the case, municipalities would simply continue to provide existing services to their residents and would not receive funding from producers.

➢ *Municipal Reimbursement.* Under this approach, local governments retain responsibility for collection (and sometimes processing) of PPP materials, and are reimbursed for their net costs by producers. Municipalities continue to control which materials and items are accepted for recycling and to manage staff and day-to-day operations. They may retain direct contracts with haulers and/or processors. In most cases, producers reimburse the majority of municipal net costs, but do not cover costs entirely. For instance, producers may be responsible for reimbursing net recycling expenses based on average costs for all municipalities in a region, but not for expenses above the average. This type of reimbursement calculation is done to incentivize municipalities to control costs. In some programs, producers share expenses with municipalities (e.g., 50/50 or 80/20).

Key Elements of EPR for PPP

Certain elements are standard to all EPR systems, regardless of the materials covered. With input from numerous state and local government EPR experts, PSI developed the *Elements of an Effective EPR Bill for PPP*,[69] which provides options within each standard element based on EPR programs around the world. Key elements include:

Producer Responsibility Organizations (PROs)

Under both full producer responsibility and municipal reimbursement, producers typically organize under structures known as Producer Responsibility Organizations (PROs), which meet regulatory requirements on their behalf. PROs may operate as non-profit organizations or as for-profit entities, although most North American systems prefer or require PROs to be non-profits because of the governments' interest in greater data transparency.[70] Most PROs in the U.S. today that operate EPR programs are non-profits. Some EPR laws require PROs to seek input from multiple stakeholders in the form of an advisory board or committee, which may include representation from local and state governments.

One of the primary functions of PROs is to manage producers' financial responsibilities. This includes setting fees on all packaging and paper materials introduced into the market, which PROs collect from producers. When establishing fees, a PRO may be required to propose a fee structure to the governing authority for approval. In some regions, private sector service providers help PROs calculate and set fees, and often offer a suite of additional services, such as annual reporting. For example, several Canadian

PROs contract with the Canadian Stewardship Services Alliance (CSSA),[71] which provides administration and management services for packaging in multiple provinces. PROs in Europe, as well as several non-European countries and the province of Québec, subscribe to the Extended Producer Responsibility Alliance (EXPRA).[72]

Under full producer responsibility (in which producers finance and operate a collection and processing system for PPP), PROs will contract directly with waste haulers (including local governments) and processors on behalf of member producers. Under municipal reimbursement (in which producers are responsible for reimbursing municipal recycling costs), a PRO may distribute funds directly to municipalities (e.g., Ontario and Manitoba), or through a quasi-governmental agency that in turn distributes funds to local governments (e.g., Québec).

Stewardship Plans

Under most EPR programs, producers are required to submit a stewardship plan, either individually or collectively under a PRO. If producers have formed a PRO, the PRO will submit a stewardship plan on their behalf. A stewardship plan describes every element of an EPR program, including all aspects of a PRO's structure and financing approach. Typically, a draft stewardship plan is submitted to the governing authority (e.g., state, provincial, or national government) for review and approval before the EPR program can be launched. A five-year initial plan is standard, with subsequent plan updates submitted for approval at five-year intervals. A critical element of EPR policies is to allow the governing authority to require changes before a stewardship plan is approved and then at any time throughout the duration of the program if targets are not met or circumstances change in a significant way. Local governments and other stakeholders can also influence the EPR system via the stewardship plan, typically by submitting comments and participating in a stakeholder engagement process.

Covered Materials

Throughout Europe and Canada, EPR programs cover a similar range of PPP, including residential/consumer-facing packaging and printed paper (e.g., newspapers, flyers, and marketing brochures). Packaging is defined by its functions: containment and/or protection of goods. Service packaging designed and intended to be filled at the point of sale (e.g., paper or plastic produce and bulk food bags) is also covered under these programs. **Packaging and paper products are covered under EPR programs regardless of their current recyclability.** In other words, producers pay into these programs for any PPP materials they supply to the market, regardless of whether those materials are currently reused, recycled, composted, or disposed.

Industrial, commercial, and institutional (ICI) packaging is also covered under many European programs, but producers organize under separate PROs for ICI and residential PPP (e.g., Belgium). Most Canadian programs currently cover residential packaging only, but some provincial governments are considering including ICI materials in their programs.[73] Packaging-like products such as sandwich bags, cardboard

moving boxes, and aluminum foil, as well as single-use plastic products such as cutlery and straws, are options to consider in EPR frameworks. Given that residents often place these items in recycling bins, Recycle BC proposed adding them to its program, but the proposal was opposed by the packaging-like product producers.[74] No existing program has incorporated these items.

Internalized Costs

All EPR for PPP programs around the world are financed by "cost internalization" and not point of sale fees (which are called "eco fees" in the U.S.). Under **cost internalization** systems, producers incorporate program costs into their business expenses. Program costs usually include collection, transportation, processing, recycling, and other recovery of PPP. They also include consumer education, program administration, and government oversight. Costs are paid by producers via fees set by the PRO. Fees are typically based on a variety of factors related to costs to manage covered materials in the recycling system, weight, and environmental impacts. They tend to be a fraction of a cent on a per-item basis, such that consumer prices for products have not noticeably risen to cover system costs.[75] Small businesses are typically protected from an undue burden within this system by being exempted if they are below a given threshold (e.g., less than $1 million in annual revenue or one ton of materials supplied per year), or by paying flat fees.

Producers pay material fees to the PRO on all packaging and paper products they supply to the market, regardless of whether the materials are ultimately collected and recycled. Funding from covered materials that are not collected, processed, or recycled is used to cover general program costs as well as to advance the adoption of difficult-to-recycle materials in the system. For example, funds may be used to develop markets for difficult-to-recycle materials to increase their value.

Point of sale fees that flow to the PRO, which are currently part of EPR systems for paint, mattresses, and carpet in the U.S., are not practical for PPP due to the vast number of packaging materials that would need to be itemized on a receipt, many of them a fraction of a cent. Point of sale fees are also not applicable for materials that are distributed rather than sold, such as flyers, because there is no monetary transaction with a consumer during which a fee could be assessed.

In most instances, costs to manage PPP imported from outside the jurisdiction of an EPR program are financed by the importer (i.e., the resident retailer or distributor). One aspect of modern markets that poses challenges to some existing programs in other countries is the purchase of goods through e-commerce.[76] In those countries, online shopping poses legal obstacles to enforcing EPR for PPP schemes, as online retailers may have no physical presence within the jurisdiction of the program and thus evade paying material fees for items they ship directly to consumers. However, following a U.S. Supreme Court decision in 2018,[77] most states have enacted laws to facilitate the collection of sales taxes from remote sellers. This sales tax obligation will enable states to take compliance and enforcement action to ensure that fees that may result from EPR obligations can be collected.[78]

Material Fees

Fees that producers pay usually fall into two types: modulated fees that are based on weight and net recycling costs, and eco-modulated fees that are based on more nuanced factors that attempt to provide an incentive for producers to reduce the environmental impact of their packaging. Early EPR programs routinely used modulated fees as the basis to set fees producers paid on their packaging. However, there is now a significant trend toward building on the basic fees and adding eco-modulated fees to have a greater influence on product design.

Modulated Fees. PROs in Europe and Canada typically calculate material fees based on two basic variables:

- **Weight.** Producers pay fees for PPP based on the total amount of materials they introduce into the market, which is measured by weight.
- **Net recycling costs.** Fees are calculated to cover the cost to manage each material in the recycling system, minus its market value. Materials that are easy to sort at MRFs and have high market value, such as steel cans, often incur lower fees per kg relative to other materials.

For example, in Canada, three EPR for PPP programs use a fee-setting methodology developed by CSSA that apportions system costs across materials in accordance with the costs to manage them, ensuring that difficult-to-recycle materials attract sufficient funds to advance their adoption in the recycling system. This is known as the Four-Step Fee Methodology. CSSA is currently conducting a Material Cost Differentiation study to more accurately assess the cost impacts of materials on the system, which will be a key input to the methodology. [79]

Eco-Modulated Fees. During the last five years, some EPR for PPP programs have evolved beyond modulated fees. **Increasingly, PROs are setting eco-modulated fees that more precisely incentivize upstream design changes to reduce environmental impacts.** Eco-modulated fees incorporate such considerations as:

- **Recycled content.** Producers that use recycled content may receive a bonus, and producers that do not use recycled content may pay a penalty.
- **Greenhouse gas emissions.** PPP materials with lower lifecycle or GHG impacts may incur lower fees.
- **Reusability.** Reusable packaging may be exempt from fees.
- **Light weighting.** Producers that reduce the amount of raw material used in PPP may receive a bonus.
- **Recyclability.** Producers that use widely recyclable PPP may receive a bonus, and producers that use difficult-to-recycle materials may pay a penalty.

For example, France's PRO for PPP, CITEO, has implemented a 50% fee bonus for producers that integrate a minimum of 50% recycled HDPE into LDPE films.[80] CITEO also charges a 10% "malus" fee (beyond the cost to manage the material) for materials (e.g., dark plastics) that are disruptive to recycling systems or are not consistently recyclable.[81] In Québec, the PRO (Éco Entreprises Québec, or ÉEQ) offers a 20% credit to producers for the inclusion of recycled content in certain materials at specified thresholds.[82] ÉEQ also recently established an *Ecodesign and Circular Economy* team that is developing a model to incorporate environmental criteria, such as GHG emissions, into its fee structure.[83] **Eco-modulated fees are expected to spark more upstream design changes in the coming years, and will soon be mandatory in all EU member states.[84]**

Recycling Access

One of the key facets of EPR for PPP is convenient access to recycling for residents at no extra charge. In many cases, convenience standards are set by the governing authority, which can mandate access to curbside pickup or drop-off services for a minimum percent of the population (e.g., 95% of all households). EPR laws typically require producers to meet or exceed existing state and local convenience levels for recycling. For example, producers may be required to preserve and/or expand curbside pickup in places where it exists prior to the implementation of EPR. In locations where there is no curbside pick-up service, EPR systems must maintain or expand the existing level of convenience. In areas without pre-existing services (e.g., subscription customers), residents are provided a level of service consistent with the wider region (e.g., neighboring municipalities). Maintaining convenient access to recycling with minimal service interruptions preserves public trust in the recycling system and is a key requirement in EPR for PPP policies.

Performance Standards

Under full producer responsibility, governments often set ambitious (yet achievable) collection and recycling targets for producers across each material type (e.g., glass, paper, plastic, metal) either through statute or regulations. Alternatively, producers may propose targets in their stewardship plan, subject to approval by the oversight agency. In either case, producers determine how best to meet performance standards. Initial targets are often informed by baseline data and can increase over time. PROs are required to report on their performance annually. Countries or provinces often include audit requirements for data collection and material disposition in EPR for PPP laws to ensure accuracy of progress and performance reports.

Holding producers accountable to numeric performance targets can be challenging if the producers are not managing the system. Under municipal reimbursement, governments are typically unable to set or enforce recycling targets for producers because producers do not have the management authority to make system changes that might improve efficiency or reduce contamination. No existing EPR for PPP municipal reimbursement programs have effectively enforced measurable performance targets for

producers. However, some PROs, such as in Ontario and Québec, offer municipalities incentives and technical assistance to encourage efficiency and enhanced recycling outcomes.

Education & Outreach

PROs often have additional responsibilities for education and outreach under EPR for PPP systems. Under full producer responsibility, producers take a lead role in educating consumers on proper end-of-life management for their products, which may include promoting recycling through social media channels, maintaining a consumer-facing website, and/or producing ad campaigns (e.g., Figure 3). Under municipal reimbursement, local governments retain the responsibility for recycling education and outreach. However, under either approach, **producers and local governments can share responsibility for consumer outreach.** For example, PROs often provide templates that municipalities customize for their own needs. **System-wide educational materials can create more consistency and reduce confusion across a state, country, or region** by unifying messaging across jurisdictions. A main objective of EPR for PPP programs should be cohesive, standardized, region-wide resident education.



Figure 3: Recycling outreach campaign by Recycle BC (the PRO in British Columbia).

In addition to educating consumers, PROs and organizations that serve PROs provide educational resources to producers to encourage packaging sustainability and re-design. For instance, EXPRA has formed a Sustainability and Packaging Working Group to educate producers about packaging design for recyclability and to help producers ensure that their packaging is recyclable.[85] Many PROs offer tools that help producers understand and navigate product and packaging requirements, as well as advice and resources to help them re-design packaging that better meets system requirements (e.g., ÉEQ's OptimEco Kit).[86]

EPR for PPP in Canada: A Review of Four Programs

All Canadian EPR for PPP programs are either fully or partially financed by producers. The Recycle BC program is the only full producer responsibility system in place in Canada, with producers fully financing and operating the program. EPR for PPP programs implemented in Ontario, Québec, Manitoba, and Saskatchewan are all managed by local governments with either full or partial reimbursement from producers. Notably, these programs are all transitioning to EPR systems that provide greater operational authority to producers. Ontario and Québec are both transitioning to full producer responsibility. Four of the five Canadian provincial programs are described in detail below and compared in Table 1.

In Canadian programs, PROs measure program success in part with material recovery rates, which are defined differently in each province (see Appendix A). In Ontario and Manitoba, only materials managed by recycling are considered recovered. In Québec and B.C., as in the U.S., materials converted to engineered fuel and managed in other ways (e.g., disposal) are included in the calculation of recovery rate, although these tend to be minimal components of the overall program. As in all recycling programs around the world, some collected materials cannot be recycled, including both accepted materials that are contaminated or broken (e.g., glass) and non-accepted materials. Given the variability across programs in definitions of recovery and priorities for materials management, extracting comparable PPP recycling rates remains a challenge. Recycle BC does report the percentage of materials that are truly recycled (i.e., sold to recycling markets), converted to engineered fuel, and disposed (see Table 3).

Ontario

Ontario is the birthplace of curbside recycling. The program first emerged as an industry and government funded pilot in 1981.[87] By 1994, most municipalities in Ontario were required by the provincial government to implement curbside recycling, referred to as the Blue Box Program.[88] (For the full list of covered materials, see Appendix B.) Additional requirements were introduced over the last decade for the provision of collection infrastructure in public spaces, and remain in effect today. Provincial EPR for PPP began under the *Waste Diversion Act* (2002),[89] which required producers to fund 50% of the net Blue Box Program costs (a model referred to as "shared cost"). In 2019, the 50% funding level total for producers amounted to approximately $97 million USD.[90] Producers contributed these funds through their PRO, Stewardship Ontario.



Stewardship Ontario currently sets material fees for producers based on the recycling rate and net cost to manage each material.[91] This fee structure is designed to fairly allocate costs across designated materials. It incorporates data from material composition studies conducted curbside and at MRFs, as well as studies that estimate the costs to handle materials from collection through transfer, sorting, and processing.

The EPR for PPP program in Ontario is set to transition from a shared cost model to full producer responsibility. A new oversight body established by the Ontario Government, known as the Resource Productivity and Recovery Authority (RPRA), is overseeing the transition. Until the transition to full producer responsibility is complete at the end of 2025, RPRA is responsible for setting the amount producers are required to pay municipalities. The 50/50 shared cost model is still in place, with costs based on collection data provided by municipalities and adjusted for best practices. There are currently no legally mandated recovery or recycling performance targets for municipalities or producers.

Table 1: Comparison of Key EPR Elements Across Select Canadian EPR for PPP Programs

Key Element	Ontario	Québec	Manitoba	British Columbia
EPR Approach	Municipal Reimbursement*	Municipal Reimbursement*	Municipal Reimbursement	Full producer responsibility
PRO (primary)	Stewardship Ontario	Éco Entreprises Québec (ÉEQ)	Multi-Material Stewardship Manitoba (MMSM)	Recycle BC
PRO structure	Not-for-profit	Not-for-profit	Not-for-profit	Not-for-profit
Covered Materials *(See Appendix B for full lists)*	Residential PPP (liquor bottles covered in deposit program)	Residential PPP (soda and beer bottles covered in deposit programs)	Residential PPP (includes most containers)	Residential PPP (most beverage containers covered in deposit programs)
No. of Registered Producers	1,900	3,400	796	1,176
% of Producer Funding	50% of net reasonable costs* (see Key Terms)	100% of net reasonable costs* (see Key Terms)	80% of net reasonable costs (see Key Terms)	100% producer financing and management
% of Households with Recycling Access (curbside & depots)	94%	99%	94%	98%
No. of Participating Municipalities	245	568 [92]	144	169
Recovery Rate (& how defined)**	61% (recycled tonnes / generated tonnes)	63.6% (collected tonnes / generated tonnes)	84.4% (recycled tonnes / market supply)	78.1% (net collected tonnes / market supply)
Legal responsibility for performance targets	N/A (no performance targets mandated)*	Municipalities*	N/A (no performance targets mandated)	Recycle BC
Education & Outreach	Municipalities lead; Stewardship Ontario voluntarily supports with regional ads & social media	Municipalities lead	Municipalities lead; MMSM provides customizable print materials & funds some local campaigns	Recycle BC leads; runs province-wide and targeted campaigns; coordinates with service providers

**The Ontario and Québec programs are shifting to full producer responsibility – see "Ontario" and "Québec," above.*

***Each province calculates recovery rates differently, which makes direct comparisons across programs difficult for this metric. Here, "generated tonnes" refers to metric tons derived from waste characterization studies, while "market supply" refers to metric tons supplied to the market, as reported by producers. Recycle BC reports "net collected tonnes" because the system integrates materials covered by multiple stewardship programs (e.g., beverage bottles and newspapers), and the PPP recovery rate is corrected for these materials. For more information on each province's recovery rates and how they are calculated, see Appendix A.*

Ontario's EPR for PPP system is changing because producers and municipalities alike recognize the need for a reboot. Despite numerous successful initiatives by Stewardship Ontario, such as a Continuous Improvement Fund[93] to assist municipalities in optimizing recycling performance and efficiency, investments in local recycling markets to improve plastics recycling, and comprehensive technical support for producers, Ontario's system continues to face many challenges. By 2016, recovery rates had stagnated at an average of 60% across materials for over 10 years, with some hard-to-process materials recycled at rates less than 10%.[94] Although there are no legal performance requirements for municipalities or producers under the current system, all parties agree that improved recycling outcomes are necessary given increasingly tight global markets and growing public pressure to address waste. Tired of paying for the system without the operational control to reduce costs and increase performance, producers were ready for a change. As expressed in Stewardship Ontario's 2018 annual report:

> *"The current shared responsibility model for Ontario's Blue Box Program is inadequate. It fosters system fragmentation by leaving operational decisions to individual municipalities. Across Ontario there are hundreds of different recycling programs, meaning decisions are localized and disconnected. This fragmentation creates confusion for consumers; businesses have no way of influencing local programs and therefore do not fully engage on packaging design choices; and essential economies of scale cannot be achieved to support a circular economy because uncertainty deters investment in new processes and systems."* [95]

Ontario's *Resource Recovery and Circular Economy Act* (2016),[96] which was supported by municipalities as well as producers, created a province-wide framework for more robust EPR across all targeted products. With PPP materials evolving, markets shrinking, and public demand growing, municipalities undertook negotiations with producers and reached agreement in 2019 to transition to full producer responsibility for the province under the *Act's* framework.[97]

The Ontario Government intends to consult on a new Blue Box Program regulation in 2020 that will solidify the province's transition to full producer responsibility. Under the new system, producers will be financially and operationally responsible for PPP collection, sorting, transportation, and processing. Materials accepted in the Blue Box Program will be standardized across all municipalities within the province. The changes will enable the government to set enforceable waste diversion targets for the first time. It is anticipated that producers will be legally responsible for achieving these targets. The transition will be complete by 2025, with some municipalities and First Nations transitioning by 2023.[98]

Under Ontario's new system, producers will register directly with RPRA, which is a delegated administrative authority (DAA) for the Ontario Government with staff who are authorized to act as enforcement officers. Stewardship Ontario will be dissolved as a corporation, and one or more new PROs will be formed. Over the next three years, the Ontario Government will consult with stakeholders to address issues such as how to create a standard list of materials to be collected, what performance

targets should be included, the setting of minimum levels of accessibility, and the service standards to be met by producers to ensure a smooth transition. Local governments will have the opportunity to bid on collection services for PROs if they wish to continue providing these services.[99]

Québec

Québec's EPR for PPP system launched in 2005. (For the full list of covered materials, see Appendix B.) Under this system, producers reimburse municipalities for their net reasonable recycling costs (i.e., municipal reimbursement). Initially, producers were responsible for 50% of recycling costs, similar to Ontario, but the program gradually transitioned to a greater share of producer funding. Since 2013, producers have reimbursed 100% of net reasonable municipal costs in Québec, as determined by the quasi-governmental agency, Recyc-Québec. Curbside collection and sorting are managed directly by municipalities, either in-house or by contract with private collectors. There are two PROs managing PPP materials: RecycleMédias, which oversees newspaper recycling, and Éco Entreprises Québec (ÉEQ), which oversees all other covered materials.

Municipalities report the net costs of their recycling operations to Recyc-Québec, which then determines the level of financial reimbursement required by producers. Recyc-Québec calculates the average municipal cost for groups of programs serving similar population sizes and located at similar distances to major metropolitan areas. Municipalities are reimbursed based on the average cost within their group, which creates a financial incentive to control costs. A flat percentage (currently 6.45%[100] and adjusted periodically based on waste studies) is also deducted from net costs to account for materials collected by municipalities for which producers are not responsible (e.g., items subject to the bottle deposit program that residents place in curbside recycling rather than redeem for deposit). In 2019, ÉEQ reimbursed municipalities a total of $136 million USD.[101]

ÉEQ collects fees from producers and submits them to Recyc-Québec for distribution to municipalities. Each year, ÉEQ undertakes a consultation process with producers to create a Schedule of Contributions outlining all material fees (see Appendix B).[102] Fees in the Québec program are modulated, accounting for weight, collection rates, and the net costs of managing each material in the system. For example, those materials with high collection rates and low management costs will pay less than those with low collection rates and high management costs. The average fee is $220 USD per metric ton put onto the market.[103]

ÉEQ also provides services to producers beyond setting fees, such as case studies and tools to encourage best practices in both recycling operations and packaging design, and a phone service offering free direct support. To enhance system performance, the PRO facilitates investment in research and optimization for material-specific recycling technologies and end markets. For example, the producer-funded Innovative Glass Works Plan[104] was launched in 2016 to improve purity in recycled glass streams and develop markets for 100% of collected glass. ÉEQ also funded the region's first study of the economic opportunities and impacts of the local circular economy.[105]

In 2011, the Quebec Government established a 70% target recovery rate for paper, cardboard, plastics, glass, and metals in its *Residual Materials Management Policy Action Plan,*[106] with primary responsibility for achieving these targets resting on municipalities. However, the average recovery rate across materials in Québec remains at 63.6%.[107] ÉEQ has noted that improvements to education and outreach, as well as investments in end markets, are still needed to improve this rate.[108] But one of the greatest challenges to the Québec system is its legal structure, with municipalities still making individual decisions as to which PPP items are collected, and producers are not legally obligated to achieve any performance measures. As in Ontario, this framework has perpetuated a fragmented system, with inconsistent collection lists and public education across the province.[109] ÉEQ has struggled to achieve a streamlined, modernized processing network, significantly reduce contamination, and achieve efficiencies at scale due to such inconsistencies, which are outside the PRO's control.

Éco Entreprises Québec

As in Ontario, producers in Québec expressed a desire for more control over curbside collection and sorting. To this end, Québec created an "action committee for the modernization of waste recovery and recycling,"[110] with objectives to:

- Define new roles and a new model for shared responsibility for the actors in the packaging value chain, and
- Determine measures to improve the current system's performance.

As a result of the PRO's recommendations and the committee's work, the program will transition to full producer responsibility.[111] Proposed elements of a new program include standardization of collected materials province-wide, a greater emphasis on eco-design for packaging, and increased development of local markets for recycling materials.[112] Under the new regulations, ÉEQ anticipates that it will assume legal responsibility for achieving recovery targets and other program performance metrics.[113]

Manitoba

Manitoba's EPR for PPP program is managed by two PROs: Multi-Material Stewardship Manitoba (MMSM) and the Canadian Beverage Container Recycling Association (CBCRA). MMSM is responsible for most PPP materials and reimburses municipalities for 80% of their net reasonable recycling costs (i.e., municipal reimbursement). Under this system, local governments are responsible for both curbside collection and drop-off facilities, as well as materials sorting. The program was launched in 2010 by the *Waste Reduction and Prevention (WRAP) Act*[114] and subsequent *Packaging and Printed Paper Stewardship Regulation.*[115] While these regulations required producers to establish the program, they did not set specific recovery or program performance measures for either producers or municipalities. The Environment Minister reserves the right to issue guidelines regarding performance requirements or recovery targets for any specific materials, but thus far such guidelines have only been issued for plastic

bags.[116] In practice, MMSM proposes program targets in its *Packaging and Printed Paper (PPP) Program Plan,*[117] which are negotiated and ultimately approved by the Minister. In 2017, MMSM reported an 84.4% recovery rate across materials, which include containers that are covered by deposit programs in other provinces.[118]

While the Manitoba system uses a municipal reimbursement approach, municipal programs must meet certain efficiency requirements to receive producer funding. Municipalities are also required to consult with MMSM before making any changes to their recycling programs that would have significant cost implications.[119] MMSM sets fees based on the costs to recycle materials, as described earlier. Producers supplying difficult-to-recycle materials will pay relatively more for their products because the fee structure assigns revenues only to materials that earn them (i.e., are sold to recycling markets) and assigns additional costs to difficult-to-recycle materials to invest in new options for their end-of-life management.

MMSM assists municipalities with contractual arrangements and equipment purchases and in other ways that improve overall system efficiency and cost savings. MMSM also invests in education and outreach by providing municipalities with a customizable recycling guide and customizable posters, and funds recycling campaigns in various municipalities each year to help spread consumer awareness and drive traffic to consumer-facing websites (e.g., Figure 4). In addition, the PRO undertakes province-wide initiatives, such as a 2016 plastic bag reduction campaign.[120] However, municipalities retain primary responsibility to ensure consumers comply with recycling rules.



Figure 4: Sample outreach materials produced by MMSM.

Overall, MMSM has achieved a high recovery rate across materials. Even so, direct comparison with recovery rates in other provincial EPR programs is challenging due to differences among programs, including how recovery is calculated (Appendix A) and what materials are collected. Population size and density are also likely factors impacting recovery rates (Manitoba's population is approximately 1 million people compared to 5.1 million in B.C., 8.5 million in Québec, and 19 million in Ontario). Additionally, MMSM collects most bottles and beverage containers sold in the province (which does not have a bottle deposit program), and the recovery rate accounts for these containers. By contrast, all four other provinces with EPR for PPP programs in Canada have at least some portion of bottles covered by deposit schemes, and those containers are not reflected in their recovery rates.

British Columbia

The first EPR program in B.C. was launched for paint in 1994.[121] In 1997, producers began the Beverage Container Stewardship Program,[122] covering ready-to-drink beverages. In 2003, B.C. adopted the *Environmental Management Act (EMA)* to streamline EPR and expand producer responsibility to more product categories. The *EMA* provided a legal framework for waste management throughout the province. In 2004, the B.C. Ministry of the Environment developed the *Recycling Regulation* to implement the *EMA*, which required producers of many product types to submit stewardship plans to the Ministry and obligated them to achieve target material recovery rates of at least 75% (described below). One of the main features of the *Recycling Regulation* is the requirement for producers to take "full producer responsibility" for the end-of-life management of their products.[123]

While the *Recycling Regulation* broadly established EPR in B.C. in 2004, PPP was not listed as a designated product until 2011. Producers formed the PPP PRO, Multi-Material BC, shortly thereafter, and launched the EPR for PPP program in 2014. In 2017, Multi-Material BC was rebranded as Recycle BC. **Recycle BC was the first PRO to operate a full producer responsibility program for PPP in Canada.** Two additional PROs manage PPP materials in B.C.: Brewers Recycled Container Collection Council (BRCCC), which primarily handles beverage bottles (see A Note on Bottle Bills, below) but also collects the cardboard cases and boxboard cartons used to package glass bottles and metal cans,[124] and News Media Canada (NMC), whose first stewardship plan for the management of printed newspapers throughout the province was approved in 2017.[125] NMC relies on Recycle BC as a service provider. Newspapers are collected together with other PPP materials using Recycle BC's existing infrastructure throughout the province.

On behalf of producers, Recycle BC is responsible for residential collection services across the province, as well as materials processing and marketing collected materials to end users. (For the full list of materials collected by Recycle BC, see Appendix B.) Recycle BC's EPR for PPP program currently serves more than 1.8 million single- and multi-family households.

Under the Recycle BC framework, local governments and First Nations are provided flexibility to choose from among three options for participation in the EPR program (akin to the options outlined in EPR for PPP: Basic Approaches, above):

- **Opt for Recycle BC to Directly Manage Collection ("Full Opt-in")**: In this case, local governments elect to have Recycle BC directly manage their curbside recycling service. These local

governments are no longer responsible for oversight or management of recycling services or resident education.

- Participate as Collectors Under Contract to Recycle BC ("Partial Opt-in"): Local governments choose to deliver recycling collection services to their residents under commercial contract to Recycle BC. In this case, local governments must meet Recycle BC's collector qualification standards. Collectors are paid incentive rates for their services,[126] and Recycle BC is responsible for processing and marketing collected materials. This option tends to be favored by local governments because it enables them to bundle services (e.g., recycling, garbage, and organics collection).
- Opt-out: Local governments elect to maintain the status quo and do not receive funding from Recycle BC. Instead, they continue to manage their own recycling services outside of the Recycle BC program.

When the program first launched in 2014, Recycle BC made initial offers to local governments across the province. Most chose to accept these offers and act as collection service providers for the PRO ("partial opt-in"). While few local governments initially chose to turn collection over to Recycle BC ("full opt-in"), as the program was still unfamiliar, only a handful (less than 10) opted out entirely. Over time, interest and trust in the program has expanded. As of 2020, some local governments have transitioned from partial to full opt-in, and several that initially opted out have now transitioned to partial opt-in. While most local governments continue to operate as collectors under contract to Recycle BC (partial opt-in), the local governments that have fully opted in contain over half of the province's population.

The reasons municipalities made their choices depend on their priorities. For example, a community acting as a collector for Recycle BC (partial opt-in) might want to use their existing trucks to collect both garbage and recycling. Several local governments, especially in the province's large population centers, have transitioned to direct management by Recycle BC ("full opt-in"). Some of these communities chose this option from the start to obtain greater net benefit by reallocating funds saved on municipal recycling to other environmental priorities, such as organics collection, while others that initially acted as service providers have since transitioned to direct management (full opt-in). The City of Vancouver, for example, initially acted as a collection service provider for Recycle BC. In 2015, faced with prohibitive costs to replace its collection fleet,[127] the City decided to have Recycle BC directly manage its curbside and multi-family recycling services. Recycle BC now contracts with commercial haulers for collection services previously provided by City of Vancouver employees, thus significantly expanding local opportunities for private collectors.

Looking to the Future

Ten years after the passage of the CCME's federal *Action Plan for Producer Responsibility,* Canada's provincial EPR programs are evolving. A new national *Zero Plastic Waste Action Plan* has committed the CCME to harmonizing EPR for PPP across the country, and the trend is clearly toward full producer responsibility. Producers are increasingly driven to expand and improve recycling as public pressure to solve the waste crisis continues to grow. Public commitments by many household brands are motivating these companies to invest in the recyclability of their products and packaging. EPR has shown promise as an effective approach to achieving their goals in Canada.

Under full producer responsibility, producers have greater incentive – and the means – to increase the performance and efficiency of recycling systems. They are also legally responsible for program performance, which helps to ensure success. With control over operations, producers can increase the quality of collected materials, decrease contamination, and cultivate recycling markets. Canadian officials have stated that assigning full accountability to PPP producers throughout Canada is viewed as the best path forward to create a coordinated, cross-regional system that can stimulate investment at scale.[128] Provincial governments and producers are both looking to the full producer responsibility approach to enhance material collection, reduce waste and carbon emissions, and supply businesses with a reliable, high-quality stream of resources to return to the circular economy.

A Note on Bottle Bills

Many Canadian provinces have long-established container deposit laws that require producers to provide infrastructure for bottle collection and impose deposits on consumers who purchase these products. As EPR for PPP has spread across the country, provinces have largely kept these programs separate from container deposit programs. While each province operates slightly different container deposit and EPR programs, the two systems have been able to work in harmony alongside one another in each province.

For example, in Québec, soda bottles are managed by the producer organization Boissons Gazeuses Environment, while beer bottles are managed by brewers, as well as by Recyc-Québec. All deposit containers can be returned at the point of sale by consumers wishing to redeem their deposits.

In Ontario, EPR first emerged as a means for producers to avoid expansion of the provincial container deposit system[129] (i.e., producers agreed to contribute funding to the Blue Box Program because the Ontario Government was considering expanding requirements for consumer-paid deposits). As the Blue Box Program transitions to full producer responsibility, bottles not covered by the existing container deposit law will continue to be collected by producers in curbside bins, while long-covered alcohol containers will remain under the existing bottle deposit scheme.

In B.C., two PROs operate deposit systems for bottle returns. BC Brewers Recycled Container Collection Council (BRCCC) covers most domestic beer and cider brands, while Encorp Pacific covers all other beverage containers that are subject to a deposit, including wine, spirits, and non-alcoholic beverages. Bottles are returned at retail locations as well as drop-off depots managed by Encorp Pacific. Recycle BC earns the deposit value of any beverage containers that flow through its system (i.e., bottles that wind up in curbside bins or at Recycle BC's collection depots) and uses these funds to offset gross system costs. No fees or refunds are remitted to municipalities from bottle deposits because the container deposit systems are entirely managed by B.C.'s beverage PROs.

In Manitoba, consumers do not pay deposits on beverage containers, but there is a two-cent visible fee applied at point of sale for beverage containers that is used to fund and recover containers in both residential and away-from-home locations.





4. British Columbia: A Case Study

PSI examined the EPR for PPP program in B.C. in detail because it is one of the more recently established programs in North America and was designed with the benefit of knowledge gained through many other programs. It is also the only full producer responsibility program operating in Canada for PPP. This case study provides further insight into the operational elements of the B.C. program. (For background on Canadian EPR programs and the evolution of EPR in B.C., see EPR for PPP in Canada: Five Provincial Programs, above).

Governing Structure

Producer Responsibility Organization (PRO)

As described earlier, Recycle BC carries out producers' responsibilities for the collection of PPP materials from consumers, the processing of these materials, and the sale of materials to recycling markets. Recycle BC manages curbside collection and drop-off depot locations through contracts with haulers, private depots, or local governments. The B.C. program offers flexibility for local governments to participate to varying degrees in the EPR for PPP system, either turning the management and financing of residential collection over to Recycle BC or continuing to collect materials and receive a payment for each household served.

For municipalities that have chosen to act as collection service providers to Recycle BC, payments are distributed directly to local governments by the PRO. Recycle BC pays municipal collectors based on the number of households served, with some variation based on factors such as whether municipalities choose to offer single- or multi-stream collection, and household/population density. As of 2018, payments ranged from $25 to $33 USD per household for curbside collection.[130]

All collection providers, including local governments, private companies, and non-profits, must meet certain qualification standards, such as providing collection service on a consistent schedule and furnishing residents with collection containers of sufficient size.[131] Collectors work under a Master Service

Agreement with Recycle BC.[132] Each year Recycle BC assesses collection needs and may add collection providers to its network.

Recycle BC is informed by an Advisory Committee with representatives from industry and local government.[133] The Committee meets four times each year to discuss core elements of the program, identify and resolve issues, and provide feedback and recommendations to the PRO.

Investments in Infrastructure

The transition to full producer responsibility in B.C. was relatively smooth for collectors. As previously described, municipalities had the option to continue providing collection services, and any collection providers in the province signed agreements with Recycle BC to ensure consistent service standards for all residents. In terms of post-collection, implementation of the Recycle BC program led to significant investments in processing infrastructure. At the start of the program, Recycle BC published a Request for Proposals (RFP) for post-collection transport and processing services. The RFP divided the province into several regions, so that bids from smaller operators could remain competitive (i.e., so as not to force small, local operators to compete with larger-scale, regional companies). Waste management companies had the option to provide proposals for multiple zones to achieve efficiencies of scale.

During that procurement process, three of the largest industrial recyclers in the province (Cascades Recovery, Emterra Environmental, and Merlin Plastics) joined together to form a private consortium called Green By Nature (GBN).[134] GBN consulted with MRF operators and haulers across the province and secured agreements from a significant number of them to sub-contract within their networks, enabling GBN to submit a proposal to serve the entire province. **This efficient use of existing infrastructure, as well as the partnership created with sub-contractors, allowed small operators to maintain their role in the system and insulated the region from job loss and stranded assets.** More than 20 subcontracted businesses, local governments, and non-profits currently operate approximately 32 receiving, consolidation, and transfer facilities (RCTs) and 11 pre-conditioning facilities (PCFs) on GBN's behalf (Figure 5).[135]

With its post-collection contract set to expire in 2020, Recycle BC developed a new RFP in 2019 after consulting with several waste management companies (local, national, and international) in a "market-sounding exercise." Ultimately, Recycle BC outlined several desired outcomes of the procurement process, including:

- Prioritizing local recycling markets;
- Fostering investment in recycling infrastructure;
- Enhancing system efficiency;
- Delivering clear and transparent business processes; and
- Encouraging on-going innovation and technology investments.

In late 2019, Recycle BC announced that it had signed an agreement with Canada Fibers, Ltd. to assume its post-collection work (receipt, transportation, processing, marketing, and reporting of the materials that Recycle BC collects).[136] Under the new agreement, Recycle BC intends to process more materials in North America, especially fiber. Canada Fibers plans to make significant investments in recycling infrastructure in B.C., including investments in new technology, facilities, and processing capability.[137] Over the coming months, Canada Fibers will develop agreements with receiving facilities that will serve as the backbone of the post-collection network. Much like the current system, Canada Fibers will seek to partner with local and regional facilities to develop an efficient supply chain and optimize use of existing infrastructure.

Stable funding and regional consistency spurred unprecedented levels of investment in recycling across B.C. To launch the program, Green By Nature invested approximately $25 million USD into B.C.'s recycling infrastructure .[138] A portion of this funding enabled Merlin Plastics to build a $15 million USD container recovery facility (CRF) specifically designed to meet the demands of the province's anticipated recycling growth, with enough capacity to process all containers (of all material types) collected throughout the province. The CRF, which was the first of its kind in North America, used the most advanced technology available in the recycling industry to maximize sorting efficiency and the quality of each material stream.[139]

Market stability created by the EPR program also resulted in a secure environment for small haulers, MRFs, and local governments to make voluntary upgrades to equipment and systems with little market risk. Investments in infrastructure and harmonization of collected materials across the province allowed local operators to handle increased volumes of material and to optimize their roles based on their unique capabilities and specializations. At the municipal level, some communities were able to redirect resident taxes that were no longer needed for recycling collection into complementary collection services, such as organics composting, while others simply reduced taxes for their residents overall.[140] Since the program's inception, producers have provided $312 million USD to manage residential PPP across the province.[141]

Having the option to participate in a producer-funded system enabled curbside recycling for many communities across the province for the very first time. Within one year of Recycle BC's launch, 20 communities and First Nations had new curbside recycling programs, including Prince George, which has a population of over 85,000.[142]

Stewardship Plan

Recycle BC initially submitted its *Packaging and Printed Paper Stewardship Plan* in 2012 to the B.C. Ministry of Environment for approval. As required by law, the PRO consulted with stakeholders prior to submitting the plan. Final approval for the program was granted in 2013.[143] The plan covered all elements of the proposed EPR framework for the region, including the formation of the PRO, covered materials, the proposed program structure, and performance measures to be reported annually over five years. In 2016,

the plan was updated ahead of schedule to account for the program's growth during its first two years of operation. Local governments that had initially declined to participate in the system had been placed on a waitlist while Recycle BC built capacity to accommodate their needs. The updated plan outlined a process for adding these municipalities to the program.[144]

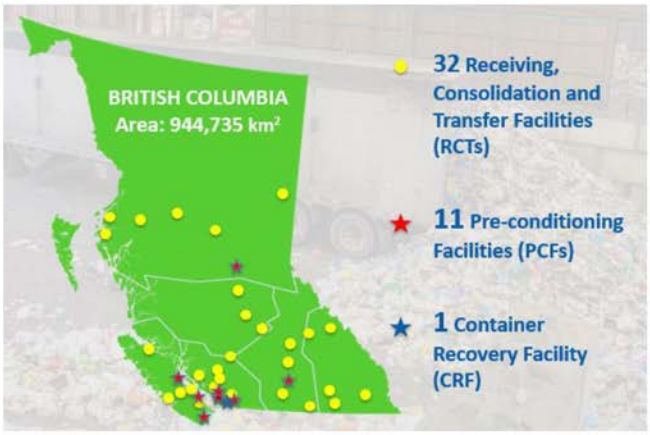


Figure 5: RCTs and PCFs throughout B.C., as well as a new CRF provided by Recycle BC. Image courtesy of CSSA.

Recycle BC began the process of consulting on a revised plan by hosting a stakeholder workshop over two days in November 2017 and completing multiple rounds of stakeholder consultation through September 2018. Local governments, haulers, processors, and producers provided feedback to inform the revised plan prior to its submission. The revised *Packaging and Paper Product Extended Producer Responsibility Plan* for Recycle BC was approved in June 2019.[145] The revised plan lays out a renewed vision that includes geographic expansion and special projects, continued reduction of contaminants, and technical innovation for difficult-to-recycle materials. The plan also highlights consistent metrics for reporting recycling performance on a material-specific basis, including material-specific recovery targets and recycling performance targets in specific sub-categories, with an emphasis on plastics.

Collected Materials

One of the most transformative aspects of EPR for PPP in B.C. has been the introduction of Recycle BC's standardized list of collected materials, which has enabled the PRO to meet and exceed the initial government-mandated 75% recovery rate, achieve relatively low contamination rates, and successfully market its collected materials. Prior to the implementation of EPR for PPP, local governments made

individual decisions about what to collect based on capacity, existing technology, costs, and other individualized factors, which led to inconsistencies between municipalities and resident confusion.

All types of packaging and printed paper are covered under the EPR for PPP system in B.C., regardless of their material content. B.C.'s *EMA*[146] and *Recycling Regulation*[147] set the definitions of packaging and paper products. The *EMA* defines packaging as "a material, substance or object that is (a) used to protect, contain, or transport a commodity or product, or (b) attached to a commodity or product or its container for the purpose of marketing or communicating information about the commodity or product."[148] Schedule 5 of the *Recycling Regulation* defines paper as "paper of any description," including flyers, brochures, catalogues, phone books, and other paper materials[149] (see Appendix C for the full definitions of packaging and paper products).

Recycle BC's *Stewardship Plan* further clarifies the definition of packaging that is covered by the program with a **list approved by the B.C. Government via the approval of the *Plan*.** The list encompasses consumer facing primary, secondary, and tertiary packaging, as well as certain single-use and carry-out items such as grocery bags[150] (see Appendix C for details). Certain items may be excluded from collection if they are agreed upon by the PRO and the Ministry; for example, Recycle BC does not currently collect the following items, although producers must still pay fees on them:[151]

- Plastic-lined paper;
- Paper-lined plastic;
- Biodegradable and/or compostable plastic;
- Vinyl; and
- Plastic squeeze tubes.

Fees paid by producers on materials that are not collected are used to cover program costs, including operational, administrative, and educational expenses, as well as dedicated projects initiated to advance the recyclability of these materials in the system (as described below).

Additionally, Recycle BC has implemented location-specific and material-specific requirements where necessary. Foam (packaging, containers, trays, and cups) is only accepted at drop-off depots.[152] Curbside glass collection is only available in a select number of municipalities that choose to collect it, and glass is required to be separated from other recyclables to reduce contamination in other collection streams. If residents mistakenly include glass in their curbside bins, haulers do not pick up these materials, but instead leave educational tags to explain why they have been left behind. Glass packaging not collected curbside (and not covered under the province's two bottle deposit programs) is accepted at Recycle BC depots. These and other specific material considerations are included in the PRO's *Stewardship Plan*. **Since only a handful of materials are not collected by Recycle BC, consumer recycling guides are clear, simple, and uniform throughout participating communities.** As previously mentioned, beverage

containers (both alcoholic and non-alcoholic) that are subject to a deposit are managed under a separate producer-run system and are therefore not covered under Recycle BC's EPR for PPP system (see A Note on Bottle Bills, above).

Recycle BC has launched multiple pilot programs to expand the number of materials it collects. While the program already accepted plastic bags and overwrap at drop-off depot locations, in 2018 Recycle BC introduced the material category Other Flexible Plastic Packaging (OFPP) through a pilot program, and officially added the category as a part of its accepted materials in January 2019.[153] Examples of OFPP include stand-up zipper lock pouches (e.g., pouches for granola, frozen berries, etc.); crinkly wrappers and bags (e.g., coffee bags, chip bags); flexible trays with a peel-off seal (e.g., packaging for fresh pasta or pre-packaged deli meats); non-food protective wrap (e.g., bubble wrap or plastic envelopes); and net bags for produce. Items in this category are currently only accepted at drop-off depots and certain return-to-retailer locations. Recycle BC also conducted a pilot program in the City of Coquitlam for the collection of plastic squeeze tubes in 2018 (placed curbside in a special bag; see Figure 6), but these have not yet been added to the program's province-wide accepted materials list.[154]



Figure 6: Plastic squeeze tube pilot, 2018

The program has also included various special projects to expand collection mechanisms, including a streetscape collection program piloting various PPP collection bins on public streets and park pathways. Recycle BC funded this project to develop a proof of concept for streetscape PPP collection so that in the future it can include public collection bins among the services it offers.

Internalized Costs

As with all EPR for PPP programs, producers in B.C. do not apply material fees as point of sale charges. Instead, fees are internalized by producers as part of the cost of doing business. Recycle BC has well-established methodologies for setting producer fees, which were developed in partnership with CSSA. Fees are calculated annually by the PRO and paid by producers on an annual or quarterly basis.[155] (The latest fee schedule for Recycle BC is shown in Appendix B.)

Smaller businesses, if they supply fewer than 2,200 pounds of PPP to the B.C. market annually or earn less than $1 million CAN ($765,000 USD) in annual revenue, are exempt from the system altogether. Businesses producing between 2,200 pounds and 33,000 pounds annually may qualify to pay flat fees to

avoid undergoing the fee calculation process. Recycle BC provides an online assessment tool to help small businesses determine whether they are eligible for flat fees.[156]

Under B.C.'s system, material fees paid into the system by producers increased by an average of 26% between 2019 and 2020 due to the China Sword policies taking effect in 2018 (the highest increase since the start of the program). Despite this increase, consumer impact has been less than one cent per household item, and consumers in B.C. have not changed their purchasing behavior since the implementation of EPR.[157] Thus far there is no evidence that producers have passed their costs to consumers.[158]

Modulated Fees

Recycle BC uses CSSA's standardized Four-Step Methodology to calculate material fees. As described above, this fee formula is designed to ensure that all covered materials contribute to the system, even when they are not yet recyclable, by allocating a portion of overall program costs to materials based on the quantities supplied by producers. Additional costs are imposed for materials that are difficult-to-recycle, and revenues are only credited to materials that have adequate market value.

Performance Standards

B.C.'s *Recycling Regulation* requires producers to achieve "any performance measures, performance requirements, or targets" for each material that may be specified by the B.C. Government.[159] These parameters are finalized through the approval of the *Stewardship Plan*. Recycle BC proposes targets and performance measures within its plan and the Province amends and ultimately approves these measures once they are deemed satisfactory.

Recycle BC measures its performance based on several metrics, including recovery rate. This rate is calculated by dividing the net tonnes (metric tons) of PPP materials collected by the total amount of materials supplied to the market, as reported by producers (referred to as "generated tonnes" in Table 2, below). For this calculation, net tonnes are gross collected tonnes minus materials collected on behalf of other stewardship programs, such as beverage bottles and newspapers. Currently, Recycle BC has a mandated target recovery rate of 77% across materials, which will increase to 78% in 2022. In 2018, the PRO reported a 78.1% recovery rate.[160]

In Table 2, each material category managed by Recycle BC is listed individually. Contaminants are collected materials that are not accepted or covered by the program. For instance, a resident may include scrap metals in their curbside bin, such as metal pipes, which are not PPP materials and are not accepted as part of the EPR program. These materials are included in net tonnes collected because Recycle BC still collects them and makes every effort to recycle or otherwise manage them if they make their way into the system. Although the metal pipes are counted as a contaminant even if recycled, they are not included in the program recycling rate since they are not a covered PPP material on which producers pay

a fee. Contaminants that are unable to be recycled and are disposed are included in tonnes disposed (see Table 3).

Table 2: Recycle BC Program Performance in 2018* [161]

Covered Materials	Tonnes Generated (Market Supply)	Net Tonnes** Collected	Recovery Rate (net collected /generated)
Paper	140,385	120,267	86%
Glass	19,392	15,162	78%
Metal	13,169	8,837	67%
Rigid Plastic	42,689	22,865	54%
Flexible Plastic	20,020	3,762	19%
Contaminants (not-accepted materials)		*13,090*	*6%*
Aggregate	235,655	183,983	**78%**

**Amounts reported in metric tons (tonnes). One tonne is equal to 1,000 kg, or roughly 2,200 pounds.*
*** Net tonnes are gross collected tonnes minus materials collected on behalf of other stewardship programs, such as beverage bottles and newspapers.*

Recycle BC also follows the Province's pollution prevention hierarchy as established in the *Recycling Regulation* (generally, reduce, reuse, recycle – for the full hierarchy see Appendix D). Recycle BC's goal is to direct 85% to 90% of collected materials to commodity markets. For 2018, the program reported that 87.3% of collected materials were "managed by recycling."[162] For 2018, recycling rates, disposal rates, and the rate of conversion of materials to engineered fuel are reported in Table 3. In addition to Recycle BC's reported recycling rate, Table 3 also shows the rate of materials recycled as a proportion of the amount of materials supplied to the market.

Table 3: Collected Materials Managed by Recycling, Fuel Conversion, and Disposal (2018)* [163]

Gross Tonnes Collected	Gross Tonnes Recycled	Percentage of generated materials recycled (recycled /generated)	Reported Recycling Rate (recycled/ gross collected)	Converted to engineered fuel	Disposed
206,778	180,532	76.6%	**87.31%**	6,185 (2.99%)	16,742 (8.1%)

**Amounts reported in metric tons (tonnes). One tonne is equal to 1,000 kg, or roughly 2,200 pounds.*

Recycle BC does not report material-specific recycling rates because covered PPP materials are processed with materials the PRO collects on behalf of other stewardship programs (e.g., beverage bottles and newspapers) at receiving facilities and the province's central CRF (described earlier). All materials processed at the CRF are commingled before sale to recycling markets, making data on recycling of only covered PPP materials challenging to calculate. The PRO thus reports gross tonnes recycled (Table 3), which includes materials recycled on behalf of other stewardship programs. While gross tonnes recycled includes some non-covered materials, dividing by gross collected tonnes (which includes the same non-covered materials) to calculate the recovery rate helps to account for non-program items.

Overall, Recycle BC uses mechanical processes to convert 3% of collected materials (plastics that cannot otherwise be recycled) to engineered fuel that can replace coal in mostly industrial purposes. Notably, the PRO differentiates this process from incineration, which is the burning of any type of waste without energy recovery. No PPP materials collected by Recycle BC curbside or at depots are incinerated. Currently, a portion of the flexible plastics collected (those in the OFPP category) are converted to fuel, as well as a small portion of rigid plastics that are too contaminated to be recycled. B.C.'s pollution prevention hierarchy prioritizes conversion to fuel over landfilling these materials. Some flexible plastics collected by Recycle BC that are *not* in the OFPP category, such as plastic bread sleeves, are in fact recycled, and the PRO is continuing to seek recycling solutions for all OFPP items.

The last resort for managing PPP materials in B.C. is disposal in a landfill. Materials that are landfilled by Recycle BC include any collected materials that cannot be managed by other means, such as materials that are too dirty to be processed and recycled, or non-covered materials that have ended up in the system for which there are no other end-of-life solutions. In 2018, approximately 8% of collected materials were disposed (Table 3). Recycle BC does not report material-specific data on contamination, which often leads to disposal.

In 2018, at the B.C. Government's direction, Recycle BC undertook an internal process with its member producers to establish specific recovery targets for paper, plastics, metal, and glass, as well as targets for sub-categories of plastics (rigids and flexibles). These were based on actual recovery rates for each material category in 2017 and are being staggered so that only the paper (90%), metal (67%), and glass (76%) targets must be achieved in 2020. Plastics (both rigid and flexible) will ramp up to initial targets (55% and 22%, respectively) by 2022 and higher rates (60% and 25%) by 2025. The full details of Recycle BC's material-specific recovery targets are shown in Table 4.

Beyond recovery rates, Recycle BC sets targets for accessibility and consumer awareness. The program aims to provide access to recycling through curbside collection or depots to 98% of residents, and to ensure that at least 90% of consumers are aware of their PPP recycling options by the end of the first five years of implementation (2019). Recycling access is measured by the population size within a 30- or 45-minute drive of each depot, or the number of residents receiving curbside pickup services. Consumer awareness is measured through annual consumer research. Recycle BC estimates that it has exceeded,

and will continue to exceed, this target.[164] The PRO also estimates that 51% of the population is aware that producers are funding the province-wide recycling system under the Recycle BC brand.[165] In 2020, Recycle BC will conduct consumer awareness campaigns aimed at multi-family residences to support its efforts to achieve material-specific recovery targets.

Table 4: Material-specific recovery targets for Recycle BC

Material Category	2017 Recovery Rate	Target Recovery Rate*	Year to Achieve Target
Paper	87%	90%	2020
Glass	72%	75%	2020
Metal	66%	67%	2020
Plastic	41%	50%	2025
Rigid Plastic	50%	55%	2022
		60%	2025
Flexible Plastic	20%	22%	2022
		25%	2025

**Target recovery rates are calculated as net tonnes collected divided by tonnes supplied to the market (generated tonnes)*

As of 2019, GHG emissions have been added as another program performance measure. Collectors and processors are now obligated to report their emissions annually to Recycle BC across all stages of the value chain, including collection, transportation, processing, and delivery to recycling markets.[166] The data will be compiled and included in annual reports from the PRO to the province. The GHG metric does not currently have a numeric target, as 2019 data will provide the baseline for subsequent years.

Recycle BC must annually report on its performance relative to its recovery targets and other performance measures. The recovery metrics included in the most recent annual report to the B.C. Government (for program year 2018) were as follows:

- Tonnes of PPP and other materials collected within each of the province's 27 Regional Districts;
- Kg per capita of PPP and other materials collected within each Regional District;
- Tonnes of PPP and other materials recycled and recovered for the province;
- Kg per capita of PPP and other materials recycled and recovered for the province;
- PPP recovery rate expressed as a percentage for the province;
- Tonnes and recovery rate expressed as a percentage for the major categories of paper; plastic, metal, and glass, as well as the sub-categories of flexible and rigid plastics.

Overall program costs (measured as cost per kg and cost per household) are also included in annual performance reports, although there is not a set budget target for the program.

Recycling Access

Producers in B.C. are required by the *Recycling Regulation* to provide "reasonable and free consumer access to collection facilities or collection services."[167] Like most other program performance measures, specific accessibility targets such as access to curbside collection and drop-off depots, are set by the PRO itself (with Ministry of Environment approval) within the *Stewardship Plan*.

Recycle BC is committed to several metrics for accessibility, including access to recycling[168] for 98% of residents throughout the province (either through curbside collection or depots).[169] In its 2019 *Plan*, Recycle BC outlined updated accessibility performance targets, including targeted expansion of collection services to remote communities and First Nations. The PRO currently provides curbside collection to 973,400 single-family households and 421,600 multi-family residences, as well as access to 215 drop-off depots throughout the province.[170]

Education & Outreach

Recycle BC is responsible for creating, distributing, and funding educational activities for its recycling program to ensure consumer awareness and minimize contamination. The *Recycling Regulation* states that the PRO's educational program must fulfill two objectives:[171]

- Increase resident awareness of the recycling program's features (including availability of collection services) and benefits; and
- Encourage residents to make smart decisions about management and preparation for PPP recycling.

Recycle BC uses several strategies to accomplish these goals, including awareness campaigns and research on consumer habits.[172] In 2018, the PRO conducted several education campaigns, including:[173]

- ***Make the Right Call.*** Recycle BC partnered with the Vancouver Canucks on an advertising campaign raising awareness that coffee cups are accepted for recycling (Figure 7).
- ***Bring Your Bag.*** To encourage plastic bag reduction, Recycle BC partnered with London Drugs and Save-On-Foods to launch an advertising campaign and media event urging shoppers to bring their own reusable bags.



Figure 7: Vancouver Canucks partnership with Recycle BC for "Make the Right Call" campaign.

- ***Rethink the Way you Recycle***. Through video and print media, Recycle BC launched a program to teach residents the risks of including plastic bags in their recycling bins (as these are only accepted at drop-off depots), as well as the importance of rinsing materials before putting them in the bin to reduce contamination.

In addition to direct consumer outreach campaigns, **Recycle BC's Community Events Team coordinates with local governments to arrange visits to communities throughout the province.**[174] Activities offered by the team in 2018 included a recycling museum, a sorting game, and a virtual reality experience.[175] Recycle BC also provides printed and digital educational resources to all collectors, including local governments, mainly for the purposes of ensuring that residents place only properly cleaned, accepted materials in their curbside bins. The new five-year *Stewardship Plan* identifies increased outreach to First Nations and remote communities as an area of strategic focus.

Adoption & Adaptation

Locating and Developing Markets

Prior to implementation of EPR for PPP, B.C.'s processing facilities exported many bales of recovered materials overseas. With the launch of the Recycle BC program, the promise of a consistent, clean supply of materials enabled the PRO to cultivate robust markets for recycled materials (especially plastics) locally. Through its province-wide processing contract, the PRO leverages its network of local buyers (including Merlin Plastics) to keep materials as close to home as possible. **Currently 99% of all plastics collected by Recycle BC are managed in B.C.**[176] When identifying recycling markets outside of Canada, Recycle BC prioritizes those located in Organization for Economic Cooperation and Development (OECD) countries, which tend to have stringent environmental and human health standards for end-of-life materials management.

In 2018, 87.3% of Recycle BC's materials were sold to recycling markets (180,532 tonnes out of 206,778 collected).[177] The markets for these materials were as follows:

- **Plastic containers, plastic bags, and overwrap** were collected and processed in B.C. For example, a facility in Vancouver processes these plastic materials into pellets, flakes, and bricks, which are then shipped to other companies to manufacture new packaging and other products. About 99% of plastic containers, bags, and overwrap are processed within B.C.[178]
- **Glass** was shipped to Abbotsford, B.C. to be processed into new bottles. It was also shipped to Quesnel, B.C. to be made into sandblasted materials. A portion of recycled glass is also incorporated into agricultural mulch.

- Metal containers were sold to markets in Ontario, B.C., and the United States. Metal is often recycled into new packaging, like aluminum cans, as well as sheet metal for automotive manufacturing.
- Paper was sold to markets overseas (South Korea, Indonesia, and China), in the United States, and in B.C. Recovered and recycled paper can be made into egg cartons, boxes, and other paper products.
- Foam packaging was recycled locally in Vancouver, B.C. as well as overseas, and was used to make products like picture frames and molding.
- Other Flexible Plastic Packaging (OFPP) is currently collected as part of a research and development project to determine how to best manage this material. Until recycling opportunities are available, OFPP is being converted into engineered fuel along with contaminated rigid and flexible plastics not in the OFPP category.

Program Results

Recycle BC has achieved high recovery rates province-wide and has significantly expanded the scope of PPP materials collected in B.C. Across materials, the 2018 recovery rate was 78.1%, with 87.3% of collected materials successfully sold to recycling markets (see Tables 2 and 3, above). Collection rates for plastics have outpaced growth in generated tonnes year to year, with an overall plastics recovery rate of 42% in 2018 – nearly twice the average rate in the U.S., which was last reported at 24%.[179]

One of the most important achievements of the B.C. system is a relatively low contamination level, which helps to ensure that collected materials are marketable and, therefore, actually recycled. Contamination across materials is currently below 10% (see Tables 2 and 3).

Recycle BC's centralized post-collection contract provides producers, governing authorities, and the public with a clear understanding of how materials are managed at their end-of-life. In 2019, a Canadian news segment produced by CBC Marketplace purportedly revealed that bales of household plastics were being landfilled or incinerated rather than recycled.[180] Recycle BC was able to quickly clear up this misinformation and clarify that these bales consisted of non-covered materials managed outside of the Recycle BC system by other parties.[181] To comply with Ministry of Environment requirements for auditing end-of-life treatment of materials, Recycle BC's system includes traceability and auditability of all shipments sent to recycling markets or disposal facilities.

Recycle BC has fared better than most recycling systems in North America following the China Sword crisis, in large part due to the high quality of materials produced through the program and robust relationships with local markets. While PPP recycling programs across Canada and the U.S. have been forced to remove difficult-to-recycle materials from collection lists over the past two years, Recycle BC has continued to expand the items it accepts in curbside containers and at drop-off depots. The program has pushed the cutting edge of recycling technology through investments in research and technical

capacity, with curbside collection in participating municipalities now including such items as aerosol cans for non-toxic products, coffee cups, and thin rigid plastics such as plant pots and berry cartons – all items that are commonly excluded in other programs since the China Sword.[182]

However, the program is not entirely immune to the rising costs of recycling. All of Canada's EPR programs have been impacted by these costs. In municipal reimbursement programs, municipalities and producers share the burden of these cost increases, whereas in B.C. producers have borne the burden. Recycle BC's operating costs in 2018 were $364 USD per tonne[183] – up from $300 USD per tonne in 2016.[184] This increase in operating costs, largely due to market changes related to the China Sword, forced Recycle BC's Board of Directors to draw from program reserves in an effort to contain fee increases.[185] Even still, material fees increased by an average of 26% to cover program costs, as previously described. Critically, the impact of rising program costs on consumers has been minimal and there is no evidence to suggest that producers pass these costs directly to consumers.

As new packaging continues to emerge, the B.C. program can adapt more nimbly than municipal-run alternatives in other provinces since it covers the entire province with one set of recyclables and integrated collection and processing systems. Recycle BC can add new forms of packaging to its list of collected materials at any time and can incentivize investment in processing capacity for these materials.

Summary

Full producer responsibility has transformed the recycling landscape in B.C.

EPR for PPP has transformed the recycling landscape in B.C. from a collection of disjointed municipal operations into a unified and streamlined network spanning the entire province. With producers fully responsible for the financial and day-to-day operations of PPP recycling, Recycle BC has used its autonomy to design a province-wide system that greatly enhances efficiency and environmental outcomes. Access to recycling has expanded at multi-family residences and in rural and remote communities since the program launched in 2014.[186] The standardized list of accepted materials has reduced consumer confusion and contamination across material streams.

Economies of scale provide reliable recycled material for local recycling markets.

Because producers finance and operate the entire recycling system in B.C., they have been able to expand the overall list of PPP materials that are collected and recycled. At the same time, they have expanded collection services. The provincial scale of the B.C. system optimizes efficiencies in a way that individual municipal systems cannot achieve. For example, processing all collected containers for the province at a single CRF spurred major investments in state-of-the-art technology that reduces contamination and produces a clean, reliable stream of materials. This reliability assists in accessing markets for key materials such as plastics, the majority of which are in Canada or North America.

The centralized post-collection contract supports small haulers and MRFs.
From its inception, Recycle BC's province-wide post-collection processing contract maintained healthy diversity among RCTs and processors by generating a network of subcontracts. This efficient use of existing assets mitigated impacts to haulers and processors during the transition to EPR. In some instances, a sustained supply of ICI materials managed outside of the EPR program further enabled MRFs to continue previous business operations.

Smaller businesses pay lower fees or are exempt.
Businesses that supply less than 1,000 kg (2,200 pounds) to the market are exempt from paying material fees, and a flat fee structure is offered for entities producing between 1,000 and 15,000 kg (2,200 – 33,000 pounds). Because the fee structure is designed to ensure that materials pay their own way through the recycling system, there is no cross-subsidization of materials (e.g., higher value materials do not subsidize the processing of lower value materials).

Non-recyclable items such as OFPP remain a challenge for the B.C. system. Items such as flexible pouches and polyethylene tubes, which may be technically recyclable but still lack robust end markets, are currently converted to engineered fuel. Out of 206,778 tonnes of PPP collected by Recycle BC in 2018, 16,742 tonnes (8%) were ultimately disposed because they were too contaminated or contained non-recyclable items mistakenly included in PPP collection bins by residents.[187] Three percent (3%) of collected tonnes was converted into engineered fuel, most of which consisted of non-recyclable OFPP.[188] Recycle BC is working to address these challenges through projects such as the OFPP pilot. Collected OFPP is currently sent to a local market, where industry is working to develop recycling solutions for these materials.

The B.C. system continues to evolve and improve.
With each year, B.C.'s EPR for PPP program continues to evolve and mature. Recycle BC is enhancing transparency within the system through its annual reports, website, consultations, and online publications. Innovative pilot projects, such as the OFPP pilot, are addressing the program's biggest challenges to ensure the PRO meets or exceeds its material recovery and waste hierarchy targets each year. Although the B.C. system faces challenges such as emerging, hard-to-recycle packaging types, its overall success has led to widespread acclaim and recognition.[189]

As the CCME and CSSA continue to advocate for consistency in product stewardship across Canada, other provinces are looking to B.C.'s program as a promising approach to EPR for PPP. Producers are attracted to the autonomy they can exercise over the entire post-consumer supply chain to achieve ambitious environmental outcomes. They also value the ability to weather extreme volatility in global markets by cultivating relationships with local buyers. Local governments appreciate that the program has removed, or greatly relieved, the financial burden of providing recycling services, and has offered choices regarding their level of engagement in the system.[190]



5. Conclusion and Recommendations

EPR for PPP has proven to be successful across the EU and Canada and continues to spread around the world. Collection, recovery, and recycling rates in countries with EPR for PPP far outpace the current industry averages in the U.S., and municipalities have realized significant savings by shifting costs to producers. EPR for PPP can also restore public faith in recycling during a time of unprecedented global uncertainty and skepticism. As producers continue to announce sustainability goals and circular economy initiatives regarding their packaging, EPR provides a path to achieving these outcomes by increasing overall material recovery and recycling rates and providing reliable, clean streams of recycled content for packaging and paper production.

Striking the right balance between government oversight and control of system outcomes and producer flexibility and control over system implementation will be critical to the success of EPR for PPP in the U.S. There are several opportunities for negotiations to take place that will arrive at the proper balance for each U.S. state, including in legislation, regulations, and product stewardship plans. State and local governments need assurance that existing recycling programs will continue to provide residents with the service they expect, and states must have authority to adjust implementation efforts as needed to achieve those goals. Local governments also seek options to find the right approach for their jurisdiction

that meets local needs while improving recycling outcomes. Producers, for their part, need flexibility to reach performance goals and seek control over how their financing is spent to ensure program efficiency and effectiveness.

Experience has shown that programs that are more successful and sustainable have achieved a healthy balance between government and producer interests, while also integrating the important interests of waste management companies (which are the backbone of the domestic recycling infrastructure), environmental groups, and other key stakeholders. Full producer responsibility programs in Europe and Canada have achieved large-scale efficiencies and investments in infrastructure that have significantly improved recycling performance. Producers have expressed support for these programs and have advocated for greater control over recycling systems and consistent application of EPR legislation at national and provincial levels. **Producers are ready for a harmonized system that can help them achieve a circular economy and meet their sustainability goals – and EPR provides a path to building this system.**

Eco-modulated fees can further strengthen EPR systems and advance the circular economy by incentivizing upstream design innovation to minimize environmental impacts at end-of-life. As these fee structures continue to evolve worldwide and become mandatory throughout the EU, we can expect to see changes in packaging production that favor materials that have less impact on the environment. These materials will continue to be recycled at increasing rates and will increasingly be made with reusable and recyclable materials. We also expect a reduction in the overall volume of packaging produced for consumer goods as the cost to avoid externalities is internalized into business operations.

EPR for PPP systems will buffer states and local governments from disruptions to the global recycling market, reduce taxpayer spending on recycling infrastructure, increase material recovery rates, and help to generate local recycling markets where they are sorely needed. PSI has already developed model legislation and guidance on the key elements of EPR for PPP, which can be applied to a spectrum of EPR approaches.

Appendix A: The PPP Recovery Rate in Each Canadian Province

In the U.S., recovery is typically understood to be a measure of materials collected with the intention of recycling, even though not all materials collected will ultimately be recycled. The recovery rate is therefore the percentage of all generated materials that are collected, as follows:

Recovery = Collection / Generation

However, each Canadian province defines recovery differently, including differing in how generated and collected tonnes are measured. While some define recovery as all collected materials, others define recovery only on the basis of whether materials are actually recycled. The provincial programs also differ in that some recovery rates include newspapers while others do not. A summary of the recovery rate, and how it is calculated, in each of the four provinces is discussed in detail below. (*Note: Amounts are reported in metric tons (tonnes). One tonne is equal to 1,000 kg, or roughly 2,200 pounds.)*

Ontario:

Stewardship Ontario defines recovery as collected tonnes that are recycled. The program's recovery rate is calculated as recycled tonnes divided by generated tonnes, where generated tonnes are estimated based on **waste audits conducted by municipalities**.

Recovery = Recycling / Generation

Materials that are managed by conversion to fuel, waste to energy, gasification, or other thermal treatment, as well as by disposal, are **not** counted toward this recovery rate. Thus, Ontario's recovery rate more closely represents what U.S. programs call a recycling rate.

For more information on Stewardship Ontario's recovery rate, see: https://stewardshipontario.ca/wp-content/uploads/2019/06/SO2018.pdf

Québec:

Éco Entreprises Québec (ÉEQ) defines recovery as collected tonnes. The program's recovery rate is calculated as collected tonnes divided by generated tonnes, where generated tonnes are extrapolated from audits of curbside collection bins conducted by ÉEQ in over 800 communities.

Recovery = Collection / Generation

Collected tonnes are counted toward recovery regardless of how they are ultimately managed, so the program's recovery rate includes some materials that are disposed due to contamination or other factors. Collected tonnes are not broken down by the amount of materials recycled, disposed, or converted to fuel.

For more information on ÉEQ's recovery rate, see: https://www.ÉEQ.ca/wp-content/uploads/carac_residentielle_finale_2012-2016_eng.pdf

Manitoba:

Multi-Materials Stewardship Manitoba (MMSM) defines recovery as collected tonnes *that are recycled,* as does Ontario. The program's recovery rate is calculated by dividing recycled tonnes (based on municipal recycling reports) by tonnes supplied into the market (as reported by producers).

Recovery = Recycling / Market Supply

This recovery rate methodology was introduced in 2018. Prior to that time, MMSM estimated the amount of supplied PPP materials using curbside waste audits, similar to curbside audits conducted in Québec.

For more information on MMSM's recovery rate, see: https://stewardshipmanitoba.org/wp-content/uploads/2019/06/Jun3_203870-MMSM-2018-Annual-Report-Web.pdf

British Columbia:

Recycle BC defines recovery as net tonnes collected, after subtracting materials collected on behalf of other stewardship programs (e.g., beverage bottles or printed newspapers). The program's recovery rate, which is defined in the *Recycling Regulation,* is calculated as net collected tonnes divided by tonnes supplied into the market (as reported by producers).

Recovery = Collection / Market Supply

Net collected tonnes are counted toward recovery regardless of how they are ultimately managed, so the program's recovery rate includes a percentage of materials that are converted to engineered fuel or disposed (which was 11% in 2018, see Table 3). Annual recycling, fuel conversion, and disposal rates are reported individually. Newspaper is **not** included in the figure for recovered tonnes.

For more information on Recycle BC's recovery rate, see: http://recyclebc.ca/wp-content/uploads/2019/07/RecycleBCStewardshipPlan_16July2019.pdf

A Note on Compostable PPP

Currently, compostable PPP is not collected in Canadian EPR programs. However, Recycle BC is conducting research on compostable packaging. If the quantity of PPP in the compost stream (managed outside of the existing EPR system) is determined to be significant and Recycle BC is able to determine the quantity of PPP by material category recovered annually in local governments' organic waste collection programs, the PRO will include the end-of-life management of compostable PPP in its Pollution Prevention Hierarchy report. If feasible, the PRO will then develop financial incentives to promote the management of appropriate types of PPP (e.g., soiled paper and compostable bio-plastics) in the organic material stream.

Appendix B: Fee Schedules for Canadian EPR Programs

Note: Fees are provided in Canadian Dollars. One Canadian Dollar is equal to $0.75 USD as of March 3, 2020.

2020 Fee Schedule, Ontario

STEWARDSHIP ONTARIO FEE SCHEDULE (CENTS/KG)				
Category	**Material**	**2020 Fee Rates (cents/ kg)**	**2019 Fee Rates (cents/ kg)**	**Variance %**
PRINTED PAPER	Newsprint - CNA/OCNA	0.63	0.59	6.8%
	Newsprint - Non-CNA/OCNA	6.90	5.98	15.4%
	Magazines and Catalogues	12.70	9.04	40.5%
	Telephone Books	13.25	11.06	19.8%
	Other Printed Paper	16.00	18.45	-13.3%
PAPER PACKAGING	Corrugated Cardboard	11.28	10.13	11.4%
	Boxboard	11.28	10.13	11.4%
	Gable Top Cartons	28.33	22.44	26.2%
	Paper Laminates	28.33	22.44	26.2%
	Aseptic Containers	28.33	22.44	26.2%
PLASTICS	PET Bottles	17.39	19.65	-11.5%
	HDPE Bottles	13.92	13.21	5.4%
	Plastic Film	36.67	33.07	10.9%
	Plastic Laminates	36.67	33.07	10.9%
	Polystyrene	36.67	33.07	10.9%
	Other Plastics	36.67	33.07	10.9%
STEEL	Steel Food & Beverage Cans	6.97	7.10	-1.8%
	Steel Aerosols	6.97	7.10	-1.8%
	Steel Paint Cans	6.97	7.10	-1.8%
ALUMINUM	Aluminum Food & Beverage Cans	5.16	3.68	40.2%
	Other Aluminum Packaging	13.32	7.96	67.3%
GLASS	Clear Glass	4.07	3.80	7.1%
	Coloured Glass	7.95	6.76	17.6%
IN-KIND	In-Kind Amount	$4,860,588	$5,112,007	-4.9%

Source: https://stewardshipontario.ca/stewards-bluebox/fees-and-payments/

2020 Fee Schedule, Québec

Material	2020 Schedule $/t	Variation
Printed matter	335.24	43.2 %
Newsprint inserts and circulars	292.25	43.4 %
Printed matter	425.74	45.0 %
Containers and packaging	278.36	17.5%
Paper / Cardboard	239.12	18.9 %
Corrugated carton and Kraft paper	217.80	19.2 %
Boxboard and other paper packaging	238.67	19.2 %
Gable-top containers	225.34	18.3 %
Aseptic containers	278.48	19.2 %
Laminated paper	340.81	18.9 %
Plastic	409.36	14.6 %
PET bottles and containers	300.08	5.9 %
HDPE bottles and containers < 5 l.	162.66	50.0 %
Plastic film, bags and plastic laminates	542.67	15.1 %
PVC, PLA and polystyrenes	941.97	19.3 %
Other plastics	359.08	25.5 %
Aluminium	204.95	13.9 %
Steel	175.80	2.4 %
Glass	208.66	21.1%
Clear glass	210.06	22.0%
Coloured glass	207.67	20.6%
Average rate	289.54	22.5%

Source: https://www.eeq.ca/wp-content/uploads/SE_consultations_2020_VF_EN-2.pdf

2020 Fee Schedule, Manitoba

Category	Material	Cents/ kg
Printed paper	Newsprint	10.29 ¢/kg
	Magazines and Catalogues	15.54 ¢/kg
	Telephone Books	16.91 ¢/kg
	Other Printed Paper	11.77 ¢/kg
Paper packaging	Corrugated Cardboard	31.78 ¢/kg
	Boxboard	31.78 ¢/kg
	Gable Top Cartons	71.39 ¢/kg
	Paper Laminates	71.39 ¢/kg
	Aseptic Containers	71.39 ¢/kg
Plastics	PET Bottles	43.62 ¢/kg
	HDPE Bottles	52.25 ¢/kg
	Plastic Film	51.30 ¢/kg
	Plastic Laminates	51.30 ¢/kg
	Polystyrene	51.30 ¢/kg
	Other Plastics	51.30 ¢/kg
Steel	Steel Food & Beverage Cans	17.85 ¢/kg
	Steel Aerosols	17.85 ¢/kg
	Other Steel Containers	17.85 ¢/kg
Aluminum	Aluminum Food & Beverage Cans	-7.32 ¢/kg
	Other Aluminum Packaging	10.89 ¢/kg
Glass	Clear Glass	5.00 ¢/kg
	Coloured Glass	5.00 ¢/kg

Source: https://stewardshipmanitoba.org/stewards/fees-and-payments/

2020 Fee Schedule, British Columbia

RECYCLE BC FEE SCHEDULE (CENTS/KG)				
Category	Material	2020 Fee Rates (cents/ kg)	2019 Fee Rates (cents/ kg)	Variance %
PRINTED PAPER	Newsprint	16.00	11.00	45.5%
	Magazines and Catalogues	26.00	14.00	85.7%
	Telephone Books	26.00	14.00	85.7%
	Other Printed Paper	26.00	14.00	85.7%
PAPER PACKAGING	Corrugated Cardboard	36.00	25.00	44.0%
	Boxboard	36.00	25.00	44.0%
	Gable Top Cartons	83.00	55.00	50.9%
	Paper Laminates	83.00	55.00	50.9%
	Aseptic Containers	83.00	55.00	50.9%
PLASTICS	PET Containers	77.00	63.00	22.2%
	HDPE Containers	77.00	63.00	22.2%
	Plastic Film	112.00	100.00	12.0%
	Plastic Laminates	141.00	128.00	10.2%
	Polystyrene	112.00	100.00	12.0%
	Other Plastics	112.00	100.00	12.0%
STEEL	Other Steel Packaging	30.00	27.00	11.1%
	Steel Aerosols	30.00	27.00	11.1%
	Steel Paint Cans	30.00	27.00	11.1%
ALUMINUM	Aluminum Food & Milk Containers	56.00	42.00	33.3%
	Other Aluminum Packaging	56.00	42.00	33.3%
GLASS	Clear Glass	17.00	16.00	6.3%
	Coloured Glass	17.00	16.00	6.3%

Source: https://recyclebc.ca/stewards/feespayments/stewards-fee-schedule/

Appendix C: Packaging and Paper Definitions in British Columbia

Environmental Management Act – Definitions:

"'**Packaging'** means a material, substance or object that is

(a) used to protect, contain or transport a commodity or product, or

(b) attached to a commodity or product or its container for the purpose of marketing or communicating information about the commodity or product."

Source: http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/03053_01#section1

B.C. Recycling Regulation, Schedule 5 (Packaging and Paper)

"Schedule 5

[en. B.C. Reg. 88/2011, Sch. s. 13; am. B.C. Reg. 206/2017, s. 20.]

Packaging and Paper Product Category

"Definition

1 (1) In this Schedule, '**paper**' means, subject to subsection (2), paper of any description, including

(a) flyers,

(b) brochures,

(c) booklets,

(d) catalogues,

(e) telephone directories,

(f) newspapers,

(g) magazines,

(h) paper fibre, and

(i) paper used for copying, writing or any other general use.

(2) For the purposes of subsection (1), paper does not include

(a) paper products that, by virtue of their anticipated use, could become unsafe or unsanitary to recycle, or

(b) any type of bound book not mentioned in subsection (1).

"Packaging and paper product category

2 The packaging and paper product category consists of packaging and paper."

Source: http://www.bclaws.ca/Recon/document/ID/freeside/449_2004#Schedule5

Recycle BC Stewardship Plan – Definitions:

"Packaging: Packaging for purposes of producer obligation and reporting under the Program Plan includes:

(a) Primary packaging, i.e., packaging that contains the product at the point of sale to the residential consumer;
(b) Grouped packaging or secondary packaging that goes to the household;
(c) Transportation, distribution or tertiary packaging that goes to the household;
(d) Service packaging designed and intended to be filled at the point of sale and 'disposable' items sold, filled or designed and intended to be filled at the point of sale such as:
    a. Paper or plastic carry-out bags provided at checkout;
    b. Bags filled at the shelves with bulk goods, produce, baked goods, etc.;
    c. Disposable plates and cups;
    d. Take-out and home delivery food service packaging such as pizza boxes, cups, bags, folded cartons, wraps, trays, etc.;
    e. Flower box/wrap;
    f. Food wraps provided by the grocer for meats, fish, cheese, etc.;
    g. Prescriptions bottles filled and provided by pharmacists;
    h. Gift wrapping/tissue paper added by the retailer; and
(e) Packaging components and ancillary elements integrated into packaging, including ancillary elements directly hung or attached to a product and which perform a packaging function unless they are an integral part of the product and all elements are intended to be consumed or disposed of together.

"Paper: Paper product is now defined as paper of any description, including:

(a) flyers,
(b) brochures,
(c) booklets,
(d) catalogues,
(e) telephone directories,
(f) newspapers,
(g) magazines,
(h) paper fibre, and
(i) paper used for copying, writing or any other general use.

"This definition of paper does not include paper products that, by virtue of their anticipated use, could become unsafe or unsanitary to recycle, or any type of bound book not mentioned above. For the purposes of the Program Plan, paper product comprises any type of cellulosic fibre source including, but not limited to wood, wheat, rice, cotton, bananas, eucalyptus, bamboo, hemp, and sugar cane (bagasse) fibre sources."

Source: https://recyclebc.ca/stewards/regulation_and_stewardship_plan/

Appendix D: British Columbia's Pollution Prevention Hierarchy

As defined in the *Recycling Regulation* (Section 5(3)):

"The pollution prevention hierarchy is as follows in descending order of preference, such that pollution prevention is not undertaken at one level unless or until all feasible opportunities for pollution prevention at a higher level have been taken:

(a)reduce the environmental impact of producing the product by eliminating toxic components and increasing energy and resource efficiency;

(b)redesign the product to improve reusability or recyclability;

(c)eliminate or reduce the generation of unused portions of a product that is consumable;

(d)reuse the product;

(e)recycle the product;

(f)recover material or energy from the product;

(g)otherwise dispose of the waste from the product in compliance with the Act."

Source: http://www.bclaws.ca/Recon/document/ID/freeside/449_2004#section5

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[9] Early U.S. take-back programs for high-priority products had limited roles for producers. Those funded through advanced recycling fees on used oil, tires and automobile batteries included point of sale fees on designated products, which were paid by consumers into a state government fund that covered the cost of municipal and retail collection of the products at end-of-life. Other take-back programs, such as household hazardous waste and electronics, were funded and managed directly by state or local governments. Such early product stewardship approaches fall outside the scope of EPR as defined in the U.S., which shifts the bulk of responsibility for financing and managing products directly onto producers, although other stakeholders have important responsibilities as well.

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[68] Note: this is not the standard terminology used in EPR for PPP programs across the EU or Canada. PSI has adopted these terms for the purposes of this report.
[69] See PSI's website for more info and resources: www.productstewardship.us.
[70] Typically, producers form a single non-profit PRO for PPP. In some early European systems, for-profit PROs were established where multiples PROs for PPP formed within a single program (e.g., Austria).
[71] Summary provided by CSSA, January 2019: "CSSA is the largest compliance solution provider to approved EPR programs in North America. With 85 staff located in Toronto, Vancouver, Saskatoon, Winnipeg and Halifax, it administers programs with over $300M in stewardship revenues and provides support services to four Canadian packaging and paper product (PPP) programs in Canada as well as municipal hazardous waste programs in Ontario. It is the interface to almost 3,000 producers in Canada who report and pay fees to an approved stewardship plan. CSSA's core competencies are analytics, procurement, and

the mechanics of implementing and operating Extended Producer Responsibility (EPR) programs and its services include: design, implement and support EPR programs; "One-window" reporting for producers according to harmonized administrative rules and call centre support for all programs; a common IT platform for all programs; business data warehouse and analytics support; full financial service support—payables receivables, reporting, audit support, fee calculations; procurement and supply chain support to PROs; and tools and Resources to simplify reporting for smaller businesses."

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June 16, 2020

Sen. John Barrasso, Chair
U.S. Senate Committee on Environment and Public Works
410 Dirksen Senate Office Building
Washington, D.C. 20510

Statement of Support for S. 3263: Break Free From Plastic Pollution Act of 2020

Dear Senator Barrasso and Committee Members:

Thank you for the opportunity to submit testimony in support of S.3263, which is a landmark bill that will reduce plastic and packaging waste and transform the recycling system.

The Product Stewardship Institute (PSI) is a national nonprofit working to reduce the health and environmental impacts of consumer products from design and production through end-of-life. PSI works closely with 47 state environmental agency members, hundreds of local government members, and over 120 partners from businesses, organizations, universities, and international governments.

This bill would implement Extended Producer Responsibility (EPR) for packaging and paper products, along with a nationwide container deposit requirement, bans on certain single-use plastic products, a carryout bag fee, and standardized labeling for recycling and disposal. The bill will also temporarily pause the permitting of new and expanded industrial facilities for the creation and processing of plastics.

PSI created the model for packaging EPR that is central to S.3263 based on decades of research and partnership with EPR practitioners around the world. The EPR component of the bill will shift the financial and management burden of recycling from local governments and taxpayers to packaging producers and brand owners – those who decide what packaging to put on the market in the first place. Under EPR systems, producers share in the responsibility for properly managing their products across the entire lifecycle. This is not only a more sustainable solution; it's more equitable because it places the cost of recycling on those who produce and consume packaging. S.3263 also creates financial incentives for producers to use packaging materials with lower environmental impacts across their entire lifecycle, from extraction to manufacturing to use to end-of-life.

Local governments spend millions of taxpayer dollars each year to manage an ever-increasing array of packaging wastes, including plastics, which can harm communities at every step of their lifecycle. U.S. recyclers are struggling

because the value of recovered materials is low, while brand owners that have publicly committed to sustainable manufacturing goals are unable to find the recycled content they need to keep their commitments.

EPR would harmonize and unify the U.S. recycling system and level the playing field for all producers and brand owners. S.3263 would allow producers to develop a cohesive national recycling system to replace the current, highly fragmented one that is failing U.S. municipalities and residents. By fostering healthy end markets, the bill would help producers reach their publicly stated goals for using more post-consumer recycled materials. Under the current system, it will be incredibly difficult for companies to source enough recycled content to meet these goals. Market shifts in the wake of the China Sword and other export restrictions on recyclables have led many municipal recycling programs to stop accepting certain materials or even cease collecting materials altogether as they struggle to deal with unexpected deficits. In the wake of the coronavirus pandemic, these financial struggles are only worsening. EPR reduces the unreasonable demands placed on municipalities to manage and pay for materials that they had no role in creating, leaving local governments with more funding to focus on priorities such as public health and safety.

Over the past 20 years, PSI and its members have played a significant role in passing most of the 119 U.S. EPR laws on 14 products in 33 states. We continue to support many states that have introduced or are currently developing packaging EPR bills in recent years. However, a state-by-state approach is likely to perpetuate the fragmentation of recycling in the U.S. In Europe and Canada, where EPR policies for packaging and paper products have been in place for decades, stakeholders have called for unification of EPR systems at the national or multi-national levels. A federal approach to EPR in the U.S. will harmonize and unify our national recycling system and level the playing field for all producers and brand owners.

PSI also supports the temporary hiatus on permitting new or expanded plastics production and processing facilities in Section 4 of the bill. The exponential growth of plastic packaging production has contributed to the national recycling crisis by decreasing the value of recovered plastics and flooding waste streams with increasingly complex materials that are difficult or impossible to recycle. To keep up with production, facilities that create plastic or convert it into chemical feedstock are being rapidly constructed across the country. These facilities are permitted under outdated regulations that do not directly address the way they operate. For example, there are no U.S. Environmental Protection Agency (US EPA) regulations prohibiting the discharge of microplastic pellets into water bodies. US EPA needs time to understand and address the impacts these facilities can have on our air, land, water, and communities.

Plastic production and processing facilities, much like landfills, oil refineries, and other sources of industrial pollution, are overwhelmingly constructed in low-income communities of color. These communities already bear the brunt of environmental and economic burdens and are further put at risk by new and expanded plastics facilities. Oil and natural gas extraction and refinement for plastics production cause chronic and sometimes fatal respiratory conditions, cancers, neurotoxicity, reproductive and developmental damage, and immune suppression in thousands of people each year. As oil and gas companies continue to invest in plastic production – the majority of which is used for consumer packaging and single-use products that disrupt recycling systems – frontline communities (those adjacent to these facilities) are faced with the bulk of the environmental, health, and economic impacts.

New and expanded plastics facilities also undermine state and local government efforts to combat climate change and the growing plastics crisis. In 2019 alone, the production and incineration of plastic added more than 850 million metric tons of greenhouse gases to the atmosphere – equal to the pollution from 189 new 500-megawatt coal-fired power plants. If plastic production and use grow as currently planned, by 2030 these emissions could reach 1.34 billion tons per year – equivalent to the emissions released by more than

295 new 500-megawatt coal-fired power plants. A pause on construction of these facilities will enable US EPA to assess their impact on climate change, but more importantly it will allow for the EPR system established in the bill to take effect. A producer-led, national recycling system will reduce the need for new plastic production before resources are spent to construct new plastics facilities, because packaging and products will be manufactured using recycled content plastics.

Only 50% of packaging – and only 8% of plastic waste – is currently recycled in the U.S. These rates are far below many other countries and have been stagnant for nearly two decades. We urge you to support S.3263 to increase recycling and create thousands of jobs while saving local governments and taxpayers millions of dollars on the management of an increasingly complex waste stream.

If you have any questions, please feel free to contact me at (617) 236-4822, or Scott@ProductStewardship.US.

Sincerely,

Scott Cassel

Scott Cassel
Chief Executive Officer and Founder

CITY OF BALTIMORE
BERNARD C. "JACK" YOUNG, Mayor

DEPARTMENT OF PUBLIC WORKS
Matthew W. Garbark, Acting Director
Abel Wolman Municipal Building, 6th Floor
200 N. Holliday Street
Baltimore, Maryland 21202

June 17, 2020

Via Electronic Mail

The Honorable Ben Cardin
United States Senate
509 Hart Senate Office Building
Washington, DC 20510

The Honorable Chris Van Hollen
United States Senate
110 Hart Senate Office Building
Washington, DC 20510

RE: Responding to the Challenges Facing Recycling in the United States

Dear Senators Cardin and Van Hollen,

As you meet to discuss and respond to the challenges facing recycling in the United States, we write to share some of Baltimore City's experiences and to request your support for recycling resources, infrastructure, and end markets. In order to set Baltimore on the right path forward for the environment and the economy, we need to enable our residents to learn about proper waste management and recycling, and to give them the tools and resources to have control over their environment and to practice recycling every day. The national commitment to keep recycling going and to improve the systems for collecting and processing the materials will be invaluable to local government.

The Baltimore City Department of Public Works, Bureau of Solid Waste is responsible for curbside collection of mixed refuse, recycling, and seasonal waste for 600,000 residents in approximately 210,000 households. The Bureau's Waste Removal and Recycling Program has 292 positions. Baltimore is committed to recycling and has undertaken many programs and initiatives to raise its recycling rate, to meet the State's goal of 35%.

The Department of Public Works has just released its draft master plan for the Bureau of Solid Waste. This long-term master plan, Less Waste, Better Baltimore (LWBB), makes it clear that recycling will be a critical component of the City's future management of its waste stream. Its recommendations include providing recycling carts to every household and investing in recycling infrastructure within the city.

Unfortunately, the cost to the City to process recycling has increased considerably over the years. The City used to receive revenue from its vendor for its recycling; however, starting in 2016, it began to pay to have recycling processed. In 2019, the City paid nearly $1,375,000 to have its recycling processed, and this cost is projected to rise in 2020. These rising costs are difficult to manage for an economically stressed city.

Local government has traditionally been responsible for managing the proper disposal of post-consumer products. When recycling brought revenue to cities, it was easier to justify investment in recycling programs for their expansion and promotion. The higher cost of recycling has increased the burden on local government, and some jurisdictions have made the difficult decision to suspend recycling or to stop accepting certain items. In order to keep recycling a priority for local governments, it is critical that end markets for the materials grow.

The COVID-19 emergency has had a major financial burden on Baltimore City, as it has for many jurisdictions. Federal financial assistance will be critical to cover unexpected costs of this crisis. Throughout the COVID crisis, the Bureau was successfully collecting curbside trash and recycling on its normal schedule, even as other jurisdictions modified or stopped services. Unfortunately, the Bureau recently had several employees test positive for COVID. In order to prevent the spread, the impacted collection yard was closed and employees are self-isolating. The resulting staff shortage led to the need to temporarily suspend curbside recycling collection citywide. The public response to not having curbside recycling demonstrated that residents care deeply about recycling and consider it a core service.

The Department of Public Works continuously works to develop partnerships, and to take advantage of programs and funding that can support its recycling program. The EPA's America Recycles Day activities are important to raise public awareness and support for recycling. In honor of 2019 America Recycles Day, the Baltimore City Department of Public Works launched its Recycle Right webpage, which provides guidance for residents on the proper recycling or disposal of common household items.

Baltimore was fortunate to recently receive a grant from The Recycling Partnership to implement a citywide Recycling Anti-Contamination Campaign. This grant, which includes not only monetary assistance but also in-kind support from the Recycling Partnership, will enable the Department of Public Works to educate residents on what items are considered contaminants. By lowering the contamination rate of the recycling, the City can lower its cost of recycling. The City has also been meeting regularly with the Closed Loop Fund to discuss opportunities for funding recycling projects.

Department of Public Works also sees SWANA as an invaluable resource. Department staff is in ongoing communication with SWANA's leadership and staff regarding advocacy efforts, resources, and finding solutions to challenges. Bureau of Solid Waste staff serve in leadership positions in both the local SWANA chapter and in SWANA's Sustainable Materials Management Technical Division.

The Department of Public Works is committed to reinstating recycling and improving it for the future. Recycling is considered a key service by residents, a sentiment which has been reinforced by the current suspension of recycling. Federal support for promoting and supporting end markets for recyclable products is much needed. Recycling is worth investing in for the many positive environmental impacts, the job opportunities, and the economic opportunity.

Thank you for considering our views.

Sincerely,

Matthew W. Garbark
Acting Director

Sustainable Food Policy ALLIANCE

Sustainable Food Policy Alliance: Packaging and Recycling Policy Priorities

Each Sustainable Food Policy Alliance (SFPA) member company has invested in making consumer product packaging more sustainable with a focus on recyclability, the circular economy, and climate change. We recognize that an improved recycling system along with packaging innovation is essential to reducing our carbon footprint.

SFPA members have set ambitious goals to integrate post-consumer recycled content (PCR) into our packaging that cannot be met without significant shifts in our nation's current waste management and recycling systems. Within our own companies, we are investing in improving recycling systems around the world, innovating our packaging design, and collaborating with suppliers, local communities and retail customers to advance forward-looking solutions that help our consumers make a difference and impact the planet. There is no single solution to packaging waste, rather it is essential that stakeholders – including companies, recycling operators, federal and local government – come together to make end-to-end system changes that will truly transform our waste management system into a circular economy. SFPA supports policy solutions that include the following:

1. *Improve Access to Recycling:* Adopt policy measures to improve effectiveness of recycling systems to achieve increased recycling rates, decreased landfilling, and recycling price parity with disposal. Areas of focus for state and local governments should include: disposal surcharges, accurate product and bin labeling, infrastructure investments, resources and support for community collection, and expanded recycling education.

2. *Transform waste management to a circular system*. Ensure a nationally consistent, economy-wide approach to packaging life cycle management by establishing a public-private partnership that can make recycling infrastructure improvements to drive the transition to a circular economy. Funds would be derived from eco-modulated fees collected from brand owners and distributed toward recycling system improvements based on a quantitative analysis of community needs.

3. *Establish Consistent Standards and Enhance Measurement:* Federal and local governments can lead the way to prioritize recycling, increase collection, and decrease contamination by setting more consistent standards for accepted materials across regions and collecting, analyzing, and reporting data on U.S. recycling operations. Together, these actions will improve sortation and capture across the board, provide important data to target investments, and accelerate the move towards a more circular economy for paper and packaging materials.

June 26, 2020

Chair John Barrasso
U.S. Senate Committee on Environment and Public Works
410 Dirksen Senate Office Building
Washington, D.C. 20510

RE: Additional Information to Supplement the Hearing Record

Dear Chair, Ranking Member, and Senator Gillibrand,

I would like to provide additional information regarding the questions that Senator Gillibrand asked at the June 17, 2020 Senate Committee on Environment and Public Works hearing, including questions about plastic bag law effectiveness. Plastic bag laws are highly effective in reducing plastic bag consumption and reducing litter. I ask that you submit this letter to supplement the hearing record.

I am a Legal Associate with the Surfrider Foundation's Plastic Pollution Initiative. The Surfrider Foundation is dedicated to the protection and enjoyment of the world's oceans, waves, and beaches through a powerful activist network. Surfrider's expansive network of more than 170 chapters and student clubs nationwide organize around plastic pollution policy through the lens of ocean protection. I lead the Surfrider's policy efforts and litigation to reduce plastic pollution at local, state and national levels.

Senator Gillibrand's Question #1:
New York has enacted policies designed to significantly reduce single-use plastics that are difficult to recycle, including plastic shopping bags, straws, and Styrofoam™ containers. How effective have local bans been on reducing the amount of plastic consumed and discarded in communities with such policies in place?

Overall, local bag bans have been highly effective in reducing plastic bag consumption and reducing litter. Before I joined Surfrider I founded the website PlasticBagLaws.org.[1] At PlasticBagLaws.org I meticulously tracked plastic bag law effectiveness around the globe and helped legislators draft effective laws that avoid unintended consequences.[2] At Surfrider, I wrote our Plastic Bag Law Activist Toolkit, which details best practices for drafting bag legislation.[3] I was pro bono counsel to NYC City Council on their bag law, which was preempted by the state legislature, and I worked closely with state senators on the NY state bag law. I have also lended my expertise to Senator Udall's office in drafting the Break Free From Plastic Pollution Act (BFFPPA).

Washington, D.C.'s bag law mandating a 5-cent tax on all single-use plastic and paper carryout bags resulted in an over 60% reduction in single-use carryout bag consumption in the first year.[4] D.C.'s

[1] PlasticBagLaws.org (2020) https://www.plasticbaglaws.org/
[2] Measuring the Effectiveness of Plastic Bag Laws, PlasticBagsLaws.org (2020) https://www.plasticbaglaws.org/effectiveness
[3] Plastic Bag Law Activist Toolkit, Surfrider Foundation (2019)
http://publicfiles.surfrider.org/Plastics/Plastic_Bag_Law_Activist_Toolkit_2019.pdf
[4] Anacostia River Clean Up and Protection Act of (2009)
https://doee.dc.gov/publication/anacostia-river-clean-and-protection-act-2009

Anacostia River saw a corresponding reduction in plastic bag litter.[5] The bag law proved to be popular with the public: 83% of D.C. residents and 90% of D.C. businesses support the law or are neutral about the law.[6]

Nina Bellucci Butler testified that banning plastic bags has had "unintended consequences," specifically a decrease in the access for citizens to recycle film including bread bags.

The legislators who drafted New York State's bag ban[7] anticipated this concern and passed an updated plastic bag recycling law[8] included in the same budget bill as the bag ban. The plastic bag recycling law requires that large retailers maintain an at-store recycling program that provides an opportunity for a customer of the store to return clean and dry plastic carryout bags and other film plastic to the store. The program must accept all plastic film, including bread bags and the plastic wrap that surrounds paper towels. Customers in New York State will still have access to recycle plastic film at large retailers just as they did prior to the enactment of New York's plastic bag ban.

Ms. Bellucci Butler also testified that bag bans could have a detrimental impact if the bans do not also reduce the use of paper bags, which have a very heavy carbon footprint.

The legislators who drafted New York State's bag ban anticipated this concern as well. In keeping with the best practices for drafting plastic bag laws, New York State's plastic bag ban mandates a 5¢ fee on all paper carryout bags. Fees on carryout bags have been shown to dramatically reduce overall carryout bag consumption related environmental impacts, including a reduced carbon footprint.[9]

Senator Gillibrand's Question #2:
You testified that there are virtually no economic incentives for producers to use recycled plastic and that producing new plastic is comparatively inexpensive. What financial incentives and/or penalties could help make it more economically desirable to shift away from new plastic production and use more recyclable content and reusable products?

Ms. Bellicci Butler also testified that that the companies that take plastic films do not have "true demand" to sell their recycled resin product since virgin plastic resin prices are so low.

The real issue with plastic film recycling has less to do with access for customers and more to do with the lack of demand (a.k.a end markets) for recycled plastic film. Plastic film is not collected curbside in

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[5] Alice Ferguson Foundation, Bag Fees at Work: An Analysis of Reductions in Plastic Bags from Potomac River Watershed Cleanups 2007-2014, http://fergusonfoundation.org/wp-content/uploads/2015/05/DC_Plastic-Bag-reduction_OnePager_5-11-15-Final.pdf

[6] DDOE/Alice Ferguson Foundation, D.C. Resident and Business Bag Use Surveys Report of Findings, Resident Survey, January 2013; Business Survey, February –April 2013, at p. 10, available at https://ddoe.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/DDOE%202013%20Bag%20Law%20Survey%20Final%20Report%20(2).pdf

[7] Environmental Conservation Law, Title 28, Bag Waste Reduction, New York State (2020) https://www.nysenate.gov/legislation/laws/ENV/A27T28

[8] Environmental Conservation Law, Added Part 351, Title 27 and 28, Plastic Bag Reduction, Reuse and Recycling (2020) https://www.dec.ny.gov/docs/materials_minerals_pdf/part351rvsdexptrmsfinal.pdf

[9] City of Aspen Single Use Bag Study, Armstrong, L., O'Connell, E., (2019) http://www.susted.com/wordpress/wp-content/uploads/2018/01/Armstrong-JSE-Fall-2017-General-PDF.pdf

96%[10] of curbside recycling programs, because plastic film is a tangler for recycling sorting machinery and also because the film plastic pulled from recycling facilities is contaminated and worth nothing on the commodities market. The film plastic recycled at retail stores, which is mostly back-of-house films plus some material from customer drop-off bins, is a much cleaner stream and has some value on the commodities market.

The issue is that virgin plastic is so inexpensive that even the film plastic collected from retail stores often has no buyer. The main drivers of end markets for plastic film are two California post-consumer recycled (PCR) content mandates: a law requiring that trash bags must be made from 10% PCR content and a law requiring that all reusable bags made from plastic film must have 40% PCR content.[11] The importance of these laws was made abundantly clear when California's Governor suspended the CA bag law for 60 days during the state of emergency and the orders for PCR plastic resin immediately crashed. According to one plastic recycling company, suspension of California's bag requirements resulted in bag manufacturers reverting overnight to using 100% virgin LDPE.[12]

The answer to not having a "true demand" is adoption of comprehensive PCR content mandates for all packaging products. The BFFPPA includes PCR content requirements specific to beverage bottles as well as an Extended Producer Responsibility (EPR) system that, among other things, would require PCR content for product packaging. PCR content mandates are necessary to drive end markets and fix our broken recycling system.

Regarding reusable products, we have seen that plastic bag laws have resulted in customers bringing their own reusable bags and straws upon request policies have led to a decrease in straw consumption. However, we need to address reusable product packaging on a much larger and systematic scale. EPR programs hold producers accountable for the life cycle of a product they sell and would also incentivize producers to reduce their packaging, including the development of reuse systems.

Senator Gillibrand's Question #3:
What role do you think industry should play in bearing the cost of cleanup of plastic pollution in our environment?

Producers should pay for the cleanup of all packaging in the environment and the negative externalities associated with packaging should not be carried by the consumer. EPR programs are a good mechanism to fund the cost of cleanup of plastic pollution in the environment.[13] Under the EPR program in the BFFPPA, producers must pay into a fund for the cost of recycling/disposal and cleanup of a product's packaging. Producers pay less into the fund if they reduce their packaging, make their packaging from highly recyclable material, or exceed PCR content requirements. Money from the fund manages or reimburses local governments for the cost of recycling/disposal and cleanup. EPR laws shift responsibility from local governments to the packaging producers and drive end markets for recycled

[10] The Last Beach Cleanup, 2020 U.S. Post-Consumer Plastic Recycling Survey https://www.lastbeachcleanup.org/usplasticrecyclingsurvey
[11] California Senate Bill 270, Solid waste: Single-use carryout bags (2014) https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB270
[12] Pause on bag law is a hit to some recyclers, Plastics Recycling Update (2020) https://resource-recycling.com/plastics/2020/04/29/pause-on-bag-law-is-a-hit-to-some-recyclers/
[13] Principles of EPR, Product Stewardship Institute, (2019) https://www.productstewardship.us/page/Principles_of_EPR

plastic, while at the same time providing a funding mechanism for cleaning up plastic pollution from the environment.

Thank you for allowing me to share this additional information. Please feel free to reach out if you have any questions, and encourage you to sign on to the BFFPPA.

All the best,

Jennie Romer

cc: Committee Members, U.S. Senate Committee on Environment and Public Works

May 29, 2020

The Honorable Nancy Pelosi
Speaker
U.S. House of Representatives
Washington, DC 20515

The Honorable Mitch McConnell
Majority Leader
U.S. Senate
Washington, DC 20510

The Honorable Kevin McCarthy
Minority Leader
U.S. House of Representatives
Washington, DC 20515

The Honorable Charles Schumer
Minority Leader
U.S. Senate
Washington, DC 20510

Dear Speaker Pelosi and Leaders McConnell, Schumer and McCarthy:

As a diverse coalition of public health advocates, environmentalists, frontline community members, and recyclers, we write to you with recommendations for building a future with less plastic pollution and healthier communities, while also protecting local recycling programs and waste workers.

The COVID-19 pandemic has challenged many things, including our ability to effectively reduce waste, support local jobs and infrastructure, and keep our communities healthy. At the same time, the plastic life cycle from production to disposal continues to threaten our environment and expose us to growing health risks, including those shown to increase the severity of coronavirus infections.

We continue to throw away millions of pounds of plastic stuff every day, where it piles up in landfills, communities, and natural spaces across our planet. Meanwhile, local recycling and bottle deposit programs across the country face collapsed markets, labor shortages, and dangerous working conditions. Many programs have already been suspended while others teeter on the brink of collapse.

Nobody wins when we lose local recycling programs, but short-term Federal funding must be designed to support existing programs and community resiliency, not the demands of corporate plastic producers. Because we support local solutions and waste reduction, we oppose proposals such as the RECOVER Act (H.R.5115) as written that would allow plastic industry-affiliated groups to receive their own indirect bailout. Such funds could be used to promote dangerous, unproven, and thriftless technologies that would encourage *more* single-use plastic production at taxpayers' expense.

The profits of these groups, namely plastic producers and consumer goods manufacturers, dwarf any infrastructure stimulus proposals including the RECOVER Act. They should be held financially responsible before burdening taxpayers, especially in this time of extraordinary need.

We strongly recommend that Congress instead pass the Break Free From Plastic Pollution Act (S.3263/H.R.5845). This legislation would reduce waste and help local recyclers in the

long-term by making producers financially responsible for their discarded products and expanding container deposit laws to fund our programs, while encouraging manufacturers to design more reusable packaging and safer products.

We further recommend that reduction efforts be coupled with minimum recycled content requirements. Many producers have failed to incorporate recycled content into new products even when materials are plentiful, impairing the very programs they purport to support. We need these requirements to incentivize manufacturers to "close the loop," and reduce the production of virgin material.

The production of new plastic is also responsible for the discharge or runoff of billions of plastic pellets and other pre-consumer materials into waterways and communities surrounding facilities. Any long-term waste management plan to address plastic pollution should also include a temporary moratorium on new plastic facilities, along with updated regulations to require "zero discharge." Facilities such as the Formosa Plastics Corporation plant in Point Comfort, TX have already been required to do so.

Our communities' recycling programs need immediate support to sustain programs that protect our environment and supply recycled materials. With that said, we hope you understand that short term relief need not betray an obligation to hold polluters responsible and prioritize waste prevention and reduction in the long-term.

Thank you for your consideration,

350 Butte County
350 Conejo / San Fernando Valley
350 Humboldt
350 New Orleans
350 Silicon Valley
350 South Bay Los Angeles
7th Generation Advisors
Algalita Marine Research & Education
Beyond Plastics
Californians Against Waste
CalPIRG
CoPIRG
CARE for the Cape & Islands
Center for Biological Diversity
Center for Coalfield Justice
Center for International Environmental Law
Clean Air Council
Clean Energy Now Texas
ConnPIRG Students
Conservation Law Foundation
Earthworks
Eco-Cycle
Ecology Center
Environment America
Environment California
Environment Colorado
Environment Connecticut
Environment Florida
Environment Georgia
Environment Iowa
Environment Maine
Environment Maryland
Environment Massachusetts
Environment Michigan
Environment Minnesota
Environment Missouri

Environment Montana
Environment Nevada
Environment New Jersey
Environment New Mexico
Environment North Carolina
Environment Ohio
Environment Oregon
Environment Texas
Environment Washington
Environment Wisconsin
Eureka Recyclers
MassPIRG
MassPIRG Students
Master Composters CC TX
NJPIRG STUDENTS
Nothing Left to Waste
Oceana
Ohio PIRG
OSPIRG
OSPIRG Students
Peak Plastic Foundation
Peal Plastic Foundation
PennEnvironment
PennPIRG
Plastic Free Curriculum
Plastic Pollution Coalition
San Antonio Bay Estuarine Waterkeeper
SanDiego350
Save Our Shores
Save RGV
Sierra Club
SoCal 350 Climate Action
Sunrise Movement
Sunrise Movement Chico
Sunrise Movement Dallas
Texas Campaign for the Environment
Texas Environmental Justice Advocacy Services
TexPIRG
The 5 Gyres Institute
The Last Beach Cleanup
The Last Plastic Straw
Florida PIRG Students
FracTracker Alliance
FreshWater Accountability Project
GAIA
Greenpeace USA
Heirs To Our Oceans
Indivisible CA-33
Indivisible California Green Team
Inland Ocean Coalition
League of Conservation Voters
Maryland PIRG
The Ohio Valley Environmental Coalition
The Post-landfill Action Network
The Story of Stuff Project
The Surfrider Foundation
Turning the Tide
Turtle Island Restoration Network
U-Konserve
UMD MaryPIRG
UPSTREAM
U.S. Public Interest Research Group
WashPIRG
WisPIRG
Zero Waste Washington

Senator CARPER. And one more, if I could. I ask unanimous consent to submit—is that the same thing? They are the same. Two for the price of one. Thanks so much.

Senator BARRASSO. Thank you, Senator Carper. We received a number of letters and written testimony from cities and a variety of organizations on the state of recycling in America, and I am asking unanimous consent to enter all of this material into the record, and without objection, that will be done.

[The referenced information follows:]

American Forest & Paper Association

Statement for the Record
Senate Environment and Public Works Committee
Hearing on "Responding to the Challenges Facing Recycling in the United States"
June 17, 2020

The American Forest & Paper Association (AF&PA) serves to advance a sustainable U.S. pulp, paper, packaging, tissue and wood products manufacturing industry through fact-based public policy and marketplace advocacy. AF&PA member companies make products essential for everyday life from renewable and recyclable resources and are committed to continuous improvement through the industry's sustainability initiative — *Better Practices, Better Planet 2020*. The forest products industry accounts for approximately four percent of the total U.S. manufacturing GDP, manufactures nearly $300 billion in products annually and employs approximately 950,000 men and women. The industry meets a payroll of approximately $55 billion annually and is among the top 10 manufacturing sector employers in 45 states.

AF&PA members make numerous products including; tissue products, pulp used in diapers and other personal hygiene products, papers for communication and education, building/construction products, and packaging for food, beverages, foodservice, cleaning supplies, pharmaceuticals, medical equipment and other consumer products, and shipping boxes that get those products to market. Nationwide, more than a third of the paper industry's total fiber requirements are met using recovered material. For some products, the share of recovered fiber used in manufacturing is much higher. For example, the manufacturing of both tissue products and containerboard used to make boxes – which represent about 60 percent of industry capacity -meet a majority of fiber requirements using recovered fiber.

Paper Recycling is an Environmental Success Story

Every year since 2009, the recycling rate for paper and paper-based packaging has met or exceeded 63 percent. A strong market for paper recycling is the result of our industry's voluntary investment in building the commercial paper recycling infrastructure and funding public-private partnerships that improve communities' capacity to recovery more mill-quality recyclable materials, as well as the commitment by millions of Americans who recycle at home, work and school every day. More paper is recovered by weight for recycling from municipal waste streams than plastic, glass, steel, and aluminum combined[1].

- Since 2017, **our industry has announced $4.1 billion dollars in investments** in our own facilities in the United States that will allow us to recycle more paper. Together, those

[1] Source: U.S. EPA, Advancing Sustainable Materials Management, 2017 Fact Sheet

investments will enable the industry to recycle an additional 3.5 million tons of recovered paper annually[2].

- In 2019, 66.2 percent of paper consumed in the United States was recovered for recycling. The recycling rate for old corrugated containers (OCC) was 92 percent.
- In 2019, more than 31 million tons of recovered paper was used by mills in the U.S. to make new paper, paperboard, and other paper-based products.

AF&PA has long worked on initiatives to promote increased paper recovery for recycling that benefit community recycling, including:

- AF&PA conducts communications campaigns to educate consumers on how to recycle paper and paper-based packaging. One example includes our recently developed e-commerce communications campaign that utilizes both earned and digital media to educate consumers on how to recycle cardboard boxes.
- AF&PA is developing Design Guidance for Recyclability for Paper-based Packaging -- technical guidance for members of the paper-based packaging manufacturing supply chain to use in designing and manufacturing packaging to meet customers' needs in terms of recyclability and help community recycling programs better understand what packaging is recyclable at paper mills.
- AF&PA is working with stakeholders to unequivocally communicate to municipal materials recovery facilities (MRFs) and consumers that **pizza boxes are recyclable** and should be included among the paper-based packaging items accepted in recycling programs.

Impact of China's Import Restrictions on Recovered Paper Exports

In 2019, China continued to restrict imports of recovered paper. This reduced U.S. exports and changed patterns of domestic consumption of recovered paper. However, contrary to some perceptions that markets have "collapsed" for recovered paper in general – and for Mixed Paper in particular – the facts show that recovered paper markets are generally strong.

Total U.S. exports of recovered paper declined 13.6 percent in 2019; U.S. exports of recovered paper to China fell 30.2 percent. Thus far in 2020, U.S. exports of recovered paper to China have declined by 21.0 percent year to date through April, compared to the same four-month period in 2019. While exports have declined, domestic consumption of recovered paper is picking up the slack. Thus far in 2020, U.S. domestic consumption of recovered paper has increased 6.6 percent year to date through April, compared to the same four-month period in 2019. Leading the way are increases in consumption of Mixed Paper and OCC, up 9.1 percent and 8.1 percent, respectively. The one exception to this growth is U.S. domestic consumption of High Grade Deinking (HGD), the white paper grades used to make tissue and communications papers. 2020 consumption of HGD through April is down 1.7 percent compared to the same

[2] Source: The Recycling Partnership

four-month period in 2019, driven by lack of availability caused by COVID-19 induced shutdowns of the places where HGD grades are collected – schools and offices.

COVID-19 Impacts to Paper Recycling

The coronavirus (COVID-19) situation is highly dynamic and changing daily, and the industry is working diligently to respond to demand to meet the needs of consumers, especially the demand for tissue products, packaged food/beverages, cleaning supplies and medicine. Disruptions in the availability of these goods would cause significant hardships to consumers who depend on steady and stable supplies.

Unfortunately, like many industries, the COVID-19 pandemic is affecting the recycling supply chain.

Among the changes, we are seeing:

- A decline in the volume of recovered fiber from institutional, commercial and industrial facilities, many of which are experiencing reduced operations or are shut down (schools, hotels, factories, etc.).
- A volume shift of recovered office papers from office buildings to residential, as many American workers shelter at home. Typically, the recovery rate for materials in residential recycling streams is lower than in commercial streams.
- The suspension of residential curbside recycling collection (or diversion of collected recyclable material to landfill) in some municipalities as communities deal with labor shortages.

What AF&PA and Our Members are Doing in Response to COVID-19:

- AF&PA member companies are prioritizing worker safety, emphasizing a long-held commitment to safety and training.
- AF&PA is supplying online resources and information, including workplace safety guidance from the Occupational Safety and Health Administration, Centers for Disease Control and Prevention (CDC) and U.S. Equal Employment Opportunity Commission and guidance on the safety of packaging, mail and other paper products from the CDC, Food and Drug Administration, and the U.S. Surgeon General.
- AF&PA and other industry allies ensured that recycling was also considered an essential service in the Department of Homeland Security CISA guidance.
- AF&PA is conducting outreach to municipalities, discussing the importance of recycling to our industry's continuing commitment to sustainability and urging them to protect worker safety by following guidance from the CDC.

What Policymakers Can Do:

As Congress works on legislative packages, they should consider including the following to ensure that residential curbside collection is prepared to meet challenges created by COVID-19, including:

- After needs of emergency personnel and medical services are met, support the health and safety of the municipal recycling workforce with short-term funding for personal protective equipment to ensure that the collection, sortation and processing of recyclable materials can continue.
- Funding for EPA to establish a competitive grant program to improve the effectiveness of residential and community recycling programs through public education and outreach (the RECYCLE Act).
- Short-term federal funding *only* for municipal recycling programs facing mission-critical budget deficits brought on by the COVID-19 crisis. Funds to be used to:
    - Maintain consumer access to residential curbside and drop-off recycling programs.
    - Provide recycling education programs to educate consumers on the right way to recycle (especially related to an increase in recyclable material received at home during COVID-19).
    - Funds should *not* be used to build new municipal recycling infrastructure with federal tax dollars.

Markets are Adapting, Demand is Strong, Recycling is Not Broken

Although the recovered fiber supply stream experiences disruptions from time to time, markets are adapting and the demand for it remains strong.

The market-based paper recovery system fuels innovation, creates economically viable infrastructure without the need for taxpayer subsidies and enables us to make new products from paper that is diverted from the waste stream. Industry-led efforts to increase paper recovery for recycling are among the best examples of how we are protecting our environment, growing the economic contributions of the industry, and fostering the well-being of employees.

For example, **AF&PA member company innovations are enabling the industry to use previously less-recycled items, like poly-coated paper cups, in manufacturing**. Currently, 21 paper and paperboard mills across 14 states in the U.S. and in Quebec accept poly-coated paper cups for recycling into new paper products.

AF&PA members believe:

- Free markets are best positioned to ensure that recovered paper is put to its highest value end use without interference from legislation and regulation.
- For recovered paper, where end markets are mature and recycling is driven by robust private sector investment, flow control, recycled content mandates, and extended

producer responsibility will create uncertainty that could jeopardize future investments, shifting costs of further investment in recycling infrastructure to consumers and taxpayers.

- Government incentives or directives should not be used to divert commonly recycled paper away from reuse in manufacturing products.

The COVID-19 pandemic has created challenges for community recycling programs. However, recycling is not broken. Any action taken by Congress should only address acute, short-term COVID-19 induced challenges.

Thank you,

Elizabeth Bartheld



Vice President, Government and Industry Affairs
AMERICAN FOREST & PAPER ASSOCIATION
1101 K Street, N.W., Suite 700
Washington, D.C. 20005

AMP Robotics
1500 Cherry Street, Suite A
Louisville, CO 80027

June 16, 2020

The Honorable John A. Barrasso
Chairman
U.S. Senate Committee on Environment and Public Works
Dirksen Senate Office Building Room 410
Washington, DC 200002

The Honorable Thomas R. Carper
Ranking Member
U.S. Senate Committee on Environment and Public Works
Dirksen Senate Office Building Room 410
Washington, DC 200002

Dear Chairman Barrasso and Ranking Member Carper:

Thank you for the opportunity to present testimony regarding the Senate Committee on Environment and Public Works (EPW) hearing titled "Responding to the Challenges Facing Recycling in the United States." We at AMP Robotics appreciate your leadership on these critical issues facing the nation, and look forward to continuing to work on meaningful, lasting solutions.

AMP (Autonomous Manipulation and Perception) Robotics is a U.S. pioneer and leader in the industrial application of artificial intelligence (AI), computer vision and robotics automating the identification, sortation, and recovery of high-value commodities within complex, heterogeneous material streams. AMP's mission is to apply transformative, cutting edge U.S. technology to overcome the economic hurdles of recycling, while creating resilience for our domestic supply chain and enabling a world without waste. Our technology is deployed and being deployed throughout North America and other parts of the world at material recovery facilities (MRFs) which receive, separate and prepare recyclable materials for sale as commodities to end-use manufacturers that make a wide variety of goods, packaging and other products for industrial, commercial, and consumer use.

Dr. Matanya Horowitz founded AMP in 2014 after recognizing the opportunity to apply the latest advancements in AI and robotics to help modernize the infrastructure of the nation's recycling system. Upon completing his doctorate in controls and dynamical systems at the California Institute of Technology, he won both a *National Science Foundation Small Business Innovation Research Grant* and an *Advanced Industries Accelerator Grant* through the state of Colorado to start AMP

The legacy way of sorting materials for recycling at MRFs is by hand. Labor for sorting through waste to find recyclables is chronically hard to find, risky due to the hazards found in the material stream (like hypodermic needles and other 'sharps') and is plagued by high turnover regardless of whether there is high or low unemployment. The result is often a very high cost for recycling, along with limitations on productivity, quality, and capacity. Combined with the volatility of commodity market pricing and constantly fluctuating demand, further exacerbated by China's 'National Sword' policy, the recycling industry is an extremely difficult business to manage and make economically sustainable.

AMP Neuron™ is our core AI platform which applies the latest computer vision technology to visually recognize materials for recovery, just as a human would, by 'seeing' different colors, textures, shapes, sizes, patterns, and even brand labels to identify what the materials are that are coming down a belt. Millions of images are captured and being captured through our vision system to identify materials to recycle despite being torn, tattered, and battered. The 'eyes' of our platform then convert these images into data for the 'brain' of our AI platform to continuously train itself on what it is seeing and then AI guides high-speed industrial robots to target, pick and place the material to be recycled into 'bunkers' for baling for resale into the commodity markets to make new goods.

Our overall robotic system is called AMP Cortex™. Cortex is designed to 'drop-in' on an existing conveyor line so it can adapt to the layout of existing material recovery facilities. The modular design enables the quick installation into existing facilities without extended downtime or costly retrofit. Often our team will begin installation on a Friday and have a system up and running Sunday night in time for commissioning Monday morning. Designed to run 24/7, Cortex sorts at superhuman speed with extremely high accuracy - consistently - over extended durations of time. AMP's technology recovers plastics, cardboard, paper, metals, cartons, cups, and many other recyclables that can be reclaimed for raw material processing.

For example, the AI platform visually identifies with precision different types of plastics like Polyethylene Terephthalate (PET or PETE), High-Density Polyethylene (HDPE), Low-Density Polyethylene (LDPE), Polypropylene (PP), Polystyrene (PS), sorted further by color, clarity, and opacity, along with different form factors (e.g. lids, tubs, clamshells, cups, and many more). AMP's technology can quickly adapt to new container packaging introduced into the recycling stream. And it can swiftly pivot to handle sudden shifts in material volumes, happening now as a result of the pandemic, to recover high-demand materials, like paper, tissue, cardboard, and other packaging. This capability is especially critical as demand and prices for commodities fluctuate, given the role recyclables play in feeding the domestic supply chain for manufacturing.

Our AI technology is powered by data – as data algorithms are used to identify what we are identifying - what to sort and what not to sort. We are characterizing the entire waste stream and capturing data with accuracy and consistency previously impossible. Still in the early stages as we ramp installations, this data is extremely critical to MRF operators as they seek to optimize their operations and become more and more automated as a manufacturing factory would be. We make this data available to our customers so they can make informed decisions about their operations and business to continuously improve. We know this brings data transparency to material streams that have been historically difficult to understand – in terms of volume, composition and other attributes. We are in the early stages working with a number of different recycling stakeholders - including consumer brands and packaging producers – exploring how we can apply data to further improve our recycling infrastructure and provide a better feedback loop to connect and inform the nodes of the circular economy. In addition to commercial and residential municipal waste, we also apply our technology to recover high value materials from electronic waste, construction and demolition debris.

Headquartered and with manufacturing operations in Colorado, AMP plans to double in size from less than 50 employees starting in 2020 to over 100 going into 2021. AMP is comprised of a diverse group of employees in robotics, engineering, manufacturing, field operations, and business operations. As part of the company's growth, doubled our manufacturing facilities in Colorado to meet the increased demand for our robotic systems and doubled the size of its engineering innovation lab for the development of new AI and robotic applications for the recycling industry. As technologists, we are

constantly engineering new ways to further automate MRFs and make recycling even more efficient and cost-effective through the development and introduction of new solutions, services, and business applications.

Recycling has been classified as an essential industry and service by the Department of Homeland Security during the COVID-19 pandemic. The demand for AMP's AI and robotics technology has accelerated as recycling businesses turn to automation to remove their employees from harm's way, navigate chronic labor shortages to remain operational, and adapt to spikes in residential volume and material types caused by sudden shifts in consumer buying patterns.

In addition to technological advancements, AMP is also innovating the way technology can be brought to market and adopted. As an alternative to businesses buying capital equipment, AMP has also introduced new market models to remove the cost barriers typical of new technology. The AMP Cortex Lease program enables municipalities, waste management and recycling businesses to get the benefits of sorting automation without the capital expense. Monthly payments are fixed and with flexible terms customers can overcome budget constraints, while freeing up cash and lowering their variable expenses. These financial benefits also help municipalities maintain the public service of recycling during challenging economic times and budget shortfalls. The AMP Cortex Lease program also includes warranty, maintenance, and service packages, alleviating concerns about the perceived risk of emerging technologies like AI and robotics.

AMP achieved a major industry milestone deploying fourteen AI-guided robots at Single Stream Recyclers in Florida, the single largest global deployment of automation in the recycling industry. The robots are installed on a number of different sorting lines throughout the facility, processing plastics, cartons, fiber, metals and other materials. In addition to Florida, AMP has installations at numerous facilities across the US, including California, Colorado, Indiana, Minnesota, New York, Pennsylvania, Texas, Virginia and Wisconsin, with many more installations upcoming.

AMP would like to see Congress focus on protecting America's position as a leader in AI and the Fourth Industrial Revolution, creates a resilient domestic supply chain, modernizes its recycling infrastructure to eliminate waste, and preserves its natural resources.

Thank you for this opportunity, we at AMP Robotics are available to answer any follow up questions the Committee may have.

Sincerely,

Chris Wirth
Vice President
Marketing & Strategic Initiatives

plasticpollutioncoalition

June 16,2020

STATEMENT OF SUPPORT FOR THE BREAK FREE FROM PLASTIC POLLUTION ACT
(Senate Bill 3263, HR 5845)

The Break Free From Plastic Pollution Act of 2020, (Senate Bill 3263, HR 5845) will tackle the exploding crisis of plastic pollution and transform waste and recycling management in the United States.

Additionally, this legislation will prohibit plastic waste from being exported to developing countries, and place a temporary pause on new plastic facilities until the EPA updates and creates important environmental and health regulations on those facilities.

Plastic Pollution Coalition fully supports the Break Free From Plastic Pollution Act of 2020, for the health of humans, animals, waterways, oceans, and the environment.

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www.plasticpollutioncoalition.org

CHZ TECHNOLOGIES

June 19, 2020

The Honorable John Barrasso
Chairman
Committee on Environment and Public Works
Dirksen Senate Office Building
Washington, DC 20510

The Honorable Tom Carper
Ranking Member
Committee on Environment and Public Works
Dirksen Senate Office Building
Washington, DC 20510

Re: June 17, 2020, Hearing on "Responding to the Challenges Facing Recycling in the United States"

Dear Chairman Barrasso and Ranking Member Carper:

Thank-you for holding a hearing on the waste plastics crisis. As a small business entrepreneur that is focused on non-incineration technology solutions to waste materials, we have great confidence that with additional R&D, there are sustainable unsubsidized economic technology solutions.

Our research illustrates that recycling waste plastics and e-scrap into a source of non-CO_2 emitting hydrogen fuel, clean synthetic gas, and recovering rare earth elements (REEs) and the precious metals from e-scrap is not a pipe dream. Science, technology and engineering can deliver these outcomes with relatively small amounts of R&D.

The realities of the waste problem in the U.S. are shocking. A recent U.S. EPA report said that 35.4 million tons of plastics were generated in the U.S. in 2017, with only 8.4 percent recycled. This is a decrease of over half a percent from 2015. Another 16.4 percent were incinerated for energy and 76 percent were landfilled.

There is reason to be optimistic. Technology solutions needed to provide an environmentally responsible solution to the waste plastic and e-scrap crisis - are much closer than policy makers realize. This is a timely and significant opportunity for the U.S. to lead the world, create investment, jobs and exports.

It is timely to focus on advancing the 'circular economy' where more of our waste should become a resource for another process either as a by-product or a recovered resource for another industrial process, or as regenerative resources for nature. This regenerative approach contrasts with the traditional linear economy, which has a 'take, make, use, dispose' model of production. The traditional linear economy model that is in place today is no longer acceptable to society. With R&D, we can make significant progress toward the circular model.

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CHZ TECHNOLOGIES

To this point, CHZ Technologies, LLC strongly supports leveraging U.S. R&D spending to enhance STEM and prepare the next generation with the capabilities to advance the circular economy. It is for this reason that CHZ Technologies LLC is collaborating with the Center for Environmentally Responsible Materials Recycling (CERMR), a 501(c)(3) nonprofit corporation dedicated to providing scientific and economical non-incineration technology solutions for environmentally responsible recycling and repurposing of end-of-life materials. CERMR, in cooperation with Youngstown State University (YSU), will conduct R&D that will be used as an educational and work-place skills development center for students and their preparation of entry into the workplace associated with end-of-life material recycling science and technology. A new YSU curriculum will focus on the science, technology and economics of end-of-life materials with the goal to place YSU at the forefront of addressing the global recycling environmental crisis.

Plastics are produced by using hydrocarbons as raw materials such as natural gas and, less so today, crude oil. So, it should not be surprising that plastics 1-7 have a very high energy content between 12,000 and 19,000 Btu's per pound, averaging 15,300 Btu's per pound. Gasoline has an energy content of 19,000 Btu's per pound, and natural gas has an energy content of 20,000 Btu's per pound. The circular economy calls for recovery of that energy content and convert it into a useful recycled energy source, all while safely diminishing the waste stream.

If it can be economically recycled into a usable plastic product – so be it. However, polymer molecular science makes clear that not large amounts of waste plastics can be reused and retain the performance characteristics demanded by the consumer marketplace and or compete economically with virgin material. And, when GHG life-cycle costs are considered, recycling looks even worse. Policy makers, consumers and environmentalists have a hard time accepting this chemistry reality.

Specifically, many plastics contain halogens that making conventional recycling physically impossible or uneconomic. Halogens are added to plastic polymers as a fire retardant and to enhance plastic performance characteristics. To recycle waste plastics requires heating them. Heat causes plastics to change their molecular composition, substantially reducing their usable performance characteristics and, if they contain halogens, they can emit dioxins and furans, which are toxic and expensive to destroy. Therein lies the challenge.

Plastics that contain halogens include, but are not limited to PVC piping, electrical wiring, electronic circuit boards, plastic housings, food wrapping films, tires, a significant range of plastic composites, and all the waste plastics that are polluting the oceans. Unfortunately, local recyclers cannot easily identify and separate halogen from non-halogen containing plastic materials.

For non-halogen waste plastics like water bottles, companies are considering blending the waste plastic with virgin material. The costs are higher and there is concern that when the GHG life cycle is considered, GHG emissions increase. The blending strategy works for only a small and narrow portion of all plastics.

Ocean plastics also have a unique problem. When exposed to sunlight, salt water and constant wave action, the polymers oxidize and break down in a few months creating microplastic fragments that enter into the aquatic life food chain. The polymer structures of the collected ocean waste plastics are so damaged that they cannot to be recycled. Ocean plastics collected on the beaches or rivers by well-

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intentioned civic groups can only be baled and sent to waste landfills – an unacceptable alternative to the circular economy.

Economics and GHG emissions are also a challenge for plastic recycling. Given the public demand for more plastic recycling, companies are investing in technology solutions that would potentially increase recycling. However, as mentioned earlier, to potentially reuse plastics requires heating them and cleaning them - and that requires large energy inputs that not only increase costs but increase GHG emissions. Plus, the GHG emissions associated with the collection, separation, and transportation of the waste materials must be considered. These higher costs and higher GHG emissions make recycled plastics more costly and less climate friendly than virgin plastic.

Electronic scrap recycle rates are only slightly better but none-the-less unacceptable. Industry data says the U.S. produced 6.9 million tons of electronic wastes in 2017, or about 12.5 percent of the world's volume. This volume is growing by greater than 5 percent annually and only about 17 percent is recycled.

Unlike plastics, e-scrap is still being shipped overseas. So, it is overseas entities, like China that are extracting the precious metals and rare earth elements (REEs), an outcome that does not make economic or national security sense. A robust domestic supply of REEs is critical to securing our national defense and national economic well-being, yet we are foolishly shipping it offshore when we should be recycling all the e-scrap here in the U.S.

Recycling e-scrap and recovering the REEs is the fastest way for the U.S. to achieve REE independence. And, here again, an environmentally and economic technology solution is not far off through R&D.

Every one of the above challenges have a technology solution. As a country, we should be optimistic that through R&D, we can provide unsubsidized economic solutions to these serious and timely challenges. And, if we do, the U.S. can lead the globe in technology solutions to a world that is awash with waste materials on land and sea. Focusing on R&D and the 'circular economy' is the answer. Disruptive technologies that economically recycle these wastes lead to sustainability and a realistic circular economy. We look forward to working with you in support of advancing the circular economy.

Sincerely,

Ernest Zavoral
CEO
CHZ Technologies, LLC

Henry W. Brandhorst, Jr.
Managing Director
CHZ Technologies, LLC

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Initiatives to Ban or Reduce Consumption of Single-Use Plastics

Plastic pollution is impacting our waters and marine life, as well as our food chain and the public health. The good news is that global initiatives to reduce or eliminate the consumption of single-use plastic have been gaining momentum. This A-Z list covers efforts by regions, countries, cities and businesses to restrict the consumption and sale of single-use plastics, with a focus on plastic straws and plastic bags. We will regularly update it to include additional single-use plastic restrictions or bans of plastic bags and straws, as well as plastic cups, bottles, utensils, and more.

STRAWS

Countries

Canada, Vancouver: "Vancouver became the first major Canadian city to ban plastic straws, in a move towards banning all solid waste by 2040. According to a statement, the motion passed by city council also bans the distribution of foam cups and takeout containers, and will come into effect on June 1, 2019."

Costa Rica: "Costa Rica is taking dramatic action against plastic waste with plan to ban all single-use plastics by 2021. This includes straws, bottles, cutlery, cups and bags."

Great Britain: "The Government has announced its intention to ban the sale of plastic straws, drink stirrers and plastic-stemmed cotton buds at the start of the Commonwealth Heads of Government Summit." (announced April 18, 2018)

"Buckingham Palace has announced that plastic straws and bottles will be banned from the Royal estates." (announced February 2018)

Greece, Sikinos: "The island of Sikinos will be the first to … ban the use of plastic straws this summer, in a bid to protect the marine environment in the Cyclades archipelago." (announced May 2018)

Guatemala, San Pedro La Laguna: "San Pedro La Laguna law 111-2016 became effective in January. It prohibits plastic bags and straws, Styrofoam containers and all packaging materials made of polystyrene."

India, New Delhi: "This massive city in India, home to over 20 million people, took a major step toward helping the planet when it banned all forms of single-use plastic in 2017."

Scotland, Glasgow: Glasgow City Council will stop the use of plastic straws in all city operated properties, including museum cafes, offices, schools, sport centers and city chambers. The policy came into effect at the end of February 2018.

Seychelles: "Seychelles has banned the importation of single-use plastic straws, said a top official of the department of environment…Retailers have been given to January 2019 to use their existing stock." (announced June 8, 2018)

Switzerland, Neuchatel: "Neuchâtel looks set to become the first city in Switzerland to outlaw the use of plastic straws in cafes from 2019, following a global trend to reduce plastic waste…The ban could come into force on January 1 next year."

Taiwan: "As of 2018, food and beverage stores such as fast food chains must stop providing plastic straws for in-store use. From 2020, free plastic straws will be banned from all food and beverage outlets. From 2025, the public will have to pay for takeaway plastic straws, and a blanket ban is to be imposed in 2030."

European Union: "Under the new plans, all plastic packaging on the EU market will be recyclable by 2030, the consumption of single-use plastics will be reduced and the intentional use of microplastics will be restricted." (implemented January 16, 2018)

"The European Commission proposed on May 2018 new EU-wide rules to target the 10 single-use plastic products most often found on Europe's beaches and seas, as well as lost and abandoned fishing gear."

United States of America:

California, San Francisco: As of May of 2016 "The Board of Supervisors introduced new legislation that would ban the distribution of plastic straws and some other non-biodegradable odds and ends, in another City Hall drive to clean up San Francisco's chronic trash problem." Many cities in California have pending plastic straw legislation. Cities such as Alameda, Carmel, San Luis Obispo, Davis, Malibu, Manhattan Beach, Oakland, Richmond, and Berkeley.

Hawaii: "Hawaii Restaurant Association and the Hawaii Food Industry Association use to oppose Senate Bill 2285, which would ban the use of plastic straws throughout the state and slap offenders with fines as well as community service, namely trash details in littered public spaces… Yet several such establishments on Hawaii Island are nonetheless transitioning away from traditional plastic straws, despite expenses, to compostable paper straws."

New Jersey: "Jersey City and Hoboken — as well as Shore towns like Long Beach, Belmar, and Point Pleasant Beach — have all banned single-use plastic bags. Teaneck, Longport, and Ventnor each have put a 5- or 10-cent fee on plastic bags."

New Mexico: "A new push to usher plastic straws out in the capital city is gaining steam as Santa Fe City Council is now weighing a potential resolution in support of the idea."

New York: In May 2018, Councilman Rafael Espinal has put forth a bill that would ban the use of plastic straws restaurants throughout New York City."More than 60 restaurants here have already gone straw-free. The ban, if passed, would be enforced by the city departments of consumer affairs, sanitation and health. Violators could face fines starting at $100."

South Carolina: "South Carolina's fourth-largest city has decided to prohibit most single-use plastic bags, foam food containers and more, setting up a potential showdown with state lawmakers…The town's ban would take effect in a year, and its reach extends beyond grocery store bags and take-out clamshells. The sale of polystyrene or plastic foam coolers and packing peanuts would also be prohibited. Plastic straws would be a no-no."

Washington: "Seattle is set to enact a ban on plastic straws and utensils." This was originally put in place September of 2017, but was enacted this past month.

Pre-emption actions taken in 10 states: **Arizona, Florida, Idaho, Indiana, Iowa, Michigan, Minnesota, Mississippi, Missouri and Wisconsin.**

Businesses

Alaska Airlines: In 2018, Alaska Airlines will be removing all non-recyclable plastic stir straws and citrus picks and replacing them "with sustainable, marine-friendly alternatives on all domestic and international flights, as well as in Alaska's lounges across the country." Marine-friendly alternatives will be provided to guests who need them.

Bon Appétit Management Company: On May 31, 2018, Bon Appétit Management Company announced that it would "ban plastic straws and stirrers companywide in [its] 1,000 cafés and restaurants in 33 states. The

phase-out has begun and will be completed by September 2019. Bon Appétit is the first food service company — or major restaurant company — to make this commitment in the country."

Costa Cafe: In January 2018, UK-based Costa Coffee announced that it "will remove plastic drinking straws from its stores [in 2018] and replace them with a more environmentally friendly alternative." The announcement goes beyond the steps the company previously took to only offer straws upon request.

Hilton: "Hilton will remove plastic straws from its 650 managed properties by the end of 2018… Hilton also reveals its new goal to double its social impact investments and cut its global environmental impact in half by 2030, with the help of science-based targets.

In Europe, Middle East & Africa alone, the commitment will remove more than five million plastic straws and 20 million plastic water bottles annually."

Hyatt Hotels: "Hyatt Hotels Corporation… announced [on July 9, 2018, that] Hyatt hotels around the world plan to eliminate single-use plastic straws and drink picks. After Sept. 1, 2018, straws and picks will be available on request only, and eco-friendly alternatives will be provided where available."

Ikea: "Ikea is to phase out all single-use plastic products from its stores and restaurants by 2020 amid growing concern about the effects of plastic on the environment."

Ikea said plastic straws, plates, cups, freezer bags, bin bags, and plastic-coated paper plates and cups would all be phased out and where possible replaced by alternatives."

London City Airport: As of February 2018, "plastic straws are no longer available in any of London City Airport's food and drink outlets and have been replaced with biodegradable paper straws, which will be provided upon request."

"Until this new measure, approximately 100,000 plastic straws were distributed by London City Airport outlets each year, among a proportion of its 4.5 million annual passengers. The airport is the first in the UK to implement the ban, helping to reduce the amount of plastic waste."

Marriott International: Beginning in 2018, more than 60 Marriott International hotels in the UK will begin removing plastic straws and start offering biodegradable or paper alternatives to guests who request a straw. Hence, in Africa, Protea Hotels by Marriott, "has taken the initiative to introduce biodegradable straws in its hotels across the Sub-Saharan Africa region. This eco-conscious shift will become a brand standard across Marriott International brands such as Protea Hotels by Marriott, Protea Hotels Fire & Ice! by Marriott, African Pride Hotels Autograph Collection and the Westin Cape Town. The initiative follows the introduction of Vivreau Water in Protea Hotels, an initiative undertaken to limit the use of plastic water bottles."

McDonald's UK: In June 2018, "McDonald's announced a phased rollout of paper straws in all 1,361 McDonald's restaurants in the UK and Ireland with completion set for 2019 as well as plans to test alternatives to plastic straws in multiple markets throughout the globe later this year." Those other markets include Belgium, and select restaurants in the U.S., France, Sweden, Norway, and Australia.

National Parks Service: National Park Service (NPS) concessioners in the food and beverage industry can implement an "offer first" policy, requiring the customer to "opt-in" to using a straw rather than making straw usage the default.

Ted's Montana Grill was one of the first to sign on to the Be Straw Free campaign. Following Ted's example, the Colorado Restaurant Association implemented an "offer first" policy, and the National Restaurant Association now recognizes the "offer first" policy as an industry best practice. Xanterra Parks and Resorts launched its own "Choose to be Straw Free" program this past April, setting in motion an "offer first" trend both on national parks and other locations including: Kingsmill Resort, Zion National Park; Grand Canyon Railway, Grand Canyon South Rim; The Grand Hotel, Grand Canyon National Park; Painted Desert Oasis, Petrified Forest National

Park; Windstar Cruises, Yellowstone National Park; Crater Lake National Park; Rocky Mountain National Park; Mount Rushmore National Memorial; Furnace Creek Resort, and, Death Valley National Park; Five Ohio State Park lodges.

Concessioners in the national park system can follow the lead of many straw-free NPS concessioners and the National Restaurant Association in making straw use a customer choice rather than a business default. Each concession operation can make a difference, and as more national parks adopt such a policy, behavior in all industries may begin to shift.

Pizza Express: In response to a letter from a five-year-old concerned about the effect of straws on the environment, the UK-based company Pizza Express announced that it is "now phasing out single-use plastic straws from all 470+ restaurants [in the UK]… [and will be] replacing them with biodegradable and recyclable paper versions." The new company policy will come into effect in summer, 2018.

Pret a Manger: In 2018, Pret a Manger announced that they would begin offering paper straws to customers in the UK, with plastic straws only available upon request.

Restaurants: The Last Plastic Straw, an initiative under the Plastic Pollution Coalition, keeps a restaurant directory of eateries from California to Rhode Island that are taking efforts to skip the straw.

Royal Caribbean Cruises: "All 50 ships across the Royal Caribbean Cruises Ltd. fleet will ring in 2019 free of plastic straws. Royal Caribbean International, Celebrity Cruises, Azamara Club Cruises, TUI Cruises, and Pullmantur Cruceros are eliminating plastic straws en route to comprehensive plastics elimination programs across their brands. For over a year now, RCL ships have begun implementing a "straws upon request" policy. That program will be taken a step further by the start of 2019, when guests requesting a straw will receive a paper straw instead of a plastic one. Guests also will begin seeing Forrest Stewardship Council-certified wood coffee stirrers and bamboo garnish picks as part of RCL's plastic reduction strategy."

SeaWorld Entertainment: "As part of its mission to protect animals and habitats worldwide, and just in time for World Oceans Day, SeaWorld Entertainment, Inc.… announced [on June 8, 2018] that all 12 of its theme parks have removed all single-use plastic drinking straws and single-use plastic shopping bags."

Starbucks: On July 9, 2018, "Starbucks Coffee Company announced it would eliminate single-use plastic straws from its more than 28,000 company-operated and licensed stores by making a strawless lid or alternative-material straw options available, around the world. Starbucks, the largest food, and beverage retailer to make such a global commitment, anticipates the move will eliminate more than one billion plastic straws per year from Starbucks stores."

Union Square Hospitality Group: The Union Square Cafe and other Union Square Hospitality Group restaurants will end its use of plastic straws and start the switch immediately to biodegradable alternatives. The move was announced in May 2018.

Wagamama: In January 2018 Wagamama announced it would end its use of plastic straws. The restaurant chain stopped providing plastic straws in its 128 UK restaurants on Earth Day 2018. "Those who ask for straws will, from [Earth Day on], be given a biodegradable paper alternative. The chain said the move would prevent seven million single-use plastic straws polluting the environment each year."

Walt Disney World's Animal Kingdom: Walt Disney World's Animal Kingdom ban single-use straws throughout their concession areas. 244 million visit the park every year.

PLASTIC BAGS

Australia

Policy: The Australian Capital Territory (ACT) banned plastic bag usage in 2011. Banned plastic bags include all single-use polyethylene polymer bags that are less than 35 microns thick. The Australian government encouraged citizens to bring reusable bags when shopping to reduce their environmental impact.

Impact: The ban has been widely successful, eliminating ⅓ of plastic waste sent to landfills prior to the ban. It has also become popular among Australian citizens. Rather than feeling inconvenienced by the ban, they support it. A study conducted by ACT shows that roughly 70% of citizens do not support the ban being rescinded.

Boston, MA

Policy: Boston is on its way to implementing a dual approach of taxation and bans on single-use bags. Beginning in December 2018, there will be a ban on plastic bags, and a 5 cent tax on sustainable single-use bags.

Impact: Boston's plastic bag ban will add to the more than 70 cities and towns in Massachusetts that regulate plastic bags. Boston expects this policy to be key in reducing the more than 350 million plastic bags that are used in the city each year.

Canada

Policy: Montreal implemented a ban on plastic bags with thickness less than 50 microns in January of 2018. Several other municipalities in Canada have followed suit. Victoria intends to ban plastic bags in July of 2018, and Vancouver has also expressed interest in reducing their plastic consumption with a tax or ban. Edmonton has asked businesses to charge for plastic bags, and is reevaluating a ban proposed in 2012.

Impact: The bans on plastic in Canada are relatively new, or still in the process of implementation. Canadian governments have allowed for a 6-month grace period for businesses to come into compliance with the new legislation before strictly enforcing the ban. The plans hope to reduce the billions of plastic bags used in Canada every year.

Chile

Policy: Chile's current president is expanding the previously proposed plastic bag ban to apply to the entire country, not just coastal cities. This policy will make Chile the first country in South America to ban plastic bags. As part of the ban's enforcement, Chile will issue fines of up to $300 USD on businesses that continue to distribute plastic bags. The government is also planning to coordinate beach cleanups, specifically during peak vacation times when the most plastic waste is accumulated on the beach.

Impact: The policy is expected to go in effect in mid-2019 for large retailers. Smaller businesses will have an extra year to adapt to the policy. Until the ban is fully in place, businesses have a limit of how many bags they are allowed to give customers at the checkout. With rising awareness on the impacts of plastic pollution on marine life, this policy aims to reduce plastic pollution in the ocean and waterways.

China

Policy: The Chinese government responded to widespread plastic pollution by banning distribution of single-use plastic bags in grocery stores and shops around the country. Companies face a strict fine of 10,000 yuan, or roughly 1,593 USD, for illegal plastic bag distribution.

Impact: The NRDC estimates that China has seen a 66% reduction in plastic bag usage since the rollout of the ban. In response to inconsistent enforcement, 600,000 regulators have been sent to grocery stores around the country to make sure that they comply.

Costa Rica

Policy: The Costa Rica government declared on World Environment Day in 2017 that they aim to be plastic free by 2021. Exactly a year later the President has followed up on that commitment by issuing a directive that bans the use of plastics in certain public institutions, including schools and prisons. While a specific policy has not been put in place yet, the government says that they will have an online platform where both individuals and businesses can submit their commitments and actions. The alternatives to single-use plastic will be those that are fully recyclable and/or compostable in oceans and waterways.

Impact: The country has an admirable track record for protecting their environment. Since 1984, Costa Rica has increased their forest cover from 26% to 52%, and in 2015 and 2016 the country ran on renewable energy for more than 250 days. Furthermore, their goal to cut out plastic by 2021 coincides with their previous goal of being carbon neutral by the same time. These previous accomplishments, as well as the support from the public and the UN Development Program, proves that the Costa Rican government has the necessary tools to become plastic free.

European Union

Policy: In January 2018, the European Commission adopted the first-ever European Strategy for Plastics in a Circular Economy. The plan seeks to eliminate plastic pollution and change the way plastics are produced and consumed in the EU with a focus on plastic bags, other single-use plastics, and fishing materials. The plan also seeks to improve the economic benefit of recycling, to create jobs through engaging businesses and producers, and to invest in innovation.

Impact: The European Commission will begin to introduce regulations and measures to the European Parliament later in 2018 and 2019, including a proposals on the regulation of single-use plastics, packaging waste, and port waste management. The Strategy for Plastics in a Circular Economy will play an important role in the EU achieving its 2030 Sustainable Development Goals and commitments to the Paris Agreement. By 2030 all plastic packaging produced and sold in Europe should be reusable or recyclable. Other 2030 targets include 65% recycling of municipal waste, 75% recycling of packaging waste, and a binding agreement to reduce landfill waste to a maximum of 10% of municipal waste.

France

Policy: On July 1st 2016 France banned free distribution of thin single-use plastic bags typically distributed at grocery stores, and thin green bags used for produce on January 1st 2017. The ban aims to reduce an estimated 5 billion plastic grocery bags, and 12 billion produce bags.The French Minister of Sustainable Development noted the importance of reducing plastic pollution to reduce its disastrous effects on marine environments.

Impact: Like most bans on plastics, it has received backlash from the plastic industry. Bio-sourced and biodegradable bags made from a cornstarch and plastic blend have been proposed as a solution to potential negative economic impacts of the ban. In 2016, the French Environment Minister estimated over 3,000 jobs would result from production of a greener alternative to traditional, single-use grocery bags. The newest addition to the Energy Transition for Green Growth Act proposes a ban on plastic plates and utensils, to be further discussed in 2020.

India

Policy: India, the host of World Environment Day in 2018, used the platform to announce their commitment to ending the consumption of single-use plastics by 2022. As a sign of their commitment, the country also joined the UN Clean Seas campaign. Already throughout the sub-continent there have been several efforts to stop plastic pollution, like in Karnataka and most recently in the city of Mumbai.

Impact: This is expected to assist with India's plastic pollution problem, as only 40% of the country's plastic is recycled. With 10 regional policies already in place, a country-wide ban could further reinforce the existing rules and ensure that all regions are doing their part to end plastic pollution.

Ireland:

Policy: Ireland was the first country to place a significant tax on plastic bags — now 22 euro cents — at checkout in 2002. For the few bags that are used, the government has ensured that the revenue from the tax goes into different programs aimed at environmental protection.

Impact: The country saw a significant impact almost instantly with plastic bag consumption dropping by 94%, making the practice of using plastic bags unacceptable by the end of the year. Having inspired other countries to address this issue, Ireland proves to be one of the leading countries tackling plastic bag consumption.

Karnataka, India

Policy: Karnataka has banned plastic bags and more. Its law targets several different single-use plastic items, including plastic dinnerware. This policy puts the pressure on consumers and distributors, and the plastic manufacturers. All manufacturers in the state are banned from producing any single-use plastics.

Impact: This ambitious policy was put in place to significantly reduce the overwhelming plastic pollution found in India's streets and waterways. The policy was first implemented in 2016, and studies on its impact have yet to be produced.

Kenya

Policy: In 2017, Kenya implemented a country-wide ban of plastic bags that also falls on the distributors and producers of single-use bags. They even went as far as to implement significant repercussions for disobeying the law, which can include either a four-year jail sentence or a 40,000 fine for the sale or use of plastic bags.

Impact: While it is too soon to measure the impact, this policy was passed with the goal of aiding and protecting Kenya's agricultural, tourism, and fishing sectors.

Mexico

Policy: Although Mexico does not have a federal ban on plastic bags, many cities and states are taking action to reduce plastic pollution. In 2009, Mexico City introduced legislation to prohibit retailers from distributing single-use non-biodegradable plastic bags. Industrial hub Queretaro became the first municipality in Mexico to ban plastic bags as of April 2018. Cancun, a center for tourism, has proposed a plan to eliminate plastic bags, straws, and water bottles, initially through voluntary action.

Impact: Queretaro intends to strictly enforce the ban by confiscating illicit bags, and denying business license renewal for offenders. Mexico City's plan was met with pushback from the plastic industry, but the city has persevered in its mission to reduce plastic pollution with a recycling initiative. Officials expect Cancun's plan to be implemented over the next three years, with intentions to enact a full ban within this time frame.

Morocco

Policy: After a partial ban in 2009, Morocco's law fully banning plastic bags came into effect in July 2016. In the attempt to make plastic bag pollution nearly impossible, this law does not only cover the distribution of plastic bags, but also the import and production of them. To effectively enforce the ban, there are fines ranging from $20,000 to over $100,000 USD placed on manufacturers and distributors who break the law.

Impact: As the second largest consuming country of plastic bags, adhering to the ambitious law has taken a bit of an adjustment. The government is responding to the challenges the plastic bag ban poses by ensuring that plastic bag alternatives are easily accessible.

Rwanda

Policy: Rwanda implemented a strict plastic bag ban in 2008. Previously, plastic bags were primarily disposed of by incineration, negatively impacting Rwandan air quality. Bags that were not incinerated clogged streets and waterways.

Impact: The bag ban has been strictly enforced due to challenges posed by smugglers and tourists entering the country. Illegal use of plastic bags can result in fines or jail time. Strict enforcement has had positive impacts on the environment, reducing flooding, harm to wildlife, and erosion.

San Francisco, CA

Policy: San Francisco was the first city in the U.S. to completely ban plastic bags back in 2007. This policy pushes San Francisco residents even further to use reusable bags by placing an additional 10-cent fee on single-use compostable or recycled paper bags that customers need at the checkout.

Impact: Since 2010, this policy has led to a 72% reduction in plastic bag pollution.

Santa Monica, California, U.S.

Santa Monica's single-use carryout bag ordinance prohibits all retail establishments from providing single-use plastic carryout bags to customers at the point of sale.

Seattle, WA

Policy: Seattle made strides towards reducing plastic pollution in 2012 by banning retail stores from handing out single-use bags. Grocery stores were also prohibited from providing plastic bags at the checkout but were allowed to have single-use bags, as long as the bags were made with a minimum of 40% recycled material and taxed at five cents per bag. As of July 1, 2018, the city has officially banned all food service business from offering plastic straws and utensils. While there is a fine issued to those not in compliance, the city states that they are more focused on helping business become plastic free rather than administering consequences.

Impact: The legislation was successfully passed despite the American Chemical Society spending more than $1.4 million lobbying against the plan. Since its implementation, there has been a 78% reduction in plastic bag use in Seattle.

United Kingdom

Policy: As of October, 2015, stores in the UK began charging five pence per single-use plastic carrier bag. Consumers can avoid this charge by bringing a reusable bag to carry their goods. The plastic bag charge applies to any business that has more than 250 employees.

Impact: Since the bag tax's introduction in 2015, officials estimate that plastic bag consumption has been reduced by more than 80%. The UK government also predicts significant economic benefits from the ban, including £60 million reduction in litter clean-up costs and £13 million in carbon savings.

United Nations Environment Programme (UNEP)

#CleanSeas Campaign: UNEP launched the CleanSeas campaign in 2017 to engage stakeholders from all sectors to fight pollution of plastics in the ocean. Plastic pollution has now reached the deepest parts of the oceans and pieces of plastic are expected to outnumber fish by 2050. The goal is to address the root causes of plastic pollution, primarily the production and consumption of single-use plastics. To date, more than 40 countries have signed on to the campaign.

#BeatPlasticPollution Campaign: The #BeatPlasticPollution campaign is the focus of the 2018 World Environment Day organized by the UN. Beat Plastic Pollution, which overlaps with the CleanSeas campaign, likewise targets single-use plastics and pushes consumers to follow the motto: "If you can't reuse it, refuse it."

Vancouver, Canada
Vancouver adopted a policy in 2018 to prohibit polystyrene foam cups and take-out containers, and single-use plastic straws, as part of its Zero Waste 2040 strategy.

Washington, D.C.

Policy: The U.S. capital was one of the first cities to lead the way on ending plastic pollution by implementing a tax on plastic bags. The revenue collected from this 5-cent tax goes to the Anacostia River Clean Up and Protection Fund and distributes reusable bags to low-income and elderly communities in DC.

Impact: Since the policy was implemented in 2009, there's been an 85% reduction in plastic bag consumption. Before the ban, DC locals consumed 22.5 million bags per month. That number has now dropped to 3.3 million bags per month.

MORE ON WHAT YOU CAN DO TO END PLASTIC POLLUTION

We need governments, businesses, and individuals to help end plastic pollution. Earth Day Network is mobilizing key actors and institutions and citizens across the globe to bring about a new level of consciousness about plastics pollution and a paradigm shift.

Commit to reduce your own plastic waste. Start by tracking your waste with our plastic calculator.

Write to your local elected officials, urging them to follow the above examples.



Advancing Sustainable Materials Management: 2017 Fact Sheet

Assessing Trends in Material Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling in the United States

November 2019

Introduction

The U.S. Environmental Protection Agency (EPA) has collected and reported data on the generation and disposition of municipal solid waste (MSW) in the United States for more than 30 years. This information is used to measure the success of materials management programs across the country and to characterize the national waste stream. These facts and figures are based on the most recent information, which is from calendar year 2017.

In 2017, in the United States, approximately 268 million tons (U.S. short tons unless specified) of MSW were generated (*See* Figure 1). Of the MSW generated, approximately 67 million tons of MSW were recycled and 27 million tons of MSW were composted. Together, more than 94 million tons of MSW were recycled and composted, equivalent to a 35.2 percent recycling and composting rate (*See* Figure 2). In addition, more than 34 million tons of MSW (12.7 percent) were combusted with energy recovery. Finally, more than 139 million tons of MSW (52.1 percent) were landfilled (*See* Figure 3 and Table 1).

Information about waste generation and disposal is an important foundation for managing materials. Sustainably managing materials requires focusing on the life cycle of a product, from the time it is produced, used, reused and ultimately recycled or discarded. This is known as Sustainable Materials Management (SMM). SMM refers to the use and reuse of materials in the most productive and sustainable way across their entire life cycle. SMM conserves resources, reduces waste and minimizes the adverse environmental impacts of material use.

This report analyzes MSW trends in generation and management, materials and products, and economic indicators affecting MSW. It also includes a section on the generation of construction and demolition (C&D) debris, which is not a part of MSW, but comprises a significant portion of the non-hazardous solid waste stream.

Figure 1. MSW Generation Rates, 1960 to 2017



Figure 2. MSW Recycling and Composting Rates, 1960 to 2017

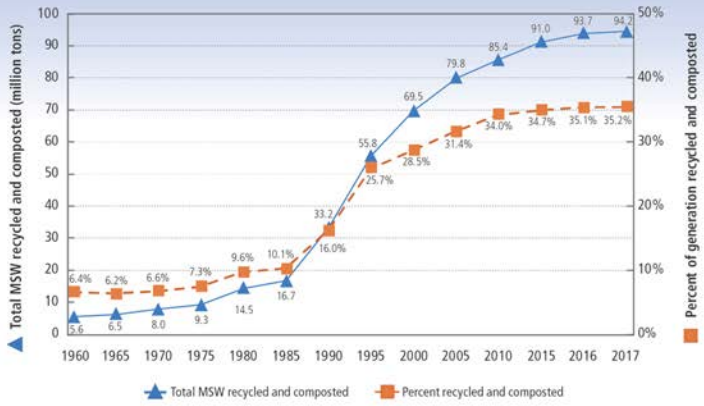


Figure 3. Management of MSW in the United States, 2017

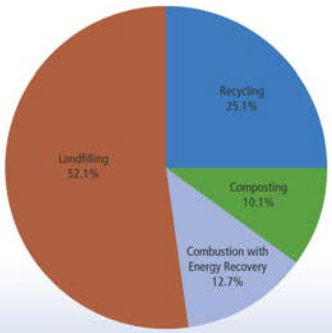


Table 1. Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling of Materials in MSW, 2017*
(in millions of tons and percent of generation of each material)

Material	Weight Generated	Weight Recycled	Weight Composted	Weight Combusted with Energy Recovery	Weight Landfilled	Recycling as Percent of Generation	Composting as Percent of Generation	Combustion as Percent of Generation	Landfilling as Percent of Generation
Paper and paperboard	67.01	44.17	-	4.49	18.35	65.9%	-	6.70%	27.38%
Glass	11.38	3.03	-	1.48	6.87	26.6%	-	13.01%	60.37%
Metals									
Steel	18.89	6.17	-	2.29	10.43	32.7%	-	12.12%	55.21%
Aluminum	3.83	0.62	-	0.56	2.65	16.2%	-	14.62%	69.19%
Other nonferrous metals†	2.33	1.54	-	0.07	0.72	66.1%	-	3.00%	30.90%
Total metals	**25.05**	**8.33**	-	**2.92**	**13.80**	**33.3%**	-	**11.66%**	**55.09%**
Plastics	35.37	2.96	-	5.59	26.82	8.4%	-	15.80%	75.83%
Rubber and leather	9.11	1.67	-	2.49	4.95	18.3%	-	27.33%	54.34%
Textiles	16.89	2.57	-	3.17	11.15	15.2%	-	18.77%	66.02%
Wood	17.99	3.00	-	2.85	12.14	16.7%	-	15.84%	67.48%
Other materials	5.10	1.45	-	0.67	2.98	28.4%	-	13.14%	58.43%
Total materials in products	**187.90**	**67.18**	-	**23.66**	**97.06**	**35.8%**	-	**12.59%**	**51.66%**
Other wastes									
Food, other‡	40.67	-	2.57	7.47	30.63	-	6.3%	18.37%	75.31%
Yard trimmings	35.18	-	24.42	2.11	8.65	-	69.4%	6.00%	24.59%
Miscellaneous inorganic wastes	4.04	-	-	0.79	3.25	-	-	19.55%	80.45%
Total other wastes	**79.89**	-	**26.99**	**10.37**	**42.53**	-	**33.8%**	**12.98%**	**53.24%**
Total municipal solid waste	**267.79**	**67.18**	**26.99**	**34.03**	**139.59**	**25.1%**	**10.1%**	**12.71%**	**52.13%**

* Includes waste from residential, commercial and institutional sources.

† Includes lead from lead-acid batteries.

‡ Includes collection of other MSW organics for composting.

Details might not add to totals due to rounding.

Negligible = Less than 5,000 tons or 0.05 percent.
A dash in the table means that data are not available.

Trends in Municipal Solid Waste

Our MSW, or trash, is comprised of various items consumers throw away. These items include packaging, food, yard trimmings, furniture, electronics, tires and appliances. MSW does not include industrial, hazardous or C&D waste. Sources of MSW include residential waste, including waste from multi-family housing, as well as waste from commercial and institutional locations, such as businesses, schools and hospitals.

Over the last few decades, the generation, recycling, composting, combustion with energy recovery and landfilling of MSW has changed substantially. Solid waste generation peaked at 4.74 pounds per person per day in 2000. The rate of 4.51 pounds per person per day in 2017 is slightly lower than the 2016 rate, which was 4.53 pounds per person per day (*See* Figure 1).

The combined recycling and composting rate increased from less than 10 percent of generated MSW in 1980 to 35.2 percent in 2017 (*See* Figure 2). Without including composting, recycling alone rose from 14.5 million tons (9.6 percent of MSW) in 1980 to 67.2 million tons (25.1 percent) in 2017. Composting was negligible in 1980, but it rose to 27.0 million tons in 2017 (10.1 percent; *See* Figure 3 and Table 2 for details).

Food

Nationally, the composting of food rose from 2.15 million tons in 2016 (5.3 percent of food generated) to 2.57 million tons in 2017 (6.3 percent).

Combustion with energy recovery was less than 2 percent of generation in 1980 at 2.8 million tons. In 2017, more than 34.0 million tons (12.7 percent of MSW generated) were combusted with energy recovery (*See* Table 2).

Since 1990, the total amount of MSW going to landfills has dropped by 5.7 million tons, from 145.3 million tons in 1990 to 139.6 million tons in 2017 (*See* Table 2). The net per capita 2017 landfilling rate was 2.3 pounds per day, which was lower than the 3.2 per capita rate in 1990 (*See* Table 3).

Table 2. Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling of MSW, 1960 to 2017 (in millions of tons)

Activity	1960	1970	1980	1990	2000	2005	2010	2015	2016	2017
Generation	88.1	121.1	151.6	208.3	243.5	253.7	251.1	262.1	266.8	267.8
Recycling	5.6	8.0	14.5	29.0	53.0	59.2	65.3	67.6	68.6	67.2
Composting*	neg.	neg.	neg.	4.2	16.5	20.6	20.2	23.4	25.1	27.0
Combustion with energy recovery†	0.0	0.5	2.8	29.8	33.7	31.7	29.3	33.5	33.9	34.0
Landfilling and other disposal‡	82.5	112.6	134.3	145.3	140.3	142.2	136.3	137.6	139.2	139.6

* Composting of yard trimmings, food and other MSW organic material. Does not include backyard composting.

† Includes combustion of MSW in mass burn or refuse-derived fuel form, and combustion with energy recovery of source separated materials in MSW (e.g., wood pallets, tire-derived fuel).

‡ Landfilling after recycling, composting and combustion with energy recovery. Includes combustion without energy recovery.

Details might not add to totals due to rounding.

neg. (negligible) = less than 5,000 tons.

Table 3. Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling of MSW, 1960 to 2017 (in pounds per person per day)

Activity	1960	1970	1980	1990	2000	2005	2010	2015	2016	2017
Generation	2.7	3.3	3.7	4.6	4.7	4.7	4.4	4.5	4.5	4.5
Recycling	0.2	0.2	0.4	0.6	1.0	1.1	1.1	1.2	1.2	1.1
Composting*	neg.	neg.	neg.	0.1	0.3	0.4	0.4	0.4	0.4	0.5
Combustion with energy recovery†	0.0	neg.	0.1	0.7	0.7	0.6	0.5	0.6	0.6	0.6
Landfilling and other disposal‡	2.5	3.1	3.2	3.2	2.7	2.6	2.4	2.3	2.3	2.3
Population (In millions)	180.0	204.0	227.3	249.9	281.4	296.4	309.1	320.9	323.1	325.1

* Composting of yard trimmings, food, and other MSW organic material. Does not include backyard composting.

† Includes combustion of MSW in mass burn or refuse-derived fuel form, and combustion with energy recovery of source separated materials in MSW (e.g., wood pallets, tire-derived fuel).

‡ Landfilling after recycling, composting, and combustion with energy recovery. Includes combustion without energy recovery.

Details might not add to totals due to rounding.

neg. (negligible) = less than 5,000 tons.

Analyzing MSW

EPA analyzes MSW by breaking down the data in two ways: by material or by product. Materials are made into products, which are ultimately reprocessed through recycling or composting, or managed by combustion with energy recovery facilities or landfills. Examples of materials that EPA tracks include paper and paperboard, plastics, metals, glass, rubber, leather, textiles, wood, food and yard trimmings. For a full list of materials, *see* Table 1.

Products are what people buy and handle, and they are manufactured out of the types of materials listed above. Product categories include containers and packaging, nondurable goods, durable goods, food and yard trimmings. Containers and packaging, such as milk cartons and plastic wrap, are assumed to be in use for a year or less; nondurable goods like newspaper and clothing are assumed to be in use for less than three years; and durable goods, such as furniture, are assumed to be in use for three or more years. Some products, such as appliances, may be made of more than one material. Information about products shows how consumers are using and discarding materials and offers strategies on ways to maximize the source reduction, recycling and composting of materials.

Materials in MSW

Table 1 and the following figures provide specific information about materials in MSW. Table 1 shows generation, recycling, composting, combustion with energy recovery and landfilling by material, weight and percent of generation.

Figure 4 below provides the breakdown of MSW generation by material. Paper and paperboard, along with food, continued to be the largest components of MSW generated. Paper and paperboard accounted for 25 percent, while food accounted for about 15 percent. Yard trimmings and plastics comprised about 13 percent each. The remaining amount of MSW generated consisted of rubber, leather and textiles; metals; wood; glass; and other materials.

Composting Collection Programs [1,2]

- About 3,860 community composting programs were documented in 2017—an increase from 3,227 in 2002.
- Food composting curbside collection programs served 6.1 million households in 2017. About 6.7 million households had access to drop-off food collection programs that year.

Figure 5 provides the breakdown of MSW recycling by material in 2017. Paper and paperboard composed the largest component of MSW recycling, representing nearly 66 percent. Metals made up over 12 percent of MSW recycled. The remaining amount of MSW recycled consisted of rubber, leather and textiles; plastics; glass; wood; and other materials.

Figure 6 provides the breakdown of MSW composting by material, Figure 7 provides the breakdown of MSW combustion with energy recovery, and Figure 8 provides the breakdown of MSW landfilling.

Figure 4. Total MSW Generation (by material), 2017
267.8 Million Tons

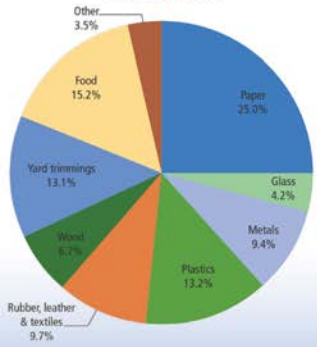


Figure 5. Total MSW Recycling (by material), 2017
67.2 Million Tons

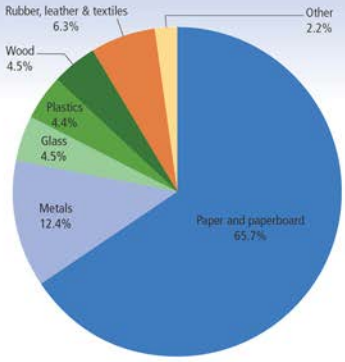


Figure 6. Total MSW Composting (by material), 2017
27.0 Million Tons

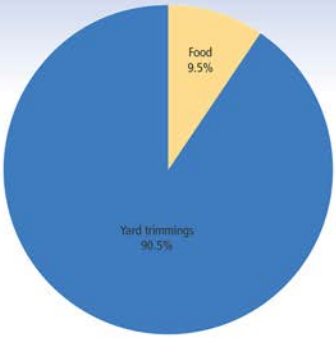


Figure 7. Total MSW Combusted with Energy Recovery (by material), 2017 34.0 Million Tons

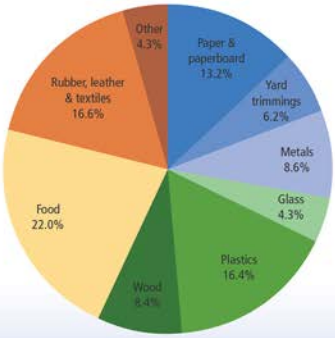
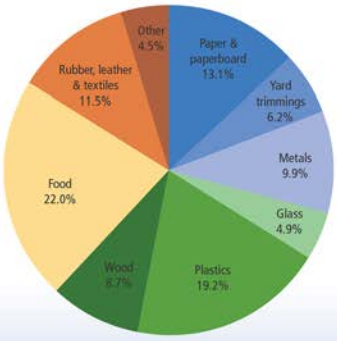


Figure 8. Total MSW Landfilled (by material), 2017
139.6 Million Tons



Products in MSW

The following information provides the details of the products found in MSW. Table 4 shows generation, recycling, composting, combustion with energy recovery and landfilling by product category, weight and percent of generation. The product categories include containers and packaging, durable goods, nondurable goods, and food and yard trimmings.

Containers and packaging made up the largest portion of MSW generated at 80 million tons (29.9 percent) in 2017. More than 57 million tons (21.4 percent of MSW generation) of durable goods were generated, while more than 50 million tons (18.9 percent of MSW generation) of nondurable goods were generated. The generation of food in MSW was over 40 million tons (15.2 percent), yard trimmings generation was 35 million tons (13.1 percent), and the generation of other wastes was about four million tons (1.5 percent).

The Containers and packaging product category had the highest recycling rate at 50.1 percent in 2017. Paper products, steel and glass were the most recycled materials by percentage in this category. The recycling of nondurable goods was 32.1 percent. Paper products such as newspapers/mechanical papers were the most recycled nondurable goods. Newspapers/mechanical papers include newspapers, directories, inserts, as well as some advertisement and direct mail printing. Overall, 18.9 percent of durable goods were recycled. With a 99.1 percent recycling rate in 2017, lead-acid batteries continued to be one of the most recycled products.

Yard trimmings had the highest composting rate of all product categories at 69.4 percent. Food was composted at a rate of 6.3 percent.

Food was the product category with the highest rate of combustion with energy recovery with a rate of 18.4 percent. Durable goods were combusted at a rate of 15.9 percent and nondurables at a rate of 13.3 percent. Containers and packaging, along with yard trimmings, were combusted at rates below 10 percent.

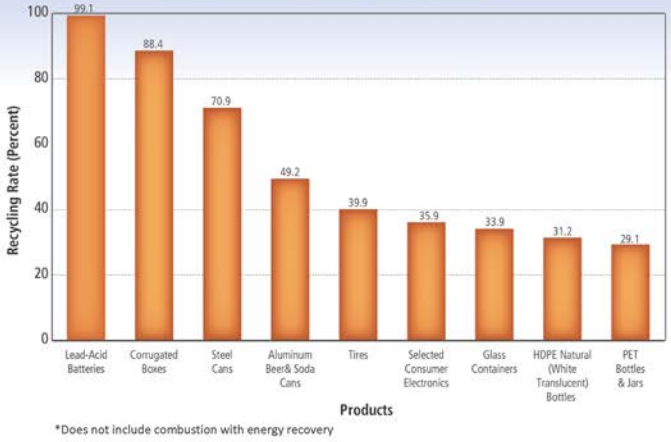
Food was the product category with the highest landfill rate at 75.3 percent. Durable goods followed with a landfill rate of 65.2 percent. Nondurable goods had the third highest landfill rate at 54.6 percent. Containers and packaging, along with yard trimmings, were the product categories with the lowest landfill rates at 40.1 percent and 24.6 percent, respectively.

Figure 9 displays selected individual products with high recycling rates.

Recycling Rates

Measured by percent of generation, individual products with the highest recycling rates in 2017 were lead-acid batteries (99.1 percent), corrugated boxes (88.4 percent), steel cans (70.9 percent), newspapers/mechanical papers (76.8 percent), major appliances (60.3 percent), aluminum cans (49.2 percent), mixed paper (48.3 percent), tires (39.9 percent) and selected consumer electronics (35.9 percent).

Figure 9. Selected Products with High Recycling Rates, 2017*



*Does not include combustion with energy recovery

Table 4. Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling of Products in MSW, 2017*
(in millions of tons and percent of generation of each product)

Products	Weight Generated	Weight Recycled	Weight Composted	Weight Combusted with Energy Recovery	Weight Landfilled	Recycling as Percent of Generation	Composting as Percent of Generation	Combustion as Percent of Generation	Landfilling as Percent of Generation
Durable goods									
Steel	16.88	4.70	-	2.19	9.99	27.8%	-	13.0%	59.2%
Aluminum	1.72	-	-	0.26	1.46	-	-	15.1%	84.9%
Other nonferrous metals†	2.33	1.54	-	0.07	0.72	66.1%	-	3.0%	30.9%
Glass	2.45	Negligible	-	0.32	2.13	Negligible	-	13.1%	86.9%
Plastics	13.46	0.85	-	1.72	10.89	6.3%	-	12.8%	80.9%
Rubber and leather	7.94	1.67	-	2.27	4.00	21.0%	-	28.6%	50.4%
Wood	6.59	Negligible	-	1.20	5.39	Negligible	-	18.2%	81.8%
Textiles	3.91	0.59	-	1.02	2.30	15.1%	-	26.1%	58.8%
Other materials	1.84	1.45	-	0.03	0.36	78.8%	-	1.6%	19.6%
Total durable goods	**57.12**	**10.80**	**-**	**9.08**	**37.24**	**18.9%**	**-**	**15.9%**	**65.2%**
Nondurable goods									
Paper and paperboard	25.95	14.09	-	2.33	9.53	54.3%	-	9.0%	36.7%
Plastics	7.42	0.22	-	1.40	5.80	3.0%	-	18.9%	78.2%
Rubber and leather	1.17	Negligible	-	0.22	0.95	Negligible	-	18.8%	81.2%
Textiles	12.68	1.98	-	2.09	8.61	15.6%	-	16.5%	67.9%
Other materials	3.48	Negligible	-	0.68	2.80	Negligible	-	19.5%	80.5%
Total nondurable goods	**50.70**	**16.29**	**-**	**6.72**	**27.69**	**32.1%**	**-**	**13.3%**	**54.6%**

Table 4 (continued). Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling of Products in MSW, 2017*
(in millions of tons and percent of generation of each product)

Products	Weight Generated	Weight Recycled	Weight Composted	Weight Combusted with Energy Recovery	Weight Landfilled	Recycling as Percent of Generation	Composting as Percent of Generation	Combustion as Percent of Generation	Landfilling as Percent of Generation
Containers and packaging									
Steel	2.01	1.47	-	0.10	0.44	73.1%	-	5.0%	21.9%
Aluminum	1.89	0.62	-	0.26	1.01	32.8%	-	13.8%	53.4%
Glass	8.93	3.03	-	1.16	4.74	33.9%	-	13.0%	53.1%
Paper and paperboard	41.06	30.08	-	2.16	8.82	73.3%	-	5.3%	21.5%
Plastics	14.49	1.89	-	2.47	10.13	13.0%	-	17.0%	69.9%
Wood	11.40	3.00	-	1.65	6.75	26.3%	-	14.5%	59.2%
Other materials	0.30	Negligible	-	0.06	0.24	Negligible	-	20.0%	80.0%
Total containers and packaging	**80.08**	**40.09**	**-**	**7.86**	**32.13**	**50.1%**	**-**	**9.8%**	**40.1%**
Other wastes									
Food, other‡	40.67	-	2.57	7.47	30.63	-	6.3%	18.4%	75.3%
Yard trimmings	35.18	-	24.42	2.11	8.65	-	69.4%	6.0%	24.6%
Miscellaneous inorganic wastes	4.04	-	-	0.79	3.25	-	-	19.6%	80.4%
Total other wastes	**79.89**	**-**	**26.99**	**10.37**	**42.53**	**-**	**33.8%**	**13.0%**	**53.2%**
Total municipal solid waste	**267.79**	**67.18**	**26.99**	**34.03**	**139.59**	**25.1%**	**10.1%**	**12.7%**	**52.1%**

* Includes waste from residential, commercial and institutional sources.

† Includes lead from lead-acid batteries.

‡ Includes collection of other MSW organics for composting.

Details might not add to totals due to rounding.

Negligible = less than 5,000 tons or 0.05 percent.
A dash in the table means that data are not available.

Environmental and Economic Benefits

Environmental Benefits of Recycling and Composting

The energy and greenhouse gas (GHG) benefits of recycling, composting and combustion with energy recovery that are shown in Table 5 are calculated using EPA's WARM (Waste Reduction Model) tool (*See*: https://www.epa.gov/warm). WARM calculates and totals the GHG emissions of baseline and alternative waste management practices, including source reduction, recycling, composting, combustion with energy recovery and landfilling. For example, paper and paperboard recycling, at about 44.2 million tons, resulted in a reduction of about 148 $MMTCO_2E$ in 2017. This reduction is equivalent to removing over 31 million cars from the road for one year.

In 2017, more than 94 million tons of MSW in the U.S. were recycled and composted, saving over 184 $MMTCO_2E$. This is comparable to the emissions that could be reduced from taking over 39 million cars off the road in a year.

Table 5. 2017 Environmental Benefits

(The numbers in the Recycled, Composted, Combustion with Energy Recovery and Landfilled columns are listed by weight of material* in millions of tons)

Material	Recycled	Composted	Combustion with Energy Recovery	Landfilled	GHG Benefits ($MMTCO_2E$)	Number of Cars Taken Off the Road Per Year (millions of cars)
Paper and paperboard	44.17	-	4.49	18.35	(147.97)	(31.42)
Glass	3.03	-	1.48	6.87	(0.89)	(0.19)
Metals						
Steel	6.17	-	2.29	10.43	(15.12)	(3.21)
Aluminum	0.62	-	0.56	2.65	(5.66)	(1.20)
Other nonferrous metals**	1.54	-	0.07	0.72	(6.87)	(1.46)
Total metals	**8.33**	**-**	**2.92**	**13.8**	**(27.65)**	**(5.87)**
Plastics	2.96	-	5.59	26.82	3.82	0.81
Rubber and leather†	1.67	-	1.74	0.78	0.17	0.04
Textiles	2.57	-	3.17	11.15	(2.76)	(0.59)
Wood	3.00	-	2.85	12.14	(3.15)	(0.67)
Food, other‡	-	2.57	7.47	30.63	(6.90)	(1.46)
Yard trimmings	-	24.42	2.11	8.65	0.85	0.18
Miscellaneous inorganic wastes	-	-	0.79	3.25	(0.27)	(0.58)
Totals	**65.73**	**26.99**	**32.61**	**132.44**	**(184.74)**	**(39.22)**

*Includes material from residential, commercial and institutional sources.
**Includes lead-acid batteries. Other nonferrous metals calculated in WARM as mixed metals.
†Only includes rubber from tires.
‡Includes collection of other MSW organics for composting.
These calculations do not include an additional 10.02 million tons of MSW that could not be addressed in the WARM model.
$MMTCO_2E$ is million metric tons of carbon dioxide equivalent. Numbers in parentheses indicate a reduction in either greenhouse gases or vehicles, and therefore represent environmental benefits.
Source: WARM model Version 15 (https://www.epa.gov/warm)

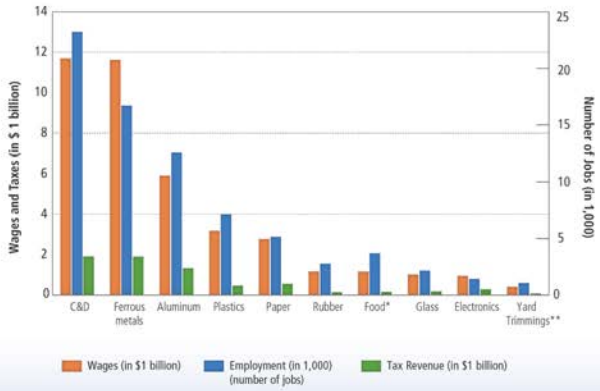
Economic Indicators

Economic Benefits of Recycling and Composting

How our nation uses materials is fundamental to our economic and environmental future. Global competition for finite resources is expected to continue to increase. A more productive and less impactful use of materials helps our society remain economically competitive, contributes to our prosperity and protects the environment. By using waste materials as valuable raw materials, recycling creates jobs, builds more competitive manufacturing industries and significantly contributes to the U.S. economy.

EPA's 2001 Recycling Economic Information (REI) Study evaluated the number of recycling jobs, wages and tax revenue. The Agency updated the study with a 2016 REI Report[3] to increase the understanding of the economic implications of material reuse and recycling. The 2016 REI Report included updated information about the number of recycling jobs, wages and tax revenue (*See* Figure 10). The report showed that the recycling and reuse of materials creates jobs and also generates local and state tax revenues. The data from the most recent year available showed that in 2007, recycling and reuse activities in the United States accounted for: 757,000 jobs; $36.6 billion in wages; and $6.7 billion in tax revenues. This calculation equates to 1.57 jobs for every 1,000 tons of materials recycled. Construction and demolition debris provided the largest contribution to all three categories (jobs, wages and tax revenue), followed by ferrous metals and nonferrous metals, such as aluminum.

Figure 10. Wages, Taxes and Jobs Attributed to Recycling



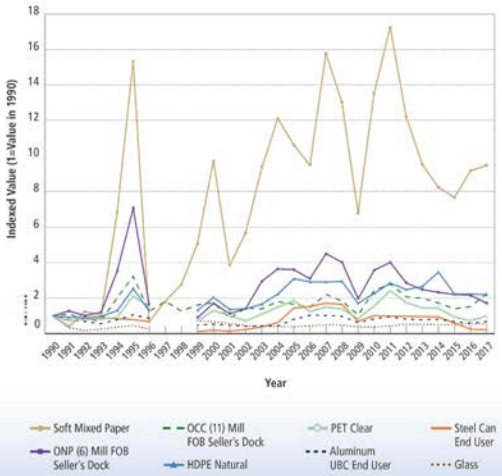
*Food category includes animal feed, meal, meat, fat, oils and tallow, as well as community food service
**Yard Trimmings category includes biodiesel, biogas, compost, mulch and wood chips

Recycled Commodity Values

Figure 11 shows the indexed values by year for the following recycled commodities from 1990 to 2017: high-density polyethylene (HDPE) natural bottles; polyethylene terephthalate (PET) clear bottles; aluminum used beverage cans (UBC); steel cans; old newspaper (ONP) (grade 6); old corrugated containers (OCC) (grade 11); paper stock (PS) (grade 1) soft mixed paper; and glass containers .The values are normalized to 2017 using the Consumer Price Index (CPI) from the Bureau of Labor Statistics (BLS).They are indexed to allow commodity values with different metrics, such as dollars per ton, dollars per gross ton and dollars per short ton, to be shown on the same graph and to compare their relative rates of change. The indexed value indicates the change in value of the data since 1990, where one is equal to the value in 1990. For example, if for a given year, the indexed value were two, then the commodity value for that year would be two times the 1990 value.

Figure 11 shows similar trends across all commodities for indexed values. For example, values for plastics and papers spiked in 1995, and values for most commodities dipped in 2009, relative to 1990. Additionally, many commodities, such as plastics and papers, also experienced a price spike in 2000, 2007 and 2011, followed by a dip in 2015. In contrast, the indexed lines for glass, aluminum and steel cans appear to fluctuate less frequently.

Figure 11. Indexed Recycled Commodity Values by Year



Source: Pulp & Paper Global Fact & Price Book, 2003-2004. Page 128. Paperloop, Inc. 2004. See endnotes for additional sources[4]

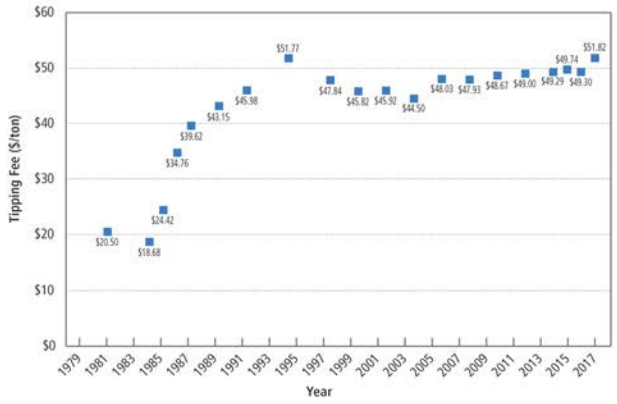
Landfill Tipping Fees

From 1985 to 1995, there was a rapid rise in national landfill tipping fees, followed by a steady decrease from 1995 to 2004. Since 2004, there has been a slow and steady average increase of about one percent per year in landfill tipping fees (*See* Figure 12). The tipping fees are expressed in constant 2017 dollars.

Tipping fees are important to consider as they typically increase as landfill capacity decreases. The difference in tipping fees regionally is correlated to landfill capacity, as the average tipping fee in Western states ($35.69) with more available space for landfills (e.g., Texas, Colorado, Idaho, Montana, Nevada) is less than half of the average in the Northeast ($74.75).[5]

National mean annual landfill tipping fees were normalized to the value of the dollar in 2017 using the Consumer Price Index (CPI) from the Bureau of Labor Statistics to allow meaningful comparisons. This figure shows an average increase from 1985 to 1995 of $3.31 per year, followed by a steady decrease of $0.81 per year through 2004 and an average increase of $0.56 per year from 2004 to 2017.

Figure 12. National Landfill Tipping Fees, 1982-2017 ($2017 per ton)



Source: National Solid Wastes Management Association (NSWMA) Municipal Solid Waste Landfill Facts. October 2011 (Data from 1985 to 2008). Waste Business Journal. "The Cost to Landfill MSW Continues to Rise Despite Soft Demand." July 11, 2017 (Data for 2010 to 2015). "Analysis of MSW Landfill Tipping Fees" April 2018 (Data for 2016 and 2017). https://erefdn.org/product/analysis-msw-landfill-tipping-fees-2/

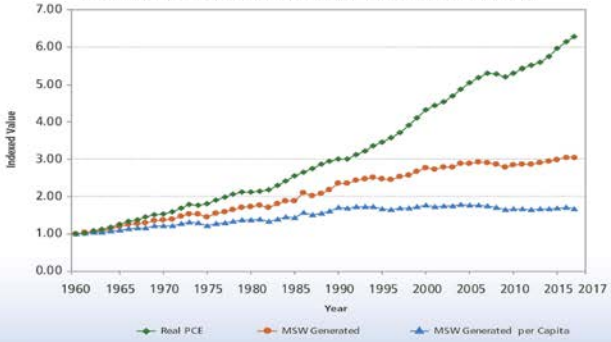
MSW Generation and Household Spending

In the United States, the change in the amount of MSW generated typically mirrors trends in how much money households spent on goods and services. Personal Consumer Expenditures (PCE) measure household spending on goods and services such as food, clothing, vehicles and recreation services. PCE is one of the four components of economic growth, along with government spending, private investments and net exports. As PCE is an indicator of the household consumption of goods and services, which make up nearly 70 percent of the gross domestic product (GDP), PCE has a stronger conceptual tie to MSW generation than the other three GDP components. PCE adjusted for inflation is referred to as real PCE. This metric is more useful in making comparisons over time because it normalizes the value of a dollar by considering how much a dollar could purchase in the past versus today. Figure 13 explores the relationship between MSW generated and real PCE.

Figure 13 is an indexed graph, showing the relative changes in real PCE, MSW generated and MSW generated per capita over time. It is indexed to allow all three of these metrics to be shown on the same graph and to compare their relative rates of change since 1960. The indexed value indicates the change in the value of the data since 1960. For example, if, for a given year, the value was three, then the data value for that year would be three times the 1960 value. In this case, if the 1960 value were 200, then the resulting year's value would be 600. The 2017 MSW per capita generation indexed value is 1.7, which means that MSW per capita generation has increased by 70 percent since 1960.

Figure 13 shows that real PCE has increased at a faster rate than MSW generation, and the disparity has become even more distinct since the mid-1990s. This index indicates that the amount of MSW generated per dollar spent is falling. In other words, the U.S. economy has been able to enjoy dramatic increases in household spending on consumer goods and services without the societal impact of similarly increasing MSW generation rates. This figure also shows that the MSW generated per capita leveled off in the early-to-mid 2000s.

Figure 13. Indexed MSW Generated and Real PCE over Time (1960-2017)



Source: See endnotes[6]

MSW Methodology

The data summarized in this fact sheet characterizes the MSW stream as a whole by using a materials flow methodology that relies on a mass balance approach. EPA recognizes that there are several approaches to measuring material flows, such as by volume. To be consistent, EPA reports the quantities of materials in tons in the current fact sheet, but the Agency will continue to explore options for alternative measurement methodologies to describe materials management in the United States.

EPA has consistently used materials flow analysis to allow for the comparison of data over the last three decades. EPA recognizes that this methodology differs from other methodologies that also estimate the generation of MSW and other waste data. EPA will continue to work with stakeholders to identify methodologies and additional publicly available data to improve our national understanding of materials flow in the United States.

Using data gathered from industry associations, businesses and government sources, such as the U.S. Department of Commerce and the U.S. Census Bureau, EPA estimates the weight in tons of all MSW materials and products generated, recycled, composted, combusted with energy recovery and landfilled. Other sources of data, such as waste characterizations and research reports performed by governments, industry or the press, supplement these data.

Construction and Demolition (C&D) Debris Generation Results

Construction and demolition (C&D) debris is a type of waste that is not included in MSW. Materials included in C&D debris are steel, wood products, drywall and plaster, brick and clay tile, asphalt shingles, concrete and asphalt concrete. These materials are used in buildings, roads and bridges, and other structures. The generation estimate represents C&D debris amounts from construction, renovation and demolition activities for buildings, roads and bridges, and other structures.

In 2017, 569 million tons of C&D debris were generated. Figure 14 shows the 2017 generation composition for C&D debris. C&D concrete was the largest portion at 69.7 percent, followed by asphalt concrete at 15.0 percent. C&D wood products made up 7.1 percent, and the other products accounted for 8.1 percent combined. The 2017 generation estimates are presented in more detail in Table 6. As shown in Figure 15, demolition represented over 90 percent of total C&D debris generation. Construction, on the other hand, represented under 10 percent.

Figure 14. C&D Generation Composition by Material (before processing), 2017
569 Million Tons

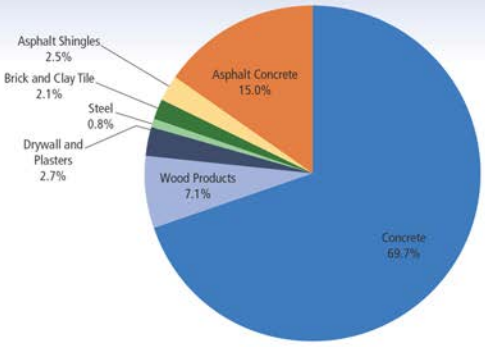


Table 6. C&D Debris Generation by Material and Activity, 2017 (in millions of tons)

	Waste During Construction	Demolition Debris	Total C&D Debris
Concrete	24.0	373.0	397.0
Wood Products[7]	3.3	36.9	40.2
Drywall and Plasters	4.3	11.0	15.3
Steel[8]	0	4.6	4.6
Brick and Clay Tile	0.3	11.9	12.2
Asphalt Shingles	1.4	13.0	14.4
Asphalt Concrete	0	85.7	85.7
Total	**33.3**	**536.1**	**569.4**

[7,8] See endnotes.

Figure 15. Contribution of Construction and Demolition Phases to Total 2017 C&D Debris Generation

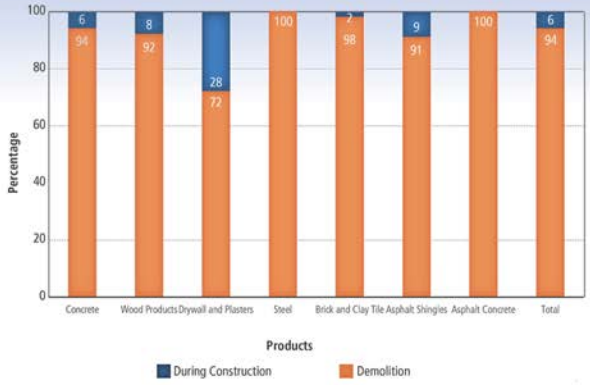


Table 7 displays the amount of C&D debris generation from buildings, roads and bridges, and other structures for each material. The "other structures" category includes C&D debris generation estimates from communication, power, transportation, sewer and waste disposal, water supply, conservation and development, and the manufacturing infrastructure. In 2017, roads and bridges contributed significantly more to C&D debris generation than buildings and other structures, and concrete made up the largest share of C&D debris generation for all three categories.

Table 7. C&D Debris Generation by Source, 2017 (in millions of tons)

	Buildings	Roads and Bridges	Other
Concrete	98.8	164.5	133.7
Wood Products[7]	38.9	-	1.3
Drywall and Plasters	15.3	-	-
Steel[8]	4.6	-	-
Brick and Clay Tile	12.2	-	-
Asphalt Shingles	14.4	-	-
Asphalt Concrete	-	85.7	-
Total	**184.2**	**250.2**	**135.0**

[7,8] See endnotes.

A dash in the table means that data are not available.

Resources

The 2017 data tables and the summary of the MSW characterization methodology are available on the EPA website, along with information about waste reduction, recycling and sustainable materials management.

Please visit:

https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling
https://www.epa.gov/recycle
https://www.epa.gov/smm
https://www.epa.gov/warm

Endnotes

1. Source for 2002 community composting program data: "The State of Garbage In America." Simmons, Phil, Scott M. Kaufman, and Nickolas J. Themelis. *BioCycle* 47, no. 4, p. 26 (2006). Source for 2017 data: Goldstein, N. 2017, "The State of Organics." *BioCycle*, October, p. 5, Table 2. Facilities composting yard trimmings, yard trimmings and food, and mixed organics. Excludes 740 facilities composting manure, biosolids, mixed MSW or not defined.
2. Sources for food composting collection programs: Streeter, V.; Platt B. 2017. Residential Food Waste Collection Access in the U.S. *BioCycle* December.
3. US EPA. 2016. "Recycling Economic Information Report" (2016). https://www.epa.gov/smm/recycling-economic-information-rei-report. The 2016 REI Report used an updated analytical framework and a new Waste Input-Output methodology, which focused on the life cycle of materials. These refinements offered significant improvements over the original 2001 REI Study by providing a better definition of recycling and addressing double counting. This new methodology assists decision makers and researchers in more accurately estimating the economic benefits of recycling, and it creates a foundation upon which additional studies can be built.
4. Recycled Commodity Values. Soft mixed paper consists of a clean, sorted mixture of various qualities of paper not limited as to type of fiber content. Prohibitive Materials may not exceed 1 percent. There are specific limits on the percent of contaminants allowed in soft mixed paper. Data were not available for ONP, metals, plastics and glass in 1997 and 1998. For plastics, glass and metals, there was a transition in data sources between 1996 and 1999 and between 2004 and 2005, so some of the change between years could be due to the methodology of the data source for capturing data.

   Additional sources include Secondary Materials Pricing and Secondary Fiber Pricing. 2003-2017. Released December 2017. Available at http://www.recyclingmarkets.net/. 1970 to 2004 historical data tabulated from weekly or monthly industry publications and averaged annually during the time periods shown. Publications included Waste Age Recycling Times, Waste News, Paper Recycler, Miller Freeman, Inc.
5. Solid Waste Environmental Excellence Protocol. "No End in Sight to US Landfill Cost Increases — Pacific Region to Experience Highest Growth". June 13, 2018. https://nrra.net/sweep/no-end-in-sight-to-us-landfill-cost-increases-pacific-region-to-experience-highest-growth/
6. MSW Generation: US EPA. 2019. Solid Waste in the United States: 2016 and 2017 Facts and Figures working papers. Population: U.S. Census Bureau. Population Division. Annual Estimates of the Resident Population. PCE: Bureau of Economic Analysis (BEA). 2019. Tables 2.3.4 and 2.3.5.
7. Wood consumption in buildings also includes some lumber consumed for the construction of other structures. Data were not available to allocate lumber consumption for non-residential and unspecified uses between buildings and other structures except for railroad ties. Since non-residential buildings such as barns, warehouses and small commercial buildings are assumed to consume a greater amount of lumber than other structures, the amount of lumber for construction remaining after the amount for railroad ties is split out is included in the buildings source category.
8. Steel consumption in buildings also includes steel consumed for the construction of roads and bridges. Data were not available to allocate steel consumption across different sources, but buildings are assumed to consume the largest portion of steel for construction.



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November 2019

AMERICAN BEVERAGE ASSOCIATION

June 17, 2020

Dear Chairman Barrasso and Ranking Member Carper:

On behalf of the American Beverage Association, we submit a statement for the record to the U.S. Senate Committee on Environment and Public Works hearing entitled, "Responding to the Challenges Facing Recycling in the United States." We applaud the committee for looking more closely at the state of recycling in our country and working to find solutions for the challenges that currently impact the system.

ABA represents the non-alcoholic beverage industry as its unified voice on policy. Our membership is committed to being good stewards of the environment. As it relates to recycling and our actions, America's leading beverage companies are working together to reduce our industry's plastic footprint through our Every Bottle Back initiative (EBB) and other actions. In this new undertaking, we are working to use less new plastic and investing in efforts to get our fully recyclable bottles back so they can be remade into new ones, and don't end up in the environment. Specifically, our companies are: 1) measuring our plastic footprint in partnership with the World Wildlife Fund; 2) investing in recycling infrastructure on the local level in cooperation with both The Recycling Partnership and Closed Loop Partners; 3) investing in raising awareness that our bottles are 100% recyclable; thus, inspiring consumers to recycle; and 4) adding a message on our plastic bottles and caps making it clear to consumers that they are recyclable and encouraging them to do so. More information on EBB can be found at www.everybottleback.com.

With Congress considering many options for improving our nation's recycling infrastructure, including Extended Producer Responsibility (EPR), ABA welcomes continued conversations with the committee on collection policy, as well as the broader challenges facing recycling in the U.S.

Sincerely,

Barbara Hiden

Barbara Hiden
Vice President, Federal Affairs
American Beverage Association

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GREENPEACE
Reports

Circular Claims Fall Flat:

Comprehensive U.S. Survey of Plastics Recyclability

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Contents

A. Comprehensive U.S. Survey of Plastics Recyclability 4
1. Executive Summary 4
2. Key Takeaways for Companies Making and Selling Plastic-Packaged Products 4
3. Survey Purpose and Drivers 5
3.1 Why do Truthful Claims and Labels on Plastic Products Matter? 6
3.2 Massive Change in U.S. Plastic Recycling Markets 6
3.3 Competition with Cheaper, Shinier New Plastic 7
3.4 Current Market Conditions for U.S. Post-Consumer Plastic Waste 7
3.5 Acceptance by a MRF is Not Proof of Recycling 8
3.6 Current Business Practices for Labeling Products as "Recyclable" are Outdated 9
4. Key Results 9
5. Conclusion and Forward Look 13
B. Survey Basis, Approach, Detailed Results and Evidence Found 15
6. Legal Basis for Recyclable Claims on Products 15
6.1 FTC Green Guides (16 CFR 260) 15
6.2 Deceptive Recyclable Claim Case: Keurig Plastic Coffee Pods 17
7. Survey of Plastic Waste Collection/Sortation and Reprocessing: Technical Approach and Detailed Results 18
7.1 Survey of U.S. Material Recovery Facilities 18
7.2 Survey of U.S. Recycling/Reprocessing Capacity for Post-Consumer Plastic Waste 20
7.3 Current U.S. Access to Municipal Collection and Sortation 22
8. Evidence of Collected Plastic Disposal and Export to Countries with Poor Waste Management 24
9. Evidence of Negligible Value of Plastic #3-7 Waste 27
10. Evidence of Shrink Sleeves and Deceptive Labeling 28
10.1 Harms Caused by Full Body Shrink Sleeves 29
10.2 Recycling and Retail Industry Design Guidelines 29
Attachment 1 2020 U.S. MRF Survey Spreadsheet 32
Endnotes 32

Plastic Resin Identification Codes[1]



A. Comprehensive U.S. Survey of Plastics Recyclability

1. Executive Summary

A comprehensive survey of plastic product waste collection, sortation and reprocessing in the United States (U.S.) was performed to determine the legitimacy of "recyclable" claims and labels on consumer plastic products. The survey is based on current conditions in October 2019 to January 2020 and U.S. Federal Trade Commission (FTC) Green Guides requirements for product claims and labeling.

Accurate recyclable claims and labels serve three valuable functions: truthful advertising to consumers, prevention of harmful contamination in America's recycling system, and identification of products for elimination or redesign to reduce waste and plastic pollution.

Key results of the survey include:

1. Only some PET #1 and HDPE #2 plastic bottles and jugs can be legitimately labeled as recyclable in the U.S. today.
2. Common plastic pollution items, including single use plastic food service and convenience products, cannot be legitimately claimed as recyclable in the U.S.
3. Plastics #3-7 have negligible-to-negative value and are effectively a category of products that municipal recycling programs may collect, but do not actually recycle. Plastic #3-7 waste collected in municipal systems across the country is being sent to landfills or incinerated.
4. Many full body shrink sleeves on PET #1 and HDPE #2 bottles and jugs make them non-recyclable.

Since China enacted policies limiting plastic waste imports, there have been significant changes in plastics acceptance policies of U.S. material recovery facilities due to declines in the demand for and value of collected plastic material. Post-consumer "mixed" plastics (plastics #3-7 and non-bottle plastics #1 and #2) have been most affected because China was the primary destination for those types of collected plastic wastes and there is minimal demand, value or reprocessing capacity for them in the U.S. Some material recovery facilities (MRFs) still accept mixed plastics but dispose of it or continue to export it outside of North America. Since collected mixed plastics are disposed of, incinerated or exported without verified recycling, acceptance of such a plastic item at a MRF alone is not sufficient and reasonable assurance to a customer that it will be manufactured into another item, as required by the FTC.[2]

Therefore, it is fair to assume that the standard for reasonable likelihood of a plastic item being recycled requires acceptance by municipal collection *and* U.S. domestic recycling/reprocessing capacity. Companies cannot legitimately place recycle symbols or "Check Locally" text on products made from plastics #3-7 because MRFs nationwide cannot assure consumers that valueless plastics #3-7 bales will actually be bought and recycled into a new product.

The results of this survey reflect the current conditions in early 2020, but may be affected in the future by changes in collected material value, Americans' access to recycling and domestic plastics reprocessing capacity. The economics of collecting, sorting and reprocessing plastic products are likely to worsen as expansion of plastic production lowers the cost of new plastic resin.

2. Key Takeaways for Companies Making and Selling Plastic-Packaged Products

In response to growing public concern on plastic pollution and excessive plastic waste generation, many corporations are making high profile, global commitments to make their products recyclable, reusable or compostable.[3] Companies are expanding the use of "recyclable" labels on plastic products at an aggressive pace.[4] Since claims and labels affect a consumer's purchasing decision, the claims and labels must not be misleading to be legal and provide the environmental benefits claimed.

Key outcomes from this comprehensive survey of U.S. collection, sortation and post-consumer plastic reprocessing facilities and recommendations for companies:

1. **Only PET #1 and HDPE #2 bottles and jugs, with acceptable shrink sleeves and labels, can be claimed as recyclable in the U.S. today**. The many other types of consumer plastic products and packaging are not recyclable and should not be claimed or labeled as such.

2. **Companies are liable and at risk now**. Companies that make "recyclable" claims in marketing materials or on products are liable for misrepresentation and need to ensure that the claims are accurate and not deceptive or misleading. Recyclable claims or labels on products other than PET #1 and HDPE #2 bottles and jugs are not accurate in the U.S. and expose companies to legal, reputational and financial liability risks.
3. **Companies need to develop their own recycling expertise**. Given the significant financial and brand risks associated with labeling products as recyclable, companies must have credible in-house expertise on the local recyclability of their products and must verify the accuracy of labels themselves. Outsourcing the decision and approval of product labels to external organizations does not protect companies from being held liable for misrepresentation if incorrect labels are used.
4. **Companies must be truthful and transparent in progress reports on pledge commitments.** In the U.S., public claims of progress on recyclable, compostable or reusable products are subject to the requirements of the FTC Green Guides. Companies who have made global commitments must produce progress reports that include the local recyclability of specific products that they sell in each market. Sufficient detail and transparency must be provided to prove claims of the progress made.
5. **Companies must take extended producer responsibility**. Companies that want their plastic products to be recyclable should make direct investments in collection, sortation and proven mechanical reprocessing of the specific type of plastic product. Companies cannot simply label their plastic products as "recyclable" and expect taxpayers to pay for the recycling systems to achieve it. Nor can they stall progress and rely on future development of unproven and problematic chemical recycling schemes. Just as companies invest in new product factories when they want to meet their profit goals, companies must similarly invest in collection, sortation and reprocessing to meet recyclable pledge goals.

Most types of plastic packaging are economically impossible to recycle now and will remain so in the foreseeable future. Companies must move beyond the outdated, failed approach of promoting recycling as the solution to excessive plastic waste and pollution. Furthermore, few U.S. cities have industrial composting facilities[5] required to treat compostable plastics and many compost facility operators don't want compostable plastics.[6] We cannot recycle or compost our way out of the growing plastic pollution problem. Instead of pretending that the trillions of throwaway plastic items produced each year will be recycled or composted, we must stop producing so many of them in the first place. To meet their "recyclable, reusable or compostable" pledge commitments, companies must become serious about employing reusable/refillable business models.

Governments and corporations are increasingly aware that their constituents and customers want choices that are better for the environment and our families now and the future generations to come, as demonstrated by legislative action[7] and pledges by companies[8] on plastic products.

To protect the health of humans and fellow creatures who share our planet, the urgent priority must be to eliminate single-use consumer plastic, and to invest in reusable, refillable and package-free approaches.

3. Survey Purpose and Drivers

This survey establishes a transparent, traceable review for the purpose of determining the legitimacy of "recyclable" claims and labels on United States (U.S.) consumer plastic products based on the current conditions in January 2020 and U.S Code of Federal Regulations 16 CFR 260 ("Green Guides") requirements for product claims and labeling. In the Green Guides, the Federal Trade Commission (FTC) requires that "Marketers must ensure that all reasonable interpretations of their claims are truthful, not misleading, and supported by a reasonable basis before they make the claims."[9] The FTC further states: "In the context of environmental marketing claims, a reasonable basis often requires competent and reliable scientific evidence. Such evidence consists of tests, analyses, research, or studies that have been conducted and evaluated in an objective manner by qualified persons."

The U.S. is grappling with two major plastic waste problems: plastic pollution and generation of excessive plastic waste that is disposed to landfills or incinerated with significant carbon emissions. In the past few years, there have been massive changes in America's recycling systems and an increase in plastic production that has reduced the cost of new plastic. The last comprehensive assessment of plastic waste recyclability was performed in 2015/2016[10] and is not representative of current market conditions, in part because of waste import restrictions imposed by China. An accurate and up-to-date analysis of the existing domestic collection and recycling/reprocessing capacity is needed now to determine the true recyclability of plastic consumer products.

3.1 Why do Truthful Claims and Labels on Plastic Products Matter?

Accurate recyclable claims and labels on consumer products serve three valuable functions:

1. **Honest Advertising to Consumers**: Claims and labels on products inform customers whether there is a potential environmental benefit to one product compared to another. Since claims and labels affect a consumer's purchasing decisions, the claims and labels must not be misleading to be legal.[11]
2. **Prevent Harm to America's Recycling System and Avoid Wasted Energy, Labor and Costs**: Incorrect recyclable labels cause consumers to mistakenly place an item in a recycle bin and cause contamination in municipal recovery facilities (MRFs). The contamination harms the ability of the MRFs to cost-effectively collect and sort other materials such as cardboard and paper that are easily ruined by contact with food-soiled packaging.[12] Energy, carbon emissions, labor and costs are wasted from collecting and sorting unwanted, worthless items through municipal sortation systems.[13]
3. **Identify Products for Redesign to Reduce Waste and Plastic Pollution**: Plastic consumer products that are not practically recyclable in municipal systems should be the first to be eliminated or redesigned, preferably to be refillable or reusable products, or be made from more environmentally advantageous materials.

Companies have marketed consumer products as having an environmental benefit, such as being recyclable, since the 1980s.[14] In response to growing public concern about plastic pollution and excessive plastic waste generation, many companies are making high profile, global commitments to make their products recyclable, reusable or compostable.[15] Product and packaging manufacturers are also pressuring MRFs to accept plastic to make them appear redeemable and avoid plastic bans. As the nation's largest waste collection and sortation company, Waste Management, stated in their 2018 Annual Report, "bans have increased pressure by manufacturers on our recycling facilities to accept a broader array of materials in curbside recycling programs to alleviate public pressures to ban the sale of those materials. However, with no viable end markets for recycling these materials, we and other recyclers are working to educate and remind customers of the need for end market demand and economic viability to support sustainable recycling programs."[16]

Companies that make "recyclable" claims in marketing materials or on products may face liability from consumers as well as from the FTC for misrepresentation and need to ensure that the claims are accurate and not deceptive or misleading. A class action lawsuit on recyclable claims on single use plastic products is currently pending against Keurig Green Mountain in U.S. Federal District Court.[17] Other corporations could face similar, significant financial and reputational risks from deceptive labels on their plastic products that are on store shelves now.

3.2 Massive Change in U.S. Plastic Recycling Markets

Since the mid-1990s, U.S. states and cities have sought to increase recycling of municipal solid waste to avoid disposal by landfill or incineration.[18] Due to low cost shipping and labor, the U.S. became reliant on China to accept plastic materials collected by U.S. municipal systems. Over time, the types of plastics accepted in municipal systems and labeled as "recyclable" grew from domestically recyclable PET #1 and HDPE #2 bottles and jugs to other types of plastics as cities and states emphasized "diversion" and companies sought to brand more of their plastic products as environmentally redeemable.

Changes in the global trade of plastics waste started in 2013 when China's Green Fence policy began restricting imports of contaminated materials. As shown on Resource Recycling's detailed timeline, China's National Sword policy followed in 2018 and the decline in exports of plastic waste and other post-consumer materials has significantly impacted America's municipal recycling collection systems.[19,20]

According to chemical industry experts at Independent Commodity Intelligence Services (ICIS), "This has completely changed the dynamics of the market. China is no longer a route for recycling and the expectation is that countries now deal with their own waste."[21] A representative of the Solid Waste Association of North America stated: "We're producing a lot of waste ourselves, and we should take care of it ourselves."[22]

Waste and recycling experts state that even before China's policy changes, "a lot of areas fooled themselves into thinking they were recycling when they were really not."[23] Export of plastic waste has declined sharply due to China's policies, import restrictions placed by other countries and concerns that many alternative receiving countries cannot provide assurance that the imported plastic waste will be safely and responsibly recycled into new products.

Since the documentary "Plastic China" debuted in China in 2014,[24] more than 60 investigations and articles have shown that millions of tons of exported plastic wastes have been dumped or burned rather than recycled.[25] In response, companies are shifting practices. For example, in 2019, Waste Management adopted a corporate policy to ship post-consumer plastics to only North American plastic recyclers/reprocessors.[26] Casella Waste Systems, the nation's fifth largest waste collection and sortation company, no longer exports residential plastics.[27]

3.3 Competition with Cheaper, Shinier New Plastic

It isn't just the decline in export options that is hurting plastic recycling. The competition with cheaper new plastic that generally has higher quality harms the market demand for recycled plastic. While some plastic waste items may be technically recyclable, the cost to do so is prohibitively high because product manufacturers prefer to buy higher quality new plastic at a lower cost. Back in 2015, the negative impacts of relatively cheap crude oil and natural gas were identified by Waste Management as a reason that customers preferred to buy cheaper new plastic than more expensive recycled plastic.[28]

The massive expansion of plastic production in the U.S., fueled by at least $200 billion of investment in 340 petrochemical projects,[29] is flooding the market and causing polyethylene prices to decline to historic lows - below prices last seen during the 2008 financial crisis.[30, 31] Plastic prices continued to decline in November and December 2019 as feedstock costs were lower, supply outpaced demand, and overall global demand slowed.[32] As a recycling veteran stated in his predictions for 2020: "With the surge in new virgin resin capacity coming online, prices for those resins are likely to go down and depress recycled resin prices."[33]

When MRFs lose money on collecting and sorting plastic or other material, it drives their decision to stop accepting it. Section 9 provides evidence found during the survey of the negligible value of plastic #3-7 materials and how it influences MRF decisions to restrict acceptance of plastics to PET #1 and HDPE #2 bottles and jugs.

3.4 Current Market Conditions for U.S. Post-Consumer Plastic Waste

America's post-consumer collection, sorting and reprocessing/recycling systems are now stressed, and in some cases failing due to excessive waste generation, contamination and severe declines in commodity values for collected cardboard, paper, metal, glass and plastic materials.[34,35]

Since China enacted the National Sword policy on January 1, 2018 limiting plastic waste imports, there have been significant changes in plastics acceptance policies of U.S. material recovery facilities due to declines in the demand for and value of collected plastic material. In Florida, the Department of Environmental Protection advises residents to only recycle plastic bottles and jugs.[36] The Oregon Refuse and Recycling Association also recommends that only plastic #1-2 bottles & jugs be collected.[37] Due to lack of markets, the Wisconsin Department of Natural Resources (DNR) has confirmed to stakeholders that mixed plastics (#3-7) can legally be disposed, even if the material has been sorted and baled.[38]

Current viable markets in the U.S. only exist for PET #1 and HDPE #2 plastic bottles and jugs. China was the primary destination for other types of plastic waste and there is minimal demand and reprocessing capacity for them in the U.S. In Summer 2019, More Recycling stated that: "Most West Coast materials recovery facilities (MRFs) are not equipped to sort plastics beyond PET and HDPE bottles. This material is often referred to as 3-7, but it includes small rigid plastic of all resins, as well as missed PET and HDPE bottles. It is this mix that is struggling to find a market in the wake of National Sword."[39]

MRFs are now adapting to these new market conditions and scaling back acceptance of plastic products.[40] As this survey reveals, many MRFs only accept the two types of post-consumer plastic items (PET #1 and HDPE #2 bottles and jugs) that are recyclable in the U.S. due to sufficient market demand and domestic reprocessing capacity. For example, the City of Erie, Pennsylvania now instructs residents to only recycle #1 and #2 plastic bottles and jugs, stating: "We cannot collect an item for recycling, unless we have an end user who is willing to purchase and recycle that item. China used to accept most of the #3, 4, 5, and 7 plastics, but it turns out that most of these plastics were not actually being recycled. They were mostly being burned for fuel."[41]

Some MRFs still accept plastics #3-7 and non-bottle #1-2 but dispose of it or continue to export it outside of North America due to the lack of domestic buyers and reprocessing capacity. In some cases, cities that have long term contracts with MRFs are forcing them to continue to collect plastics that have negligible domestic market demand and will be landfilled.[42,43] As contracts are reviewed for renewal and the public understands the true fate and negative costs of collecting unrecyclable materials, MRF acceptance policies will continue to consolidate to PET #1 and HDPE #2 bottles and jugs only.

A recycler in Illinois highlighted plastics #3-7 as a problem, stating, "Anything like a yogurt container, fruit container or cottage cheese container — you name it, those are products you cannot get rid of right now. There's no marketability, so I think you're going to continue to see a trend of those being eliminated from recycling program."[44]

When the city of Laramie, Wyoming stopped accepting plastics #3-7, a city council member said "This wasn't a decision we made to reduce our recycling, there simply just is not a market for this plastic. If we want to counter this, then reduction is the only option. So quit using plastics 3-7 if you can." [45]

ReThink Waste, a public agency that operates the Shoreway MRF in San Carlos, California, sums up the reality of plastics markets in Figure 1: "Plastics #1 & 2 are readily recyclable and are usually recycled in the U.S. Plastics #3-7 are all versions of hard plastic that are very difficult to recycle. There is currently no market for the material when it is deconstructed."[46] The Shoreway MRF continues to accept plastics #3-7 but clearly states that the collected material is sent to landfill.

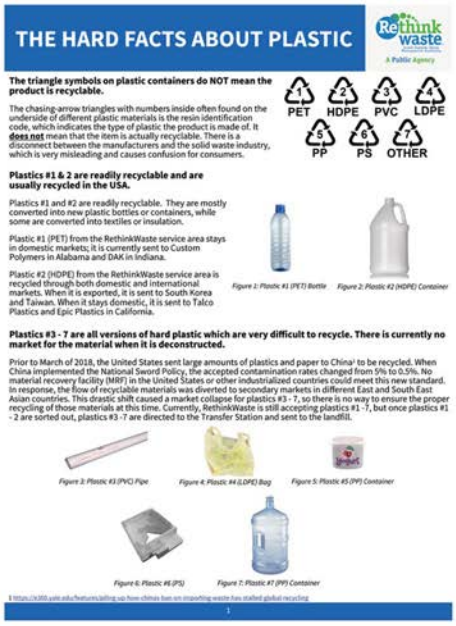


Figure 1: ReThink Waste – Shoreway MRF: The Hard Facts About Plastic[11]

According to the East Bay Express, environmental advocacy groups in California believe that local governments need to start being more transparent about what materials are actually recyclable and that cities should stop collecting non-bottle plastics in recycling bins altogether.[47]

3.5 Acceptance by a MRF is Not Proof of Recycling

The Shoreway MRF's disposal of plastics to landfill is not unique. In January 2019, Washington State's Department of Ecology advised citizens that "Commodities such as paper and plastic are piling up or being sent to landfills."[48] In June 2019, an in-depth Guardian investigation revealed that "cities around the country are no longer recycling many types of plastic dropped into recycling bins. Instead, they are being landfilled, burned or stockpiled."[49] In Blaine County, Idaho residents are told to recycle plastics items Nos. 1-5, but only #1 and 2 bottles are actually being recycled, with the rest being dumped in a landfill south of Salt Lake City.[50] Section 8 provides evidence found across the country of collected plastics being sent to landfill, incineration or stockpiled, but not recycled.

Since a substantial portion of collected plastics are disposed of, incinerated or exported without verification of recycling, acceptance of a plastic item at a MRF alone is not sufficient and "reasonable" assurance to a customer that it will be manufactured into another item, as required by the FTC in 16 CFR 260. Sufficient market demand and domestic recycling/reprocessing capacity must exist for a plastic product to be considered "recyclable." Without market demand and domestic recycling/reprocessing capacity, the plastic material collected by the MRFs will not be bought by manufacturers and will not be recycled into another product.

In the FTC Green Guides Statement of Basis and Purpose section titled "Packages Collected for Public Policy Reasons but Not Recycled," the FTC states: "The Commission agrees that unqualified recyclable claims for categories of products that municipal recycling programs collect, but do not actually recycle, may be deceptive. To make a non-deceptive unqualified claim, **a marketer should substantiate that a substantial majority of consumers or communities have**

access to facilities that will actually recycle, not accept and ultimately discard, the product. As part of this analysis, a marketer should not assume that consumers or communities have access to a particular recycling program merely because the program will accept a product."[52]

> Therefore, it is fair to assume that the standard for reasonable likelihood of a plastic item being recycled requires acceptance by municipal collection *and* U.S. domestic recycling/reprocessing capacity.

This FTC requirement puts the burden of proof on product companies to substantiate that MRFs that are accepting their recyclable-labeled products are selling plastic bales to reprocessors that are verifiably recycling the plastic bales into resin for manufacturing into new products.

3.6 Current Business Practices for Labeling Products as "Recyclable" are Outdated

A comprehensive study of the national access to municipal collection of post-consumer items for recycling was last performed in 2015/2016, by two consulting companies (RRS and Moore Recycling) contracted by The Sustainable Packaging Coalition (SPC); this pre-dated China's 2018 National Sword policy that severely impacted America's collection and recycling/reprocessing systems.[53] The study focused solely on the acceptance of items by of municipal collection but acknowledged that "It also must be realized that other questions must be answered in order to understand the full picture of recyclability." The study did not assess whether collected materials were disposed or exported to countries with poor waste management. Project sponsors included manufacturers and retailers that have interests in securing "recyclable" claims and labels for their products.[54]

Product, packaging and retail companies appear to be still employing the SPC 2015-6 access-to-collection data to substantiate claims and label products as "recyclable" in 2020. This approach is not accurate or valid because:

1. Acceptance of plastics #3-7 and non-bottle plastics #1-2 by MRFs has significantly decreased since 2015/2016 because the value of those types of plastic materials has declined to essentially zero. (RecycleMorePlastic.org reports the nationwide value of bales of "3-7 Bottles and Small Rigid Plastics" to be worth $0.003 per pound in December 2019).[55]
2. Acceptance of plastic materials at a MRF is not proof that materials will be recycled.
3. Export of plastic materials to countries with poor waste management is not proof that materials will be recycled.

In 2018, the Association of Plastic Recyclers (APR) published a survey of plastics acceptance at the largest municipality in each U.S. state and in Washington, D.C.[56] This survey was limited to 51 municipal recycling websites and was performed before the impacts of China's National Sword policy were seen at U.S. MRFs. Similar to the SPC Study, the APR survey is not valid for determining the legitimacy of recyclable claims and labels because it focused on acceptance only and is out of date.

Since the previous assessments of plastic waste recyclability are out of date, did not assess whether collected plastic was actually recycled and not representative of current market conditions, a comprehensive survey of all 367 operating MRFs in the U.S. and domestic collection and domestic recycling/reprocessing capacity was performed to determine the true recyclability of plastic consumer products in 2020.

4. Key Results

To meet the recycle label threshold required by the FTC Green Guides, it is fair to expect that Americans must have access to both collection/sortation and recycling/reprocessing of a specific item into plastic resin that could be used to manufacture another item. In this comprehensive survey, both types of facilities were assessed:

1. **Collection and sortation (MRF) facilities:** The 367 operating U.S. residential MRFs were surveyed for their publicly-posted lists of specific types of plastic products that are accepted in their curbside recycling bins. (Details provided in Section 7.1 - Survey of U.S. Material Recovery Facilities)[57]
2. **Plastic reprocessing capacity of facilities** that turn the collected/sorted material into plastic resin was assessed for total U.S. processing capacity of specific types of post-consumer plastics. (Details provided in Section 7.2 - Survey of U.S. Recycling/Reprocessing Capacity for Post-Consumer Plastic Waste)

Table 1 summarizes the survey results for plastic bottles, jugs, tubs and pods and provides an assessment of whether the specific product can legitimately be labeled as "recyclable" according to the requirements of the FTC Green Guides. (Details of the FTC Green Guides requirements are provided in Section 6). The columns are described in detail in the footnotes to the table.

Table 1: Plastic Bottles, Jugs, Tubs & Pods: American Population's Access to Municipal Collection & Likelihood of Recycling into New Product

Plastic Item	(A) % of Total (367) U.S. Material Recovery Facilities that Accept the Item	(B) Access (%) of American Population to Municipal Collection of the Item	(C) U.S. Reprocessing Capacity for Post-Consumer Plastic Type	(D) Likelihood of Collected Materials Being Recycled into New Products	(E) Can Product be Labeled as "Recyclable" per FTC Green Guides
PET #1 Bottles & Jugs[1]	100%	87%	Sufficient 22.5%	Reasonable	Yes
HDPE #2 Bottles & Jugs[1]	100%	87%	Moderate 12%	Reasonable	Yes
PP #5 Tubs	53%	31%	Low/Insufficient <5%	Not Reasonable	No
PP #5 or PS #6 Coffee Pods	0%	0%	Low/Insufficient <5%	Not Reasonable	No

Notes:

Column (A): % of U.S. Material Recovery Facilities that Accept the Item: % determined from 2020 U.S. MRF Survey (Details provided in Section 7.1)

Column (B): Access (%) of Total American Population to Municipal Collection of Item: Since about 50% of Americans have access to automatic curbside collection to MRFs and 37% have access to opt-in or drop-off municipal collection, the access for total population was determined by adjusting for Americans who have access to a particular type of municipal collection (Details provided in Section 7.3).

Column (C): Existing U.S. Reprocessing Capacity for Post-Consumer Plastic Type (Details provided in Section 7.2)

Column (D): Likelihood of Collected Materials Being Recycled into New Products: There must be adequate domestic processing capacity to create a reasonable likelihood that a collected plastic item will actually be recycled. (Details provided in Section 7.2)

Column (E): Overall assessment of whether the specific product can legitimately be claimed or labeled as recyclable based on Total Population Access (B) and Likelihood of Collected Materials being Recycled into New Products (D). The FTC Green Guides requires that a significant (>60%) portion of the Total American Population have access to municipal recycling to claim an item as recyclable.

(1) Bottles cannot have non-recyclable or non-sortable shrink sleeves.

Key Result A: Only plastic PET #1 & HDPE #2 bottles and jugs have sufficient domestic municipal collection and reprocessing capacity to provide consumers with reasonable assurance that a collected item will be recycled into another product.

PET #1 and HDPE #2 Bottles and Jugs: The 2020 U.S. MRF Survey showed that these items are accepted by 100% of MRFs. Based on up-to-date estimates (described in Section 7.3), 87% of the total American population has access to curbside and drop-off recycling service of some type. It is assumed that drop-off recycling center also accept PET #1 and HDPE #2 bottles and jugs. Therefore, the overall access to recycling by the total American population is 87% and significantly more than the 60% acceptance required by the FTC.

Polypropylene (PP#5) Tubs and Containers: The 2020 U.S. MRF Survey showed that these items are only accepted by 53% of U.S. MRFs. Based on up-to-date estimates for access to curbside and drop-off recycling, described in Section 7.3, only 31% of the total American population has access to collection of PP#5 tubs and containers. However, acceptance of the PP#5 tub by a MRF is not proof that the PP#5 tub will actually be recycled into a new product. PP#5 is typically collected as part of a mixed plastics #3-7 bale, which is not a "market-ready" bale as required by the Association of Plastic Recyclers (APR) in their definition of "recyclable" plastic.[58] The plastics industry acknowledges that individually most plastics #3-7 "are not available in the quantities necessary to justify investments in optical sorting and are difficult to sort manually due to a variety of resins used for a wide range of similar applications (i.e., creating 'look-a-like' materials and products). Therefore, most MRFs produce a mixed plastic, '#3-7' or 'pre-picked' bale that requires further sorting prior to recycling."[59] However, the economics to do that have proven to be insurmountable. A secondary plastics sorting facility

(QRS Recycling in Dundee, MD) opened in 2015 to separate mixed-plastic bales into individual resin and color streams but went bankrupt in 2017.[60]

Mixed plastic #3-7 bales, previously exported to China, now have negligible to negative value across the country and "cannot be effectively or efficiently recycled" in the U.S, according to a Kentucky-based recycler.[61] This survey found that some MRFs that still accept PP#5 tubs are known to send plastic waste to a landfill or incinerator. Some of the MRFs that accept PP#5 tubs are known to export plastic waste to countries in Asia (see Table 9), which, as detailed in Section 3, does not provide adequate assurance that the material is actually recycled into a new product.

Compounding the problem of recycling post-consumer PP#5 plastic items is that there are a limited number of plastic reprocessing facilities that will buy post-consumer PP#5 plastic. Analysis in Section 7.2 shows that there is less than 5% U.S. domestic reprocessing capacity for PP#5 post-consumer waste. The facilities are primarily in the south and east U.S., with the largest U.S. processor of PP#5 located in Alabama. Trucking collected PP#5 tubs and containers thousands of miles from the West Coast or North East to Alabama is problematic from a cost or carbon emissions perspective.

Since the FTC requires that "a marketer should substantiate that a substantial majority of consumers or communities have access to facilities that will actually recycle, not accept and ultimately discard, the product,"[62] companies cannot legitimately claim or label PP#5 tubs and containers as recyclable.

Lastly, the economics of collecting, sorting and recycling post-consumer polypropylene products are becoming even more stressed and do not provide a sufficient driver for a MRF to invest in collection or separation of PP#5 post-consumer products from mixed plastics #3-7 bales. A billion pounds of new polypropylene production aimed at the U.S. market is coming online in mid 2020 and the price of new polypropylene continues to decline.[63,64] In parallel, the value of collected post-consumer PP#5 is also declining.

The current (January 2020) average value of a post-consumer PP#5 bale is now between 5 and 6 cents/lb across the country.[65] This is a drop of more than 50% in market value since the summer of 2019.[66]

PP#5 and PS#6 Coffee Pods: The 2020 U.S. MRF Survey did not find evidence of acceptance of these items at MRFs. This is likely due to the fact that the pods are smaller than the 2 inch by 2 inch standard size requirement for sortation at MRFs.[67,68]

Key Result B: Many commonly polluted single use plastic items do not have sufficient acceptance by municipal collection or sufficient U.S. domestic reprocessing capacity to provide consumers with reasonable assurance that a collected item will be recycled into another product.

Table 2 summarizes the survey results for single use plastic food service and convenience items that are typically found in a list of top plastic pollution items collected during beach cleanups.[69] The 2020 U.S. MRF Survey found limited or no acceptance of any of these items at MRFs. It should be noted that the PET used in clamshells and trays is not the same as that used in a soda bottle.[70] The survey also showed low processing capacity for the types of materials that the items are made from.

Based on the lack of acceptance by municipal collection and low processing capacity, the assessment showed that none of these items can be legitimately claimed or labeled as recyclable in the U.S. Furthermore, when accepted by MRFs, it was found that these items are collected in mixed plastic bales that have negligible value and are known to be disposed to landfill, incinerated or exported without verification of recycling such that a consumer cannot "check locally" to determine if the item will be recycled.

Table 2: Top Plastic Pollution Items: American Population's Access to Municipal Collection & Likelihood of Recycling into New Product

Plastic Item	(A) Type of Plastic Commonly Used	(B) % of Total (367) U.S. Material Recovery Facilities that Accept the Item	(C) Access (%) American Population to Municipal Collection of the Item	(D) U.S. Reprocessing Capacity & Likelihood of Collected Materials Being Recycled into New Product	(E) Can Item be Legitimately Claimed or Labeled as "Recyclable" per FTC Green Guides
Plastic Clamshells	PET #1[1] PVC #3 PS #6	14%	7%	Low Reprocessing Capacity & Not Reasonable Likelihood of Recycling into New Product	No
Plastic Cups	PP #5 PS #6 Other #7	11%	5.5%	Low Reprocessing Capacity & Not Reasonable Likelihood of Recycling into New Product	No
Plastic Trays	PET #1[1] PP#5 Other #7	7%	3.5%	Low Reprocessing Capacity & Not Reasonable Likelihood of Recycling into New Product	No
Plastic Bag[2]	HDPE #2 LDPE #4	4%	2%	Low Reprocessing Capacity & Not Reasonable Likelihood of Recycling into New Product	No
Expanded Polystyrene (EPS) Food Service	PS #6	3%	1.5%	Low Reprocessing Capacity & Not Reasonable Likelihood of Recycling into New Product	No
Plastic Lids & Caps (Loose)	PP #5 PS #6	3%	1.5%	Low Reprocessing Capacity & Not Reasonable Likelihood of Recycling into New Product	No
Plastic Plates	PS #6	1%	0.5%	Low Reprocessing Capacity & Not Reasonable Likelihood of Recycling into New Product	No
Plastic Cutlery, Straws & Stirrers	PP #5 PS #6	1%	0.5%	Low Reprocessing Capacity & Not Reasonable Likelihood of Recycling into New Product	No
Plastic Food Wrappers & Pouches	Multiple Types & Layers of Plastic	0%	0.0%	Negligible Reprocessing Capacity & Not Reasonable Likelihood of Recycling into New Product	No

Notes:

Column (A): The plastic items may be made from more than one type of plastic.

Column (B): % of U.S. Material Recovery Facilities that Accept the Item: % determined from 2020 U.S. MRF Survey (Details provided in Section 7.1)

Column (C): Access (%) of Total American Population to Municipal Collection of Item: Since about 50% of Americans have access to automatic curbside collection to MRFs, the access for total population was adjusted by access to municipal collection (Details provided in Section 7.3).

Column (D): Likelihood of Collected Materials Being Recycled into New Products: There must be adequate domestic processing capacity to create a reasonable likelihood that a collected plastic item will actually be recycled. (Details provided in Section 7.2)

Column (E): Overall assessment of whether the specific product can legitimately be claimed or labeled as recyclable based on Total Population Access (C) and Likelihood of Collected Materials being Recycled into New Products (D). The FTC Green Guides requires that a significant (>60%) portion of the Total American Population have access to municipal recycling to claim an item as recyclable.

(1) The PET used in clamshells and trays is not the same as that used in a soda bottle.[71]

(2) Plastic bags accepted by municipal systems. This does not include plastic bags collected by drop-off at private retail operations because the FTC requirements are based on municipal collection systems.

Key Result C: Plastics #3-7 cannot be legitimately labeled as "recyclable" under FTC guidelines. Consumers cannot "Check Locally" to determine if a plastic #3-7 item will actually be recycled into a new product.

Acceptance by MRFs of plastics #3-7 does not prove that the plastic will be destined "for reuse or use in manufacturing or assembling another item" as required by the FTC. The comprehensive 2020 U.S. MRF Survey of 367 collection and sortation systems documents that while some MRFs still accept plastics #3-7, some of the collected plastics #3-7 are being landfilled or incinerated due to lack of domestic market demand and buyers. Additionally, some MRFs that accept plastics #3-7 are known to still export plastic waste to countries with poor waste management and without verification that the plastic will actually be recycled into a new product. Therefore, plastics #3-7 is a category of products that municipal recycling programs may collect, but do not actually recycle, and labeling of products made from those types of plastic may be deceptive.

Companies often place labels of large recycle symbols with small words "Check Locally" on products that less than the FTC's required "significant amount" (>60%) of Americans have access to recycle through a municipal collection system. "Check Locally" is often found on plastics #3-7 items. However, "Check Locally" is not legitimate because consumers cannot determine if their collected plastics will actually be recycled at a reprocessing facility. For example, if a resident checked on the local Salt Lake City recycling website, it states that plastic containers are accepted with photos including plastics #1-7.[72] But it has been reported that plastic waste collected through curbside recycling in Salt Lake City is sent to a cement kiln where it is burned for energy and not recycled.[73]

Companies cannot legitimately place recycle symbols or "Check Locally" text on plastics #3-7 because MRFs cannot inform consumers whether their collected plastics #3-7, which has negligible-to-negative market value, will actually be bought and recycled into a new product.

Key Result D: Many full body shrink sleeves on PET #1 and HDPE #2 bottles and jugs make them non-recyclable.

Many product companies are using full body shrink sleeve labels on plastic bottles to improve shelf appeal. Commonly used polyethylene terephthalate glycol (PETG) and polyvinyl chloride (PVC) shrink sleeves are known to prevent proper sortation of the bottles in MRFs and harm the operations of PET bottle recyclers/reprocessors.[74] Yet product companies continue to employ these types of shrink sleeves. The product companies are evidently aware that the shrink sleeves they use prohibit proper sortation and harm recycling of the plastic bottles because they place instructions on the bottles telling consumers to remove the shrink sleeves.

This is in violation of FTC Green Guides 16 CFR 260.12d that states: "**If any component significantly limits the ability to recycle the item, any recyclable claim would be deceptive. An item that is made from recyclable material, but, because of its shape, size, or some other attribute, is not accepted in recycling programs, should not be marketed as recyclable.**"[75] The FTC Green Guides do not allow companies to instruct consumers to remove an integral part of the product packaging to make it recyclable.

5. Conclusion and Forward Look

The comprehensive survey of U.S. post-consumer plastic product collection, sortation and reprocessing capacity determined that only PET #1 and HDPE #2 plastic bottles and jugs (without harmful shrink sleeves) can legitimately be claimed or labeled as recyclable. Recyclable labels on other consumer plastic products do not provide truthful advertising to American consumers and are a cause of contamination and inefficiency plaguing America's municipal collection and plastics recycling/reprocessing systems.

As scientific evidence of the harm caused by plastic pollution continues to mount, discussions about what to do about single use plastic are underway in the U.S. Congress and city halls and state capitals across the country, as well as in corporate board rooms. This survey demonstrates that many types of commonly used plastic packaging are not recyclable, and are being landfilled, incinerated, or exported without verification of recycling. All of these approaches have significant consequences for environmental and human health, which will continue to increase as long as these packaging materials are employed.

The results of this survey effort are valid now, but may be affected in the future by changes in collected material value, Americans' access to municipal recycling, and domestic post-consumer plastic reprocessing capacity. There are negative economic factors working against recycling: fixed and operating costs of MRFs continue to increase as the commodity values of collected materials continues to decline.[78] As municipal collection contracts come up for renewal and service prices increase to cover the revenue gap, additional municipalities are considering whether to end curbside recycling.[77,78,79] For example, in Brook Park, Ohio, the cost to process recyclables are going to skyrocket from $44/ton to $124/ton and city officials have begun considering options for managing the high cost including a possible moratorium on recycling.[80]

The economic driver for collecting, sorting and reprocessing post-consumer plastic products is likely to worsen as expansion of plastic production lowers the cost of new resin.

While new types of plastics reprocessing systems are being discussed,[81] chemical recycling processes are complicated, expensive and have not been proven at commercial scale to cost-effectively reprocess diverse post-consumer plastic waste and produce a resin that can be manufactured into another product. Furthermore, significant concerns persist about the energy and fresh water requirements and environmental impacts of chemical recycling systems.

Since the cost to recycle PET #1 and HDPE #2 is now higher than new plastic,[82] there is no guarantee that even PET #1 and HDPE #2 bottles and jugs will meet the "recyclable" definition in the future.

Moving forward, an updated annual analysis and transparent, traceable account of the current domestic collection, sortation and recycling/reprocessing capacity of post-consumer plastic products is required to determine legitimacy of recyclable claims.

B. Survey Basis, Approach, Detailed Results and Evidence Found

6. Legal Basis for Recyclable Claims on Products

6.1 FTC Green Guides (16 CFR 260)

In the U.S., claims and labels relating to environmental benefits of products are regulated at the national level by the FTC "Green Guides" established by the FTC pursuant to its authority under U.S. Federal Trade Commission Act.[63] Codified in the U.S. Code of Federal Regulations 16 CFR 260 (Guides for the Use of Environmental Marketing Claims), the Green Guides contain standards and examples to help companies understand what constitutes deceptive or misleading environmental advertising.[64] The Green Guides do not preempt state or local laws.

The FTC Green Guides are based on consumer understanding of environmental claims and require that "Marketers must ensure that all reasonable interpretations of their claims are truthful, not misleading, and supported by a reasonable basis before they make the claims."[65]

The Green Guides' requirements apply to labels, advertising, other forms of marketing in any medium directly or through implication. Claims on products, press releases, presentations and on company websites are covered.

The Green Guides state that **"A representation, omission, or practice is deceptive if it is likely to mislead consumers acting reasonably under the circumstances and is material to consumers' decisions."**[66] The FTC can take action under the FTC Act if a marketer makes an environmental claim inconsistent with the guides. The FTC and courts employ a "reasonable consumer test" to determine how fair-minded consumers in a general audience are likely to interpret certain claims.[67] Whether a particular claim is deceptive will depend on the net impression of the advertisement, label, or other promotional material at issue. The FTC states that "A representation, omission, or practice is deceptive if it is likely to mislead consumers acting reasonably under the circumstances and is material to consumers' decisions."

The key requirements of the Green Guides related to "recyclable" claims and labels on products are summarized in this section.

1. **Substantiation of Marketing Claims Must Be Made *Before* Claims are Made (16 CFR 260.2)**
   The Green Guides require that "Marketers must ensure that their claims are supported by a reasonable basis **before** they make claims. A reasonable basis often requires reliable scientific evidence. Such evidence consists of analyses and research that have been evaluated in an objective manner."
2. **"Recyclable" Claims Require *Established* Programs for Collection, Separation and Recovery for Use in Manufacturing Another Item (260.12a)**
   The FTC requires *existing* programs to collect, separate and use the product in manufacturing another product. Material recovery facilities perform the collection and sortation function. Plastic recycling facilities reprocess the collected materials into plastic resin for use in manufacturing another product. Therefore, existing programs run by municipalities to collect and sort items at a MRF alone are insufficient to meet the "recycling" requirement. There must also be recycling/reprocessing capacity for the plastic item to turn it into resin that can be used by manufacturers.

§ 260.12 Recyclable claims.

(a) It is deceptive to misrepresent, directly or by implication, that a product or package is recyclable. A product or package should not be marketed as recyclable unless it can be collected, separated, or otherwise recovered from the waste stream through an established recycling program for reuse or use in manufacturing or assembling another item.

Figure 2. FTC Green Guides 16 CFR 260.12a

3. **At Least 60% of Americans Must Have Access to Recycling Facilities for a Product to be Labeled as "Recyclable" (260.12b1)**
To legitimately claim a product as "recyclable," the FTC requires that recycling facilities be available to a "substantial majority" of Americans, defined to be at least 60 percent. The FTC states that "Marketers should qualify all recyclable claims for products that do not meet the 60 percent facility availability threshold. The lower the levels of access to appropriate facilities. The more strongly the marketer should emphasize the limited availability of recycling for the product."[46]

> (b) Marketers should clearly and prominently qualify recyclable claims to the extent necessary to avoid deception about the availability of recycling programs and collection sites to consumers.
> (1) When recycling facilities are available to a substantial majority of consumers or communities where the item is sold, marketers can make unqualified recyclable claims. The term "substantial majority," as used in this context, means at least 60 percent.

Figure 3. FTC Green Guides 16 CFR 260.12b1

4. **"Qualified" Recycling Claims May be Made for Limited Recycling Access (260.12b2)**
The FTC requires that when recycling facilities are available to less than a substantial majority of consumers or communities where the item is sold, marketers should qualify all recyclable claims. "Qualified" allows use of the recyclable symbol but requires additional wording describing the limitations. The lower level the access, the more limitation text required.

> (2) When recycling facilities are available to less than a substantial majority of consumers or communities where the item is sold, marketers should qualify all recyclable claims. Marketers may always qualify recyclable claims by stating the percentage of consumers or communities that have access to facilities that recycle the item. Alternatively, marketers may use qualifications that vary in strength depending on facility availability. The lower the level of access to an appropriate facility is, the more strongly the marketer should emphasize the limited availability of recycling for the product. For example, if recycling facilities are available to slightly less than a substantial majority of consumers or communities where the item is sold, a marketer may qualify a recyclable claim by stating: "This product [package] may not be recyclable in your area," or "Recycling facilities for this product [package] may not exist in your area." If recycling facilities are available only to a few consumers, marketers should use stronger clarifications. For example, a marketer in this situation may qualify its recyclable claim by stating: "This product [package] is recyclable only in the few communities that have appropriate recycling facilities."

Figure 4. FTC Green Guides 16 CFR 260.12b2

5. **"Check Locally" Not Allowed by the FTC (260.12b2 Example 4)**
The use of a label with the instruction to consumers to simply "Check Locally" is not approved in the FTC Green Guides. In an example in the Green Guides, the FTC states: "A paperboard package is marketed nationally and labeled either "Recyclable where facilities exist" or "Recyclable: Check to see if recycling facilities exist in your area." Recycling programs for these packages are available to some consumers, but not available to a substantial majority of consumers nationwide. **Both claims are deceptive because they do not adequately disclose the limited availability of recycling programs.**"

6. **Products Cannot be Labeled Recyclable if they have a Component that Significantly Limits the Ability to Recycle the Item (260.12c,d)**
The FTC does not allow a product to be labeled "recyclable" if it contains a non-incidental component that "limits the ability to recycle the item." As described in Section 10, full body shrink sleeves on plastic containers often make the product not sortable in a MRF or non-recyclable by plastics reprocessors.

The FTC Green Guides make no allowance for requiring customers to cut off labels or separate major components of an item.

> (c) Marketers can make unqualified recyclable claims for a product or package if the entire product or package, excluding minor incidental components, is recyclable. For items that are partially made of recyclable components, marketers should clearly and prominently qualify the recyclable claim to avoid deception about which portions are recyclable.
> (d) If any component significantly limits the ability to recycle the item, any recyclable claim would be deceptive. An item that is made from recyclable material, but, because of its shape, size, or some other attribute, is not accepted in recycling programs, should not be marketed as recyclable.[48]

Figure 5. FTC Green Guides 16 CFR 260.12c,d

7. **Incineration is Not Recycling (260.12d)**
   In an example, the FTC states: "A container can be burned in incinerator facilities to produce heat and power. It cannot, however, be recycled into another product or package. Any claim that the container is recyclable would be deceptive."

   The FTC Green Guides make no allowance for collecting a waste as a "recyclable" material when the end fate of the material is destruction through burning (e.g. via sales to a cement kiln to burn for energy) or combustion (e.g. via pyrolysis to fuel that will then be combusted in vehicles).

8. **FTC Requires the Collected Items Be Recycled**
   In the FTC Green Guides Statement of Basis and Purpose section titled "Packages Collected for Public Policy Reasons but Not Recycled," the FTC states: "The Commission agrees that unqualified recyclable claims for categories of products that municipal recycling programs collect, but do not actually recycle, may be deceptive. To make a non-deceptive unqualified claim, a marketer should substantiate that a substantial majority of consumers or communities have access to facilities that will actually recycle, not accept and ultimately discard, the product. As part of this analysis, a marketer should not assume that consumers or communities have access to a particular recycling program merely because the program will accept a product." [89]

   This FTC requirement puts the burden of proof on product companies to substantiate that MRFs that are accepting their recyclable-labeled products are selling plastic bales to reprocessors that are verifiably recycling the plastic bales into resin for manufacturing into new products.

6.2 Deceptive Recyclable Claim Case: Keurig Plastic Coffee Pods

In September 2018, a class action lawsuit was filed by an individual consumer in California against Keurig Green Mountain, Inc., ("Keurig") over recyclability claims and labels on their single use beverage plastic pod products.[90] As shown in Figure 6, the plaintiff alleged that Keurig's "recyclable" single-serve plastic coffee pods were mislabeled as such because they are not in fact recyclable, due to their size, composition, and the lack of a market to reuse the pods.

> 2. This Complaint seeks to remedy Defendants' unlawful, unfair and deceptive business practices with respect to the advertising, marketing and sales of plastic single serve pods that contain coffee and that are labeled as "recyclable" (the "Products").1 The Products are advertised, marketed and sold as recyclable. However, even if consumers take the many steps required to place the Products in their recycling bins, they are not in fact recyclable because most municipal recycling facilities are not properly equipped to capture such small materials. Furthermore, even where such facilities exist that are capable of segregating the Products from the general waste stream, the Products usually still end up in landfills anyway as there is no market to recycle the Products.

Figure 6 – Deceptive Complaint in Smith vs. Keurig Class Action Lawsuit (September 28, 2018)[91]

In June 2019, the District Court denied Keurig's motion to dismiss the case.[92] Table 3 summarizes the key points in the District Court's decision and relevance to general issues of product labeling. In October 2019, the case moved to Discovery phase.[93]

Table 3: Key Points in the District Court's decision[94]

U.S. Federal District Court Ruling	Relevance to Product Labeling
III.A.2 Plaintiff does not allege that she was injured by her inability to recycle the Pods, but rather that she suffered economic injury due to Defendant's mislabeling because she paid more than she would have paid had she known the Pods were not recyclable. The complaint here adequately alleges both materiality and that the **mislabeling altered Plaintiff's course of action**.	This judgement indicates that (1) labels on products affect consumer purchasing decisions and (2) incorrect labels can cause economic injury.
III.A.1: The complaint alleges that the disputed Pods are not recyclable at any MRF. If that is true, a "check locally" disclaimer could be misleading, as the disclaimer would falsely lead customers to believe that there was any point in "checking locally."	This judgement indicates that it is deceptive to instruct consumers to "check locally" if the consumer cannot determine if a plastic item will actually be recycled after collection by a MRF.
III.A.3: Keurig wrongly assumes that Plaintiff's injury is merely the inability to recycle. However, Plaintiff's alleged injury is not that she was unable to recycle the Pods, but instead that she was misled to believe they were recyclable due to Defendant's mislabeling.	This judgement indicates that the harm to consumers is in labeling of product and the fault resides with the product manufacturer. The inability to recycle a product is not the fault of the municipal collection/sortation system or plastic recycler/reprocessors.
III.B: The Green Guides state that if a product is rendered non-recyclable because of its size or components—even if the product's composite materials are recyclable—then labeling the product as recyclable would constitute deceptive marketing. See id. § 260.12(d).	This judgement indicates support for deceptive claims against bottles with full body shrink sleeve labels that prevent sortation or harm plastic recycling/reprocessing equipment.
III.B: Defendant further contends that it would be unduly burdensome to require Keurig to constantly monitor the number of MRFs at which the Pods are recyclable and revise its labeling accordingly.	This argument by Keurig shows lack of commitment to improving the recyclability of their products or reducing contamination in America's recycling system.

7. Survey of Plastic Waste Collection/ Sortation and Reprocessing: Technical Approach and Detailed Results

To meet the "recyclable" label threshold required by the FTC Green Guides, Americans must have access to both collection/sortation *and* recycling/reprocessing of a specific item into plastic resin that could be used to manufacture another item. In this comprehensive survey, both types of facilities were assessed:

1. **Collection and sortation (MRF) facilities:** The 367 operating U.S. residential MRFs were surveyed for their posted lists of specific types of plastic products that are accepted in their curbside recycling bins. (Details provided in Section 7.1 - Survey of U.S. Material Recovery Facilities)[95]
2. **Plastic reprocessing facilities** that turn the collected/ sorted material into plastic resin were surveyed for total U.S. processing capacity of specific types of post-consumer plastics. (Details provided in Section 7.2 - Survey of U.S. Recycling/Reprocessing Capacity for Post-Consumer Plastic Waste)

It is insufficient for Americans to have access to collection/ sortation of an item if there is insufficient recycling/ reprocessing capacity to produce resin to manufacture/ assemble a new item from the material. Similarly, if there is sufficient reprocessing capacity but insufficient collection/ sortation facilities and operations, then an item may not reasonably be considered recyclable.

The policies of two U.S. major recycling industry associations, Institute of Scrap Recycling Industries (ISRI) and the Association of Plastic Recyclers (APR), agree with the position that collection alone is not recycling. According to an article in ISRI's Scrap magazine, "ISRI has long held that for a product to be recyclable, it must be both technologically and economically feasible to recycle." In the same article, APR's President stated, "There must be consumer access to a recycling program, a recycler must be able to process the material, and there must be an end market."[96]

7.1 Survey of U.S. Material Recovery Facilities

7.1.1 SURVEY METHODOLOGY AND PUBLIC TRANSPARENCY

A comprehensive, objective survey of acceptance of plastic items at U.S. Residential MRFs for curbside recycling was performed from October to December 2019 and reverified in January 2020. The survey was performed and verified by technically qualified volunteers of The Last Beach Cleanup:[97] two registered professional chemical engineers and a recycling industry expert. The technical experts involved have no conflicts of interest related to legitimate recyclable labels for plastic products that would influence the assessment or results. The acceptance information was found in the public

domain and is publicly shared to promote transparency and establish a traceable account of facts related to plastic "recyclable" claims and labels. The details of the survey were captured in a spreadsheet that is publicly available for downloading on The Last Beach Cleanup website. A copy of the 2020 U.S. MRF Survey spreadsheet version (dated Februrary 9, 2020) that was the basis for the metrics stated in this report is provided in Attachment 1 to this document.

MRF Survey Basis and Verification: A comprehensive listing of "Commingled Residential MRFs" was published by The Recycling Partnership in the public domain on their website in Fall 2019.[98] The map provided the names and locations of approximately 370 MRFs in the U.S. The Recycling Partnership attributed the data to Resource Recycling, a news source in the U.S. recycling industry.[99] The information in the Recycling Partnership MRF map was manually extracted and compiled into the 2020 U.S. MRF Survey spreadsheet. The operational status of each MRF was verified through public domain searches. Approximately 17 MRF sites were found to be incorrect because they were duplicate listings, no longer in operation or no longer Residential MRFs. An additional 15 operating MRFs were identified through review of waste/recycle company websites and other information. A list of corrections was submitted to The Recycling Partnership on January 23, 2020 with a suggestion that their map be updated. The final count of operating U.S. MRFs surveyed was 367. Links to MRF information were captured on the 2020 U.S. MRF Survey spreadsheet. Links to videos about the MRFs were captured when found.

Survey of Plastic Item Acceptance: A "MRFshed" approach was employed to survey the acceptance of plastic items by Americans who have access to curbside recycling. A MRFshed is defined "as a group of communities that funnel material into the same materials recycling facility (MRF)."[100] Through web searches, each MRF was investigated for the public disclosure of items accepted for curbside recycling. About one-third of the MRFs provided information on acceptance of plastic items at their facility. When MRF acceptance information was not found, a search of websites of a local city or county that directs recycling to a specific MRF was performed. If information could not be found for the specific MRF or local municipality, recycling guidance provided by the MRF owner (e.g. Republic Services' Recycling Simplified[101] guidelines to customers) was captured. The acceptance guidance provided by MRFs and local municipal governments ranged from complicated "wizard" search tools to easily understandable text and photos. Where there was inconsistency between text and photo guidance, all items listed or shown were considered accepted. This approach was intentionally conservative to avoid bias.

Evidence of Disposal of Collected Plastic Materials
News and internet searches were performed to document evidence of disposal to landfill or incineration of collected plastic materials. The information provided by Waste Dive in the "How recycling is changing in all 50 states" website was reviewed.[102] A summary of the evidence found is given in Table 8 and links are also provided in the 2020 U.S. MRF Survey spreadsheet.

Evidence of Export of Collected Plastic Materials to Countries with Poor Waste Management
News and internet searches were performed to document evidence of export of plastic waste to countries that are not equipped to safely and securely recycle post-consumer plastic waste. An analysis of the U.S. Census Bureau database of plastic waste exports was performed to quantify the amount of plastic waste shipped by each state in 2019 (through November) to countries with poor waste management.[103] A summary of the evidence found is given in Table 9 and links are also provided in the 2020 U.S. MRF Survey spreadsheet.

Survey of Largest U.S. Material Recovery Facilities
In addition to the comprehensive survey of all 367 operating U.S. Residential MRFs, the 65 largest U.S. MRFs[104] were analyzed to ensure that there wasn't a bias in the results based on population access and mass throughput capacity of the facilities. The acceptance rates by the largest 65 MRFs were found to be in alignment in acceptance rates of all 367 U.S. MRFs. Since the largest MRFs are typically better funded than most MRFs and able to invest in expensive advanced sortation, the largest MRFs accepted slightly more types of plastics.

Customer "Check Locally" Enquiries to MRFs
Researchers and interested stakeholders involved in the 2020 U.S. MRF Survey found that they were customers of MRFs that accepted plastics #3-7 in their recycling bins. The researchers and stakeholders called five MRFs and enquired, as legitimate customers, about the destination and final fate of their plastics #3-7 and non-bottle plastics #1-2 if they put them in the recycle bin. The MRF representatives could not provide credible information to their customers on where, how or if the non-bottle plastics were actually recycled. While this was a selected sampling, it indicates that few MRFs that accept low value plastics #3-7 can credibly inform customers, who are attempting to "check locally" whether the collected plastics will be processed into new products.

Use of the Survey: The 2020 U.S. MRF Survey results may be quoted with attribution to Greenpeace. The information in the Survey spreadsheet may be quoted with attribution to the original source of the information (provided by links in the spreadsheet). The spreadsheet itself is the intellectual property of The Last Beach Cleanup and may not be reproduced without express written consent.

Table 4: Plastic Items: Acceptance for Municipal Collection by U.S. MRFs & Evidence of Disposal or Export to Countries with Poor Waste Management

Plastic Item	Acceptance at U.S. MRFs (367 Total)	Acceptance at Largest 65 U.S. MRFs (65 Total)	Non-Bottle Plastics: Acceptance by MRFs with Evidence of Disposal or Export of Collected Mixed Plastics
PET #1 Bottles & Jugs	366 (100%)	65 (100%)	
HDPE #2 Bottles & Jugs	367 (100%)	65 (100%)	
PP #5 Tubs	196 (53%)	37 (57%)	192 of 196
Plastic Clamshells	51 (14%)	8 (12%)	51 of 51
Plastic Cups	41 (11%)	9 (14%)	41 of 41
Plastic Trays	25 (7%)	6 (9%)	25 of 25
Plastic Bags	13 (4%)	2 (3%)	13 of 13
Styrofoam Food Service	10 (3%)	0 (0%)	10 of 10
Plastic Lids & Caps (Loose)	11 (3%)	6 (9%)	11 of 11
Plastic Plates	4 (1%)	1 (2%)	4 of 4
Plastic Cutlery, Straws & Stirrers	2 (1%)	0 (0%)	2 of 2
Plastic Food Wrappers & Pouches	1 (0%)	1 (2%)	Pilot MRF Program Only[105]
PP #5 or PS #6 Coffee Pods	0 (0%)	0 (0%)	Not accepted by MRFs

Survey Updates: Submissions by MRFs and local governments are welcomed to update or correct the information found and presented. Links to publicly available information are required to revise the traceable account. Since external links may change at any time, we request notification of a broken link. Please send updates with links to lastbeachcleanup@gmail.com.

7.1.2 2020 U.S. MRF SURVEY RESULTS

Table 4 summarizes the acceptance of plastic items by municipal MRF collection and corresponding evidence of disposal or export of plastic waste by MRFs. MRFs that still accept non-bottle plastics may be disposing or exporting the collected low-value mixed plastic waste.

7.2 Survey of U.S. Recycling/Reprocessing Capacity for Post-Consumer Plastic Waste

Material recycling/reprocessing facilities that process the collected/sorted material into plastic resin for use in manufacturing or assembling another item are required to be "established" by the FTC for an item to be labeled as recyclable. Since export markets are closing and do not provide sufficient assurance of recycling, sufficient domestic recycling/reprocessing capacity must exist for the plastic material collected by the MRFs to be recycled. The plastics industry publishes limited information on the capacity of U.S. plastic recyclers/reprocessors for specific types of post-consumer plastic waste. Estimates of U.S. domestic post-consumer plastic recycling/reprocessing capacity are made to determine if sufficient capacity exists to assure customers that a plastic product has a sufficient likelihood of actually being recycled into a new product if it is accepted by a MRF. The estimates are summarized in Table 5 and detailed in Sections 7.2.1 - 7.2.7.

Table 5: Summary of Estimates of Current 2020 U.S. Recycling/Reprocessing Capacity for Post-Consumer Plastic Waste

Plastic Type	Estimate of Current U.S. Recycling/Reprocessing for Post-Consumer Plastic Waste
#1 PET	22.5%
#2 HDPE	12%
#3 PVC	Negligible
#4 LDPE/LLDPE	Less than 5%
#5 PP	Less than 5%
#6 PS	Less than 1%
#7 Other	Negligible

7.2.1 USEPA 2017 PLASTIC RECYCLING RATES

Recycling rates for plastic items provide a basic indication of recycling capacity because production rates are a portion of production capacity. The most recent USEPA recycling rates (2017) for U.S. post-consumer plastics are summarized in Table 6.[106] The "recycled" material includes a significant amount of exported material. In 2017, 931 million kg of plastic waste was still sent to China and Hong Kong.[107] Since China's National Sword restrictions began on January 1, 2018, current 2019-2020 recycle rates are estimated to be lower, particularly for plastics #3-7, due to the significant decrease in plastic waste exports.[108] Nevertheless, the 2017 data provides an order-of-magnitude indication of U.S. reprocessing capacity.

Table 6: 2017 U.S. EPA Facts and Figures about Materials, Waste and Recycling[109]

USEPA 2017 Solid Waste Data	Total Post-Consumer Plastic Waste (Thousand Tons)				Total Plastics in Containers & Packaging (C&P) (Thousand Tons)			
Resin Type	Total Plastic Waste	% by Resin Type	Total Recycled	Total % Recycled	C&P Plastic Waste	% by Resin Type	C&P Recycled	C&P % Recycled
#1 PET	5,010	14%	910	18.2%	3,650	25%	910	24.9%
#2 HDPE	6,150	17%	580	9.4%	3,740	26%	580	15.5%
#3 PVC	960	3%	Negligible	0.0%	430	3%	Negligible	0.0%
#4 LDPE/LLDPE	8,080	23%	340	4.2%	3,880	27%	340	8.8%
#5 PP	8,000	23%	50	0.6%	1,840	13%	50	2.7%
#6 PS	2,350	7%	10	0.4%	570	4%	10	1.8%
#7 PLA	90	0%	Negligible	0.0%	20	0%	Negligible	0.0%
Other resins	4,730	13%	1,070	22.6%	360	2%	Negligible	0.0%
Total Plastics	35,370	100%	2,960	8.4%	14,490	100%	1,890	13.0%

7.2.2 2020 U.S. DOMESTIC REPROCESSING CAPACITY FOR POST-CONSUMER POLYETHYLENE TEREPHTHALATE (PET) PLASTIC #1 WASTE

Available data indicates that the current U.S. domestic reprocessing capacity for post-consumer PET plastic waste is approximately 22.5% of the total post-consumer PET plastic waste generated. This estimate is supported by the 18.2% recycling rate reported by the USEPA in 2017 and other evidence. Therefore, there is **sufficient likelihood** that post-consumer PET waste collected by MRFs is recycled/reprocessed into plastic resin for manufacturing of new products in the U.S. It is reasonable for U.S. consumers to believe that PET bottles and jugs that are collected by municipal systems will be recycled/reprocessed into a new product.

Evidence supporting this estimate:

1. The National Association for PET Container Resources (NAPCOR) reported that at the end of 2017 there were 22 PET recycling/reprocessing plants operating in the U.S. with total annual nameplate capacity of 2,255 million pounds capacity.[110]
2. As shown in Table 6, the U.S. produced 5.01 million tons (10 billion lbs) of PET waste in 2017. Therefore, existing U.S. domestic capacity for recycling/reprocessing PET waste is estimated to be about 22.5%.

7.2.3 U.S. DOMESTIC REPROCESSING CAPACITY FOR POST-CONSUMER HIGH DENSITY POLYETHYLENE (HDPE) PLASTIC #2 WASTE

Available data indicates that the current U.S. domestic reprocessing capacity for post-consumer HDPE plastic waste is approximately 12% of the total post-consumer HDPE plastic waste generated. This estimate is supported by the 9.4% recycling rate reported by the USEPA in 2017 and other evidence. Therefore, there is **moderate likelihood** that post-consumer HDPE waste collected by MRFs is recycled/reprocessed into plastic resin for manufacturing of new products in the U.S. It is reasonable for U.S. consumers to believe that HPDE bottles and jugs that are collected by municipal systems will be recycled/reprocessed into a new product.

Evidence supporting this estimate:

1. The Association of Plastics Recyclers (APR) reported the total U.S. HDPE postconsumer reclamation capacity was 1,418 million pounds with 25 recycling/reprocessing plants operating in the U.S.[111]
2. As shown in Table 3, the U.S. produced 6.15 million tons (12.3 billion lbs) of HDPE waste in 2017. Therefore, existing capacity U.S. domestic capacity for recycling/reprocessing HDPE waste is estimated to be about 12%.

7.2.4 U.S. DOMESTIC REPROCESSING CAPACITY FOR POST-CONSUMER HIGH POLYVINYL CHLORIDE (PVC) PLASTIC #3 WASTE

The USEPA data in Table 6 indicates that the current U.S. domestic reprocessing capacity for post-consumer PVC plastic waste is negligible. When it is accepted by a MRF, plastic #3 is typically collected as part of a mixed plastics #3-7 bale. There is negligible value for mixed plastic #3-7 bales across the country and the collected mixed plastics are often disposed to landfills or destroyed by incineration. Therefore, there is **negligible likelihood** that post-consumer PVC waste collected by MRFs is recycled/reprocessed into plastic resin for manufacturing of new products in the U.S. It is not reasonable for U.S. consumers to believe that PVC products that are collected by municipal systems will be recycled/reprocessed into a new product.

7.2.5 U.S. DOMESTIC REPROCESSING CAPACITY FOR POST-CONSUMER LOW DENSITY POLYETHYLENE (LDPE) PLASTIC #4 WASTE

The USEPA data in Table 6 indicates that the current U.S. domestic reprocessing capacity for post-consumer LDPE plastic waste is less than 5%. When it is accepted by a MRF, plastic #4 is typically collected as part of a mixed plastics #3-7 bale. Therefore, there is **low likelihood** that post-consumer LDPE waste collected by MRFs is recycled/reprocessed into plastic resin for manufacturing of new products in the U.S. It is not reasonable for U.S. consumers to believe that LDPE products that are collected by municipal systems will be recycled/reprocessed into a new product.

7.2.6 U.S. DOMESTIC REPROCESSING CAPACITY FOR POST-CONSUMER POLYPROPYLENE #5 PLASTIC WASTE

Available data indicates that the current U.S. domestic reprocessing capacity for post-consumer polypropylene plastic waste is approximately 2-5% of the total post-consumer plastic waste generated. This conservative estimate is supported by the low (0.6%) recycling rate reported by the USEPA in 2017 and other evidence. When it is accepted by a MRF, plastic #5 is typically collected as part of a mixed plastics #3-7 bale. Therefore, there is **low likelihood** that post-consumer polypropylene waste collected by MRFs is recycled/reprocessed into plastic resin for manufacturing of new products in the U.S. It is not reasonable for U.S. consumers to believe that polypropylene products that are collected by municipal systems will be recycled/reprocessed into a new product.

Evidence supporting this estimate:

1. Polypropylene is reportedly "one of the least recycled post-consumer plastics, at a rate below 1 percent for post-consumer recovery."[112]
2. KW Plastics (Alabama) is reported to be the largest processor of U.S. post-consumer polypropylene plastic waste. According to Plastics News,[113] KW has extrusion capacity to reprocess 650 million pounds of plastics a year, split about evenly between polyethylene and polypropylene. Plastics News also reports that post-consumer plastics is 87% of KW Plastics reprocessing. Therefore, KW Plastics capacity for post-consumer polypropylene plastic waste is estimated to be about 283 million lbs. As shown in Table 6, the U.S. produced 8 million tons (16 billion lbs) of polypropylene waste in 2017. Therefore, KW Plastics has the capacity to process 1.8% of U.S. post-consumer plastic waste.
3. Assuming that KW Plastics processes about one half of post-consumer polypropylene plastic waste, the total current U.S. capacity to recycle/reprocess polypropylene plastic waste is estimated to be less than 5%.

7.2.7 U.S. DOMESTIC REPROCESSING CAPACITY FOR POST-CONSUMER POLYSTYRENE (PS) PLASTIC #6 WASTE

The USEPA data in Table 6 indicates that the current U.S. domestic reprocessing capacity for post-consumer polystyrene plastic waste is less than 1%. When it is accepted by a MRF, plastic #6 is typically collected as part of a mixed plastics #3-7 bale. Therefore, there is **low likelihood** that post-consumer polystyrene waste collected by MRFs is recycled/reprocessed into plastic resin for manufacturing of new products in the U.S. It is not reasonable for U.S. consumers to believe that polystyrene products that are collected by municipal systems will be recycled/reprocessed into a new product. As an example, the City of San Antonio still tells citizens to place polystyrene foam food containers in recycling bins even though the local MRF can't recycle it and views it as harmful contamination.[114]

7.2.7 U.S. DOMESTIC REPROCESSING CAPACITY FOR PLASTIC #7 WASTE

Plastic waste #7 includes multiple types of plastics "other" than plastics #1-6, including bio-based plastics such as polylactic acid (PLA) plastic. The USEPA data in Table 6 indicates that the current U.S. domestic reprocessing capacity for "other" plastic waste is negligible. When it is accepted by a MRF, plastic #7 is typically collected as part of a mixed plastics #3-7 bale. Therefore, there is **negligible likelihood** that post-consumer plastic #7 waste collected by MRFs is recycled/reprocessed into plastic resin for manufacturing of new products in the U.S. It is not reasonable for U.S. consumers to believe that plastic #7 products that are collected by municipal systems will be recycled/reprocessed into a new product.

7.3 Current U.S. Access to Municipal Collection and Sortation

To legitimately claim a product as "recyclable", the FTC requires that recycling facilities be available to a "substantial majority" of Americans, defined to be at least 60 percent. The FTC focuses on "community-based" recycling systems, rather than privately operated mail-back or retail store take-back programs, in determining recycling availability.

The SPC 2015/2016 Centralized Study on Availability of Recycling employed three levels of access to municipal collection to determine availability of recycling for plastic products: automatic curbside collection, opt-in or subscription curbside collection and drop-off collection centers.[115]

In the four years since the 2015/2016 study was performed, many U.S. communities have reduced or eliminated municipal recycling services offered to residents, as documented by Waste Dive's website "How recycling has changed in all 50 states."[116] Table 7 provides an updated estimation of Americans' access to collection services for recycling in 2020. The 2020 estimation basis is shown and described below the table.

Table 7: Access to Collection Services for Recycling: 2020 Update Estimation

American Population Access to Municipal Collection for Recycling	Total U.S. Population 2015/2016[117]	(A) Total U.S. Population Winter 2019/2020 (estimated)	Estimation Basis: Change from 2015	(B) PP#5 Tub Acceptance (Recycling Not Assured)	PP#5 Acceptance Basis	Total US PP#5 Tub Acceptance (A x B)
Automatic Curbside Collection	53%	50%	-5%	53%	2020 U.S. MRF Survey	27%
Opt-In/Subscription for Curbside Collection	20%	18%	-10%	10%	No value for plastics #3-7	1.8%
Drop Off Access to Collection	21%	19%	-10%	10%	No value for plastics #3-7	1.9%
No Access to Collection for Recycling	6%	13%		0%		69%
Total Access to Collection for Recycling (Collected materials may not actually be recycled)	94%	87%				31%

Automatic Access to Curbside Collection Systems:

Automatic access to curbside collection refers to collection provided at a residence or apartment complex as a part of municipal waste collection that is trucked to a MRF. The 2015/2016 SPC Report estimated that 53% of Americans had this type of access to recycling.[118] Due to the decline in commodity value and increase in service fees charged, the number of municipalities providing curbside collection has declined over the past four years.

For the purpose of this 2020 assessment, a decline of 5% in automatic access to curbside collection sites was estimated based on news reports from across the country.

Opt-In/Subscription Collection Systems:

According to SPC, "an opt-in program is one provided by a community or its contractor in which residents must sign up and, in some cases, pay an additional fee to participate in recycling" and 20% of Americans had access to this type of collection in 2015/2016.[119]

The number of opt-in/subscription service contracts has fallen over the past four years, as documented by Waste Dive's website "How recycling has changed in all 50 states."[120] Opt-in/subscription service contracts have dramatically risen in cost due to the decline of all materials commodity values.[121] For the purpose of this 2020 assessment, a decline of 10% in opt-in/subscription service contracts was estimated.

Opt-in/subscription collection systems are more selective on the items accepted than MRFs. Opt-in/subscription want valuable PET and HDPE bottles and jugs because they are most easily baled and sold to domestic buyers. For the purpose of this 2020 assessment, it was estimated that 10% of opt-in/subscription service contractors accept PP#5 tubs and containers to bale and sell to recyclers/reprocessors.

Drop Off Collection Systems:

According to SPC, "drop-off recycling refers to a program where residents bring recyclables to a collection point away from their residence" and 21% of Americans had access to this type of collection in 2015/2016. The number of drop-off collection sites has also fallen over the past few years. Drop-off collection sites are commonly located in rural areas, often run by volunteers and have struggled to survive due to the decline of all materials commodity values.[122] For the purpose of this 2020 assessment, a decline of 10% in drop-off collection sites was estimated.

Drop-off collection systems are more selective on the items accepted. Drop-off collection systems want valuable PET and HDPE bottles and jugs because they are most easily baled and sold to domestic buyers. For example, the two collection sites in Albany, Georgia, accept "only plastic soda bottles and clear milk jugs."[123] In Norman, Oklahoma acceptance policy was changed to plastic bottles and jugs only due to the lack of market demand for plastics #3-7.[124] In Thomas, West Virginia, the drop-off centers now do not accept any type of plastic.[125] For the purpose of this 2020 assessment, it was estimated that 10% of drop-off sites accepted PP#5 tubs and containers to sell to recyclers/reprocessors.

8. Evidence of Collected Plastic Disposal and Export to Countries with Poor Waste Management

Extensive evidence of collected plastics waste being disposed or exported to countries with poor waste management was found during the U.S. MRF Survey. This evidence shows that consumers cannot "Check Locally" to determine if an item accepted for collection by a MRF will be bought by a recycler/reprocessor to be manufactured into a new product.

The detailed survey of U.S. MRF's acceptance of plastic items revealed:

a. **Table 7:** While some MRFs still accept plastics #3-7 and non-bottle plastics #1 & 2, there is extensive evidence that collected plastics are being landfilled or incinerated due to lack of market demand.

b. **Table 8**: Some MRFs that accept plastics #3-7 and non-bottle plastics #1 & 2s are known to export plastic waste outside of North America to countries with poor waste management without verification that the plastic will actually be recycled into a new product.

While there is strong evidence that exported plastic wastes are not all recycled but are often dumped or burned in receiving countries, many U.S states continue to export plastic waste to countries with poor waste management.[126] Figure 7 shows the largest state exporters of plastic waste to countries with poor waste management in 2019.

Table 8: Evidence that Collected Plastic Waste is Not Recycled: Disposed, Incinerated or Stored

State	Material Recovery Facility (MRF)	Evidence of Collected Plastic Material Not Recycled (Sent to Landfill, Incinerated or Stored)
Nationwide	Waste Management MRFs	The nation's largest waste hauler and MRF operator, Waste Management, states that collected plastics that have no market demand will be responsibly disposed.[127]
Arizona	Tucson MRFs	Most Nogales recyclables end up in landfills.[128]
Arizona	Arizona MRFs	MRFs in Arizona are sending some collected materials to landfills.[129]
California	California MRFs	Collected plastic #3-7 is being sent to landfill.[130]
California	San Diego MRFs	City of San Diego does not tell citizens the destination of plastics #3-7.[131]
California	Los Angeles MRFs	Waste haulers in the RecycLA program are required to collect plastics that have no market value and cannot be recycled.[132]
California	ReThink Waste Shoreway MRF	MRF states that plastics #3-7 are collected and sent to landfills.[133]
California	Manhattan Beach	Per the City's current Franchise Agreement, the City's hauler is required to accept plastics #1-7 in the recycling container. However, actual market value of certain plastics and recycling feasibility is subject to change.[134]
California	California MRFs	Recyclables are being dumped to landfill.[135]
Colorado	Colorado MRFs	Waste Management is stockpiling plastics #3-7 because there are no buyers.[136]
Connecticut	Willimantic MRF	Recyclables that are not bought or are contaminated are sent to an incinerator.[137]
Florida	City of Clearwater MRF	Collected recyclables were trucked to nearby incinerator instead of being recycled.[138]
Florida	MARPAN MRF	Marpan states that they send non-recyclable items to landfill.[139]
Florida	Florida MRFs	Materials collected for recycling that have no markets are landfilled.[140]
Florida	Lee County MRF	MRF is co-located with an incinerator.[141]
Florida	Palm Beach MRF	MRF is co-located with an incinerator. MRF sent collected plastics to incinerator.[142]
Georgia	Athens Clarke County MRF	Atlanta MRF expert says a lot of plastic cannot be recycled in U.S. and is landfilled.[143]
Georgia	Athens-Clarke County	Plastics #3-7 is sold to Greenmine Inc who has declared bankruptcy.[144,145]
Georgia, South Carolina, Tennessee, Texas	Pratt MRFs	Pratt Industries operates its own waste-to-energy plant. Unrecyclable residues are sent to the plant.[146]
Idaho & Utah	Idaho & Utah MRFs	Plastics #3-5 landfilled due to lack of buyers.[147]
Iowa	Cedar Rapids MRF	Mixed rigid plastics are now landfilled.[148]
Illinois	Keep North Illinois Beautiful Collection	Stockpiled over 400,000 tons of plastics due to lack of buyers.[149]

State	Material Recovery Facility (MRF)	Evidence of Collected Plastic Material Not Recycled (Sent to Landfill, Incinerated or Stored)
Indiana	Tri-State MRF	Plastics #3-7 have had to be sent to landfill due to lack of buyers.[150]
Maryland	Maryland MRFs	The bulk of collected plastic waste is sent to incineration.[151]
Massachusetts	Massachusetts MRFs	Some of Massachusetts collected recyclables are landfilled.[152]
Massachusetts	Zero Waste Solutions MRF	Low value plastic waste is planned to be burned.[153] Facility is storing collected material.[154]
Michigan	American Waste Traverse City	"Inferior plastics" are shredded and burned as a coal additive.[155]
Minnesota	Polk County MRF	Polk County MRF is co-located with an incinerator.[156]
Missouri	City of Columbia MRF	Plastics #3-7 are often sold at zero or negative values. "Even so, it's hard to find a buyer for these materials. Right now, there are about 30 tons of plastics outside of the facility waiting to be shipped".[157]
Nebraska	FirstStar Recycling MRF	FirstStar participates in the Hefty Energy Bag program that collects and burns plastic waste.[158]
Nevada	Republic Services	Collected plastics #3,4,6 & 7 are sent to landfill.[159]
New Jersey	Atlantic Coast Recycling	Recycled material is headed to landfills because there is no place willing to take it. Atlantic Coast Recycling stated that 10 to 25% of its collected material is now being recycled.[160]
New Mexico	Friedman Recycling	More collected material is deemed unrecyclable and disposed to landfill.[161]
New York	New York State MRFs	Mixed plastics #3-7 reportedly heading for landfill in state due to lack of buyers.[162]
North Carolina	North Carolina MRFs	In violation of contract, materials collected for recycling were shipped to Portsmouth, VA instead of being recycled.[163]
Ohio	Athens-Hocking MRF	AHRC is sending unwanted plastics to landfill.[164]
Ohio	Cleveland MRF	Cleveland recyclables have been sent to landfill.[165]
Ohio	Ohio MRFs	Recycler is sending collected plastic to landfill.[166]
Pennsylvania	Pennsylvania MRFs	Plastics with no local buyers are sent to landfill.[167]
South Carolina	North Augusta MRF	Collected materials that are not bought for recycling are sent to landfill.[168]
South Carolina	Pratt MRF	Collected plastics #3-7 being sent to landfill.[169]
Tennessee	Memphis MRF	"Tons of Memphis recyclables being sent to the dump."[170]
Texas	Texas MRFs	Collected materials without local markets going to landfill.[171]
Texas	Pratt Industries Denton MRF	MRF told city officials that plastics #3-7 have always been hard to shop to recycling companies. They called the city in March 2019 to say items like spray bottles, condiment squeeze bottles, yogurt tubs, reusable plastic keepers and plastic cups and plates were going to the landfill instead of being recycled.[172]
Utah	Salt Lake City MRF	Plastic waste collected through recycling systems is being burned in cement kilns and is not recycled.[173]
Utah	Utah MRFs	As much as 50 percent of what Draper residents think is being recycled actually ends up in the dump.[174]
Utah	Utah MRFs	Plastic scrap stockpiles reportedly growing in Utah.[175]
Utah	Utah MRFs	50% of collected materials going to landfill. Recommendation to collect plastic bottles & jugs only.[176]
Vermont	Vermont MRFs	Portion of plastics #3-7 cannot be recycled.[177]
Virginia	Portsmouth MRF	Plastic waste collected for recycling sent to incineration.[178]
Washington	Washington MRF	WA State Department of Ecology stated that plastics are piling up or being sent to landfill.[179]
Wisconsin	Wisconsin MRFs	The Wisconsin DNR has confirmed to stakeholders that mixed plastics (#3-7) can legally be disposed, even if the material has been sorted and baled.[180]
Wisconsin	Green Circle Recycling MRF	Unsellable plastic waste is sent to waste-to-energy plant.[181]
Wyoming	Wyoming Residents	Waste Management is stockpiling plastics #3-7 because there are no buyers.[182]

Table 9: Evidence that Collected Plastic is Exported Outside of North America to Countries with Poor Waste Management

State	Material Recovery Facility (MRF)	Evidence of Plastic Waste Exports Without Proof of Recycling
Arkansas	Marck Recycling	Marck Recycling website: Brokerage Services – "We utilize our connections with domestic and international mills to broker recyclable commodities for large manufacturers, city recycling centers and other facilities."[183]
Arizona, Colorado, New Mexico	Friedman Recycling	Friedman Recycling exports collected materials to Southeast Asia.[184,185]
Arizona	Tucson MRFs	Tucson is still selling most of its plastic, glass and paper overseas — to Taiwan, Indonesia, India and still some to China.[186]
California	California MRFs	California MRFs export collected plastic materials to Southeast Asia.[187]
California	Allan Company MRFs	Companies like Allan Company look "anywhere else in the world" to ship collected materials, including Vietnam, Indonesia, other parts of Asia."[188]
California	Burrtec MRFs	Burrtec exports collected materials to international markets.[189]
California	Caglia MRF	Caglia exports collected materials to worldwide markets.[190]
California	Cal Waste Recovery Systems MRFs	Cal-Waste Recovery Systems has brokers looking for new markets, like Mexico, Vietnam and wherever it can ship.[191]
California	EDCO MRFs	EDCO exports collected materials to Asian countries.[192]
California	Green Waste Recovery MRF	Green Waste exports plastic waste to Asian countries.[193]
California	Monterey Peninsula MRFs	Monterey Peninsula MRFs are exporting collected materials to countries such as Taiwan, Thailand, Indonesia and Vietnam.[194]
California	Potential Industries MRF	Potential Industries exports collected materials around the world, including to Asia.[195]
California, Washington	Recology MRFs	Recology exports 42% of collected materials, including plastics.[196]
California	Tri-CED Community Recycling	Tri-CED is exporting materials to Pakistan, Indonesia, India and Vietnam.[197]
California	Westrock MRFs	Westrock operates an international brokerage for collected materials.[198]
Colorado	GFL Alpine Recycling	Alpine exports materials to Asia.[199]
Connecticut	City Carting and Recycling	Company's video states that they export collected materials around the world.[200]
Connecticut	Oak Ridge MRFs	Oak Ridge exports to "whichever markets will take it."[201]
Georgia	Westrock MRFs	Westrock is a plastic waste exporter for materials they collect and broker for waste exports for other companies.[202]
Iowa	Mid America MRF	Mid America states that ship plastic wastes to both domestic and international recyclers.[203]
Illinois	Midwest Fibers MRF	Midwest Fibers exports collected materials to India and Vietnam.[204]
Illinois	Resource Management Companies MRFs	RMC exports collected materials to Asia. RMC is a major export broker.[205]
Massachusetts	E.L. Harvey MRF	E.L. Harvey exports some plastics overseas.[206]
Massachusetts	Green Works MRF	Green Works exports collected materials overseas.[207]
Massachusetts	Zero Waste Solutions MRF	Material will reportedly be sold to Thailand, Pakistan, India, Vietnam, Indonesia, Turkey and China.[208]
Maryland	Montgomery County MRF	Montgomery County exports collected materials to India.[209]
Michigan	RRRASOC MRF	Plastic materials are exported to Asia.[210]
Missouri	WCA MRF	WCA exports 30% of collected materials outside of the U.S.[211]
New Jersey	Bayshore MRF	Bayshore MRF serves the "global recycling market."[212]
New Jersey	Cape May MRF	Cape May MRF exports collected materials to Thailand and Vietnam.[213]
North Carolina	American Recycling of Western North Carolina MRF	MRF exports collected materials to international markets.[214]
North Carolina, South Carolina	Sonoco MRFs	Sonoco exports collected materials "to countries all over the world."[215]

State	Material Recovery Facility (MRF)	Evidence of Plastic Waste Exports Without Proof of Recycling
New York	New York City MRFs	The Guardian reports that the final destination of some NYC collected recyclables is Asia or India.[216]
New York	County Waste MRF	Facility is exporting collected materials to Asia.[217]
New York	Rockland County MRF	Rockland County exports collected materials to India.[218]
Rhode Island	RIRRC MRF	RIRRC MRF exports collected materials around the world.[219]
Washington	Seattle MRFs	City representative stated that 60% of Seattle's plastic waste is exported overseas.[220]
Washington	Pioneer Recycling MRF	Pioneer Recycling Services sells collected materials to the global market.[221]



Figure 7: Largest state exporters of plastic waste to countries with poor waste management in 2019[221]

9. Evidence of Negligible Value of Plastic #3-7 Waste

The financial value of collected plastic waste drives a MRF to decide whether to accept it for collection in municipal systems. According to industry website recyclemoreplastic.org, the nationwide value of plastic "3-7 Bottles and Other Small Rigid Plastic" was $0.003 per pound in December 2019.[223] This negligible value is an insufficient economic driver for MRFs to collect and sort this type of plastic. RecyclingMarkets.net reports negative values of commingled plastics #3-7 in several regions of the country in January 2020, including the Pacific Northwest, Southwest and Southeast U.S.[224] When materials have negative value, the MRF must pay for the bales to be taken away.

Table 10 summarizes evidence of negligible value of plastics #3-7 and non-bottles plastics #1-2 found across the country.

Table 10: Evidence of Negligible Value of Plastics #3-7 and Non-Bottle Plastics #1-2

State	Evidence of Negligible Value of Plastics #3-7 and Non-Bottle Plastics #1-2
Arkansas	The Baxter Bulletin reported that plastic #1 & 2 containers are the only plastics with sufficient value to be viably recycled.[225]
Arizona, Colorado, New Mexico	Friedman Recycling stated that there was not a viable market for plastics #3-7.[226]
Arizona	Norton Environmental is only collecting plastic #1 & 2 bottles, jugs and jars because there are no buyers for other types of plastics.[227]
California	Low value, mixed plastics are extremely hard to recycle.[228]
California	Gold Coast Recycling only accepts plastic bottles & large rigid plastics. The MRF states: "If there aren't buyers for certain types of low-quality plastics, then they cannot be recycled."[229]
California	Sacramento stops accepting plastics #4-7 due to lack of value and difficulty of recycling.[230]
Colorado	Angel of Shavano Recycling stops accepting plastics #3-7 due to lack of buyers.[231]
Connecticut	Recycling plastics is a money loser.[232]
Illinois	No market for plastics #3-7 in southern Illinois.[233]
Kansas	No market for plastics #3-7 in Kansas.[234]
Maine	Only plastic #2 accepted. No market for plastics 1, #3-7 in Maine.[235]
Maryland	Mixed plastics is effectively worthless and the WM MRF plant pays subcontractors to haul it away.[236]
Michigan	State of Michigan states that plastics #3-7 are difficult to recycle.[237]
Michigan	Michigan recycler states that "Markets have collapsed." Cites plastics #3-7 as recyclables that don't have domestic buyers.[238]
Missouri	Plastics #3-7 are often sold at zero or negative values. "Even so, it's hard to find a buyer for these materials."[239]
New Hampshire	No market for plastics.[240]
Nebraska	Nebraska Recycling Council recommends that MRFs eliminate plastics #3-7 due to lack of markets.[241]
New Jersey	Atlantic County, NJ not accepting plastics #3-7 due to lack of market.[242]
New Jersey	There are no local markets for plastics #3-7 in New Jersey.[243]
North Carolina	NC Department of Environmental Quality states that mixed plastic #3-7 bale is worth $0.00 to $0.01 per pound in the state.[244]
North Carolina	Plastics #3-7 have a negative value. "You have to pay to get rid of them."[245]
Oklahoma	Oklahoma Department of Environmental Quality states that all plastic wastes have no value.[246]
Oregon	Oregon Refuse and Recycling Association recommend that only plastic #1-2 bottles & jugs be collected. They recommend that plastics #3-7 not be collected.[247]
Pennsylvania	PA recyclers cannot find domestic buyers for plastics #3-7 and are eliminating them.[248]
Utah	No buyers for mixed plastics #3-7 in Utah.[249]
Virginia	Plastics #3-7 are no longer accepted because there are no buyers.[250]
Washington	WA State Department of Ecology recommends collection of only plastic bottles & jugs #1 & 2 due to lack of markets and contamination.[251]
Wisconsin	Due to lack of markets, the Wisconsin DNR has confirmed to stakeholders that mixed plastics (#3-7) can legally be disposed, even if the material has been sorted and baled.[252]

10. Evidence of Shrink Sleeves and Deceptive Labeling

Many product companies are increasingly using full body shrink sleeve labels on plastic bottles to improve shelf appeal and increase sales. Commonly used polyethylene terephthalate glycol (PETG) and polyvinyl chloride (PVC) shrink sleeves are known to prevent proper sortation of the bottles in MRFs and harm operations of PET bottle recyclers/reprocessors.[253] Yet product companies continue to employ these types of shrink sleeves. The product companies are evidently aware that the shrink sleeves they use prohibit proper sortation and harm recycling of the plastic bottles because they place instructions on the bottles telling consumers to remove the shrink sleeves. One example is provided in Figure 8.



Figure 8: Expanded Image of Full Body Shrink Sleeve Label on HDPE #2 Bottle

This labeling practice is not compliant with the FTC Green Guides and is deceptive in two ways:

1. **The FTC requires that components of a product cannot limit the recyclability of the product**. FTC Green Guides 16 CFR 260.12d states: "If any component significantly limits the ability to recycle the item, any recyclable claim would be deceptive. An item that is made from recyclable material, but, because of its shape, size, or some other attribute, is not accepted in recycling programs, should not be marketed as recyclable."[254]
2. **The FTC Green Guides does not allow for a company to instruct a consumer to remove an integral component to make a product recyclable**.

To become compliant with FTC Green Guides requirements, product companies must change to labels that do not harm sortation and plastic recycling/reprocessing and do not require removal by customers. Alternative, non-harmful labels are commercially available.[255]

10.1 Harms Caused by Full Body Shrink Sleeves

Several types of full body shrink sleeves on PET #1 and HDPE #2 bottles make them not sortable by optical scanners at MRFs. When the bottles are not correctly sorted, they may contaminate another material stream or be lost to the waste "residuals" stream.

PETG and PVC shrink sleeves are harmful to PET bottle recyclers because the PETG and PVC shrink sleeves cannot be separated in mechanical recycling water "sink-float" tanks. PETG and PVC materials have a specific gravity greater than one, so they sink along with PET (1.38 sp. gr.) in the tank. But the PETG and PVC labels have a lower melting point than PET. When the combined flake mixture is melted to form resin, the PETG or PVC melts first, causes clumps and harms PET drying equipment. Experts report that shrink sleeve labels can also bleed ink into wash water and stain flakes, reducing the quality of the recycled plastic.[256] Mechanical de-labelers are expensive and not effective. The PETG and PVC shrink sleeve label contamination causes material yield loss. In the 2018 United States National Postconsumer Plastic Bottle Recycling Report, sleeve labels on PET bottles were identified as a cause of poor bale yields.[257]

10.2 Recycling and Retail Industry Design Guidelines

Use of full body shrink sleeves is prohibited in the Design® Guides published by the Association of Plastic Recyclers (APR) and Walmart for recyclable plastic products. APR and other recycling organizations have clearly communicated to product designers that certain types of full body shrink sleeves should not be employed on products, yet many companies ignore the guidance and put the burden on consumers to remove the shrink sleeve.

Plastic recyclers and the world's largest retailer agree that full shrink sleeve labels cause sortation and recycling/reprocessing of plastic bottles:

1. **The Association of Plastic Recyclers (APR) Design® Guide for Plastics Recyclability**[258]

   APR publishes a design guide to "help package design engineers at consumer brand companies and converters create packaging that is fully compatible with plastics recycling systems in North America." APR notes that contamination in the recycling stream by poor package design impacts recyclers and the brands themselves.

   The APR Design® Guide provides detailed specifications to plastic product manufacturers, including requirements for label coverage and materials. In several 2019 public webinars, APR provided design guidance to product companies.[259] Figure 9 shows the APR guidance that labels on bottles exceeding 85% side coverage may cause the item to be sorted incorrectly. Figure 10 states that PETG sleeve labels impact the quality and efficiency of the PET recycling process.



Figure 9: Not Recyclable Guidance by APR on Label Coverage[260]

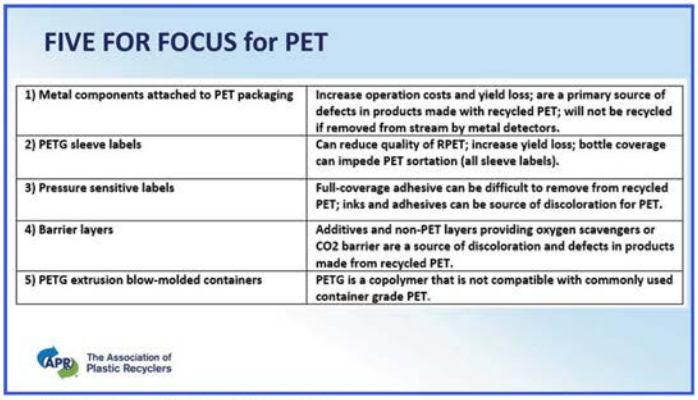
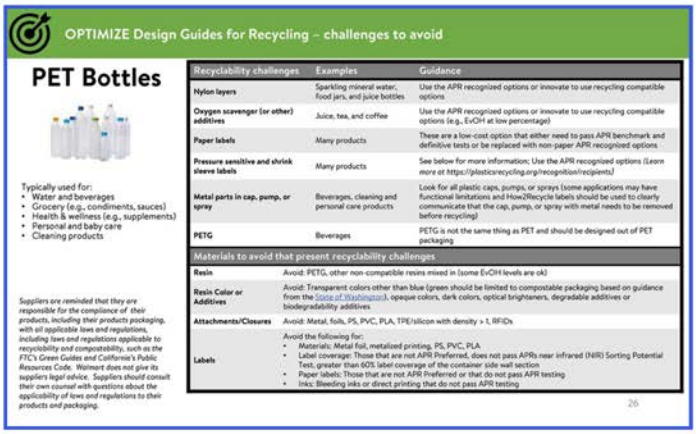


Figure 10: Problematic Design Components on PET Packaging[261]

2. **Walmart's Packaging Design Guidelines**

Walmart's "The Recycling Playbook" provides guidance for designing PET #1 and HDPE #2 bottles and jugs for recyclability. As shown in Figures 11 and 12 below, Walmart instructs product manufacturers to not employ PETG labels on PET bottles and restrict shrink sleeve labels to 60% coverage on both types of bottles.[262]



OPTIMIZE Design Guides for Recycling – challenges to avoid

PET Bottles

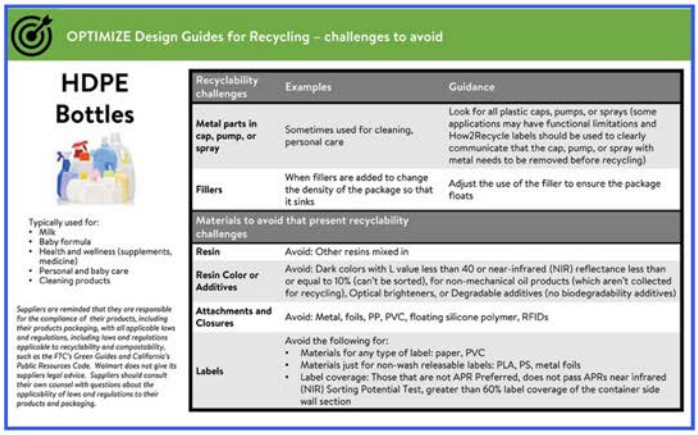
Typically used for:
- Water and beverages
- Grocery (e.g., condiments, sauces)
- Health & wellness (e.g., supplements)
- Personal and baby care
- Cleaning products

Suppliers are reminded that they are responsible for the compliance of their products, including their products packaging, with all applicable laws and regulations, including laws and regulations applicable to recyclability and compostability, such as the FTC's Green Guides and California's Public Resources Code. Walmart does not give its suppliers legal advice. Suppliers should consult their own counsel with questions about the applicability of laws and regulations to their products and packaging.

Recyclability challenges	Examples	Guidance
Nylon layers	Sparkling mineral water, food jars, and juice bottles	Use the APR recognized options or innovate to use recycling compatible options
Oxygen scavenger (or other) additives	Juice, tea, and coffee	Use the APR recognized options or innovate to use recycling compatible options (e.g., EvOH at low percentage)
Paper labels	Many products	These are a low-cost option that either need to pass APR benchmark and definitive tests or be replaced with non-paper APR recognized options
Pressure sensitive and shrink sleeve labels	Many products	See below for more information; Use the APR recognized options (*Learn more at https://plasticsrecycling.org/recognition/recipients*)
Metal parts in cap, pump, or spray	Beverages, cleaning and personal care products	Look for all plastic caps, pumps, or sprays (some applications may have functional limitations and How2Recycle labels should be used to clearly communicate that the cap, pump, or spray with metal needs to be removed before recycling)
PETG	Beverages	PETG is not the same thing as PET and should be designed out of PET packaging
Materials to avoid that present recyclability challenges		
Resin	Avoid: PETG, other non-compatible resins mixed in (some EvOH levels are ok)	
Resin Color or Additives	Avoid: Transparent colors other than blue (green should be limited to compostable packaging based on guidance from the State of Washington), opaque colors, dark colors, optical brighteners, degradable additives or biodegradability additives	
Attachments/Closures	Avoid: Metal, foils, PS, PVC, PLA, TPE/silicon with density > 1, RFIDs	
Labels	Avoid the following for: • Materials: Metal foil, metalized printing, PS, PVC, PLA • Label coverage: Those that are not APR Preferred, does not pass APRs near infrared (NIR) Sorting Potential Test, greater than 60% label coverage of the container side wall section • Paper labels: Those that are not APR Preferred or that do not pass APR testing • Inks: Bleeding inks or direct printing that do not pass APR testing	

26

Figure 11: Walmart OPTIMIZE Design Guide for PET Bottles



OPTIMIZE Design Guides for Recycling – challenges to avoid

HDPE Bottles

Typically used for:
- Milk
- Baby formula
- Health and wellness (supplements, medicine)
- Personal and baby care
- Cleaning products

Suppliers are reminded that they are responsible for the compliance of their products, including their products packaging, with all applicable laws and regulations, including laws and regulations applicable to recyclability and compostability, such as the FTC's Green Guides and California's Public Resources Code. Walmart does not give its suppliers legal advice. Suppliers should consult their own counsel with questions about the applicability of laws and regulations to their products and packaging.

Recyclability challenges	Examples	Guidance
Metal parts in cap, pump, or spray	Sometimes used for cleaning, personal care	Look for all plastic caps, pumps, or sprays (some applications may have functional limitations and How2Recycle labels should be used to clearly communicate that the cap, pump, or spray with metal needs to be removed before recycling)
Fillers	When fillers are added to change the density of the package so that it sinks	Adjust the use of the filler to ensure the package floats
Materials to avoid that present recyclability challenges		
Resin	Avoid: Other resins mixed in	
Resin Color or Additives	Avoid: Dark colors with L value less than 40 or near-infrared (NIR) reflectance less than or equal to 10% (can't be sorted), for non-mechanical oil products (which aren't collected for recycling), Optical brighteners, or Degradable additives (no biodegradability additives)	
Attachments and Closures	Avoid: Metal, foils, PP, PVC, floating silicone polymer, RFIDs	
Labels	Avoid the following for: • Materials for any type of label: paper, PVC • Materials just for non-wash releasable labels: PLA, PS, metal foils • Label coverage: Those that are not APR Preferred, does not pass APRs near infrared (NIR) Sorting Potential Test, greater than 60% label coverage of the container side wall section	

Figure 12: Walmart OPTIMIZE Design Guide for PET Bottles

3. **ASTRX Material Flow Study**[263] (ASTRX is an initiative of The Recycling Partnership and the Sustainable Packaging Coalition)[264]

   In 2019, Applying Systems Thinking to Recycling (ASTRX) collected information on material flows by interviewing MRFs that sort recyclable materials and recyclers/reprocessors that aggregate and convert materials. "The objective was to learn whether there are packaging types, materials or contaminants that present significant challenges for MRFs and the different material-type reprocessors, where specifically within the system they cause problems, and why."[265] Full body shrink sleeves were identified as a top problem to both MRFs and plastic recyclers/reprocessors. In MRFs, full shrink sleeves were reported to cause sortation issues and degradation of value of PET and HDPE bales. Plastic recyclers/reprocessors reported that full shrink sleeve are causing "contamination in plastic bales that decreases bale yield; operational issues with de-labeler equipment requiring a lot of maintenance; sortation issues: the sorter sees the label and thinks it's opaque and rejects the bottle."

Attachment 1
2020 U.S. MRF Survey Spreadsheet

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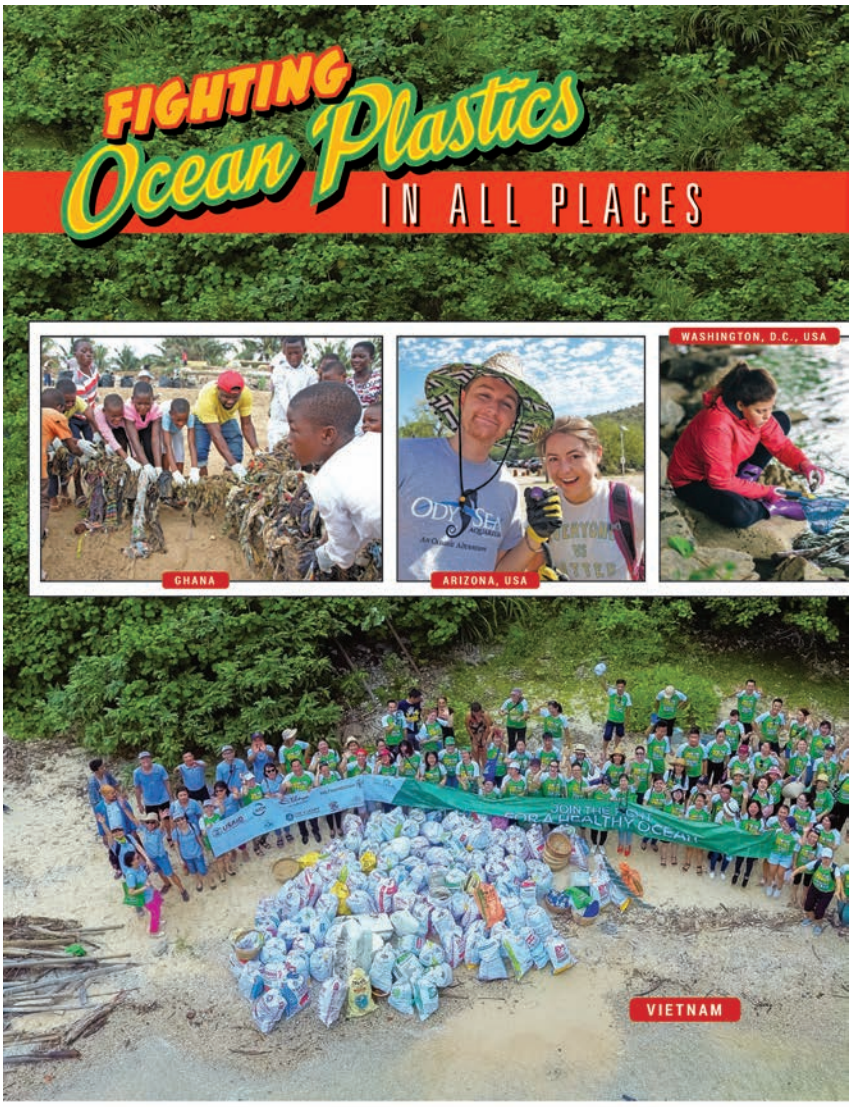
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Ocean Conservancy
International COASTAL Cleanup
THE
Beach
AND BEYOND
International COASTAL Cleanup
2019
Report


FIGHTING
Ocean Plastics
IN ALL PLACES
GHANA
ARIZONA, USA
WASHINGTON, D.C., USA
VIETNAM



A MESSAGE FROM

Ocean Conservancy's CEO

If there's one thing all superheroes have in common, it's that they wear some kind of costume to signal that they're ready for the fight ahead – a cape or armor, a mask or special amulets. The same can be said of real life heroes, too. Doctors suit up to go into surgery, firefighters suit up before entering blazing buildings, just to name a few. People suit up to get things done, to change the world, to take on problems of epic scale.

Unfortunately, ocean plastic *is* one such problem. An estimated 8 million metric tons of plastic waste flows into the ocean every year. That's the equivalent of one dump truck full of plastic every minute, every hour, every day going into the ocean. Ocean plastic doesn't just pollute our beaches and coastlines; it also impacts more than 800 species of marine life. And with plastic showing up in places as remote as Arctic ice and flowing into rivers hundreds of miles before reaching the ocean, we can't just focus on the beach. We have to fight ocean plastic on the beach ... **and beyond**.

That's why, in 2018, we urged people all over the world to "Suit Up to Clean Up" and join Ocean Conservancy's 33rd annual International Coastal Cleanup (ICC). More than 1 *million* volunteers heard our call and headed to their local beach, river or lake; rolled up their sleeves; and picked up trash – approximately 23 million pounds of it in just one day.

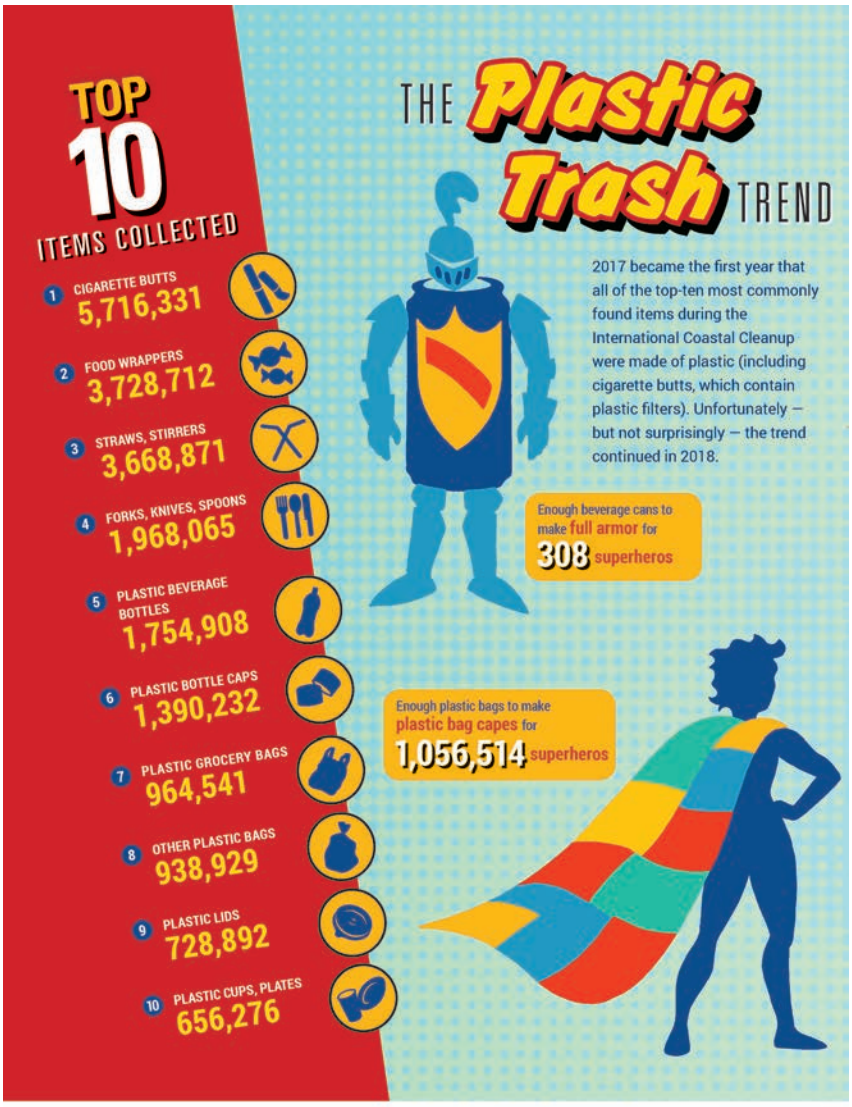
These are our highest numbers since the first ICC launched in 1986, and it's nothing short of heroic. On behalf of everyone at Ocean Conservancy, thank you for doing your part in this global fight for a clean, healthy ocean free of trash. Whether on a river in Arkansas or sun-kissed beach in Bali, everyone, everywhere can be an ocean hero.

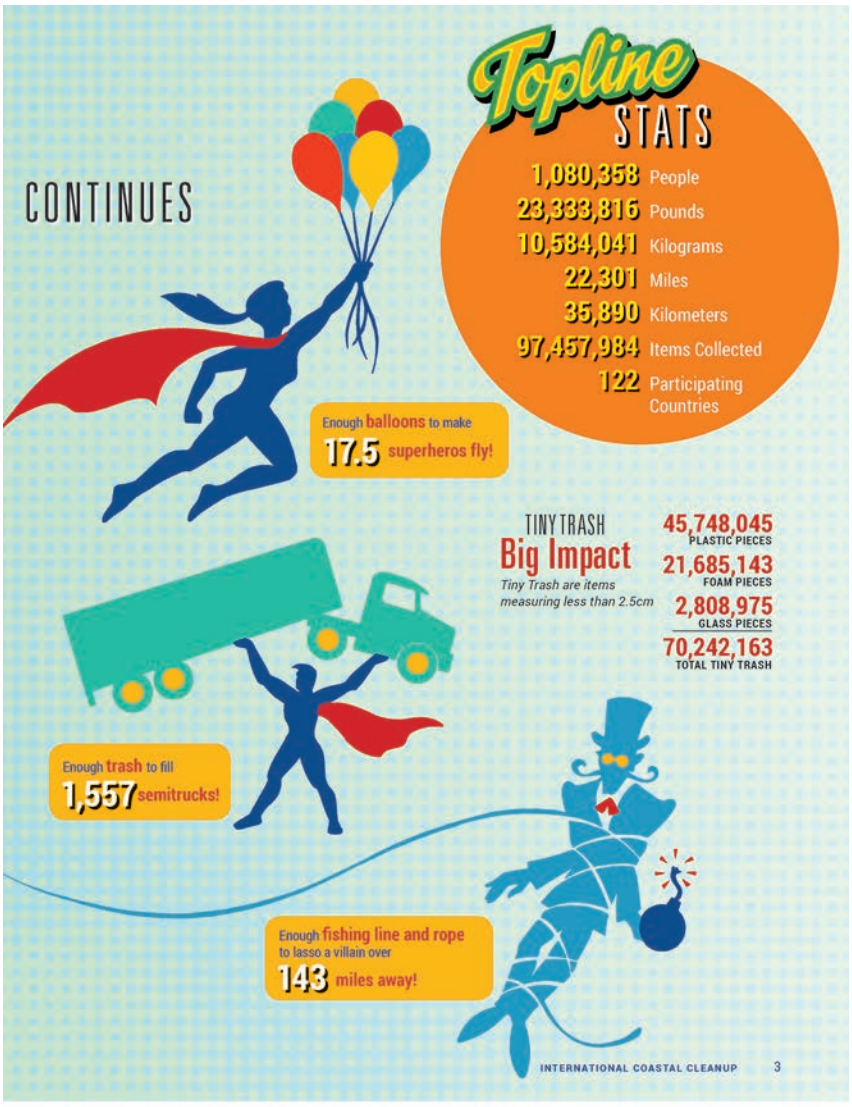
My sincerest thanks,

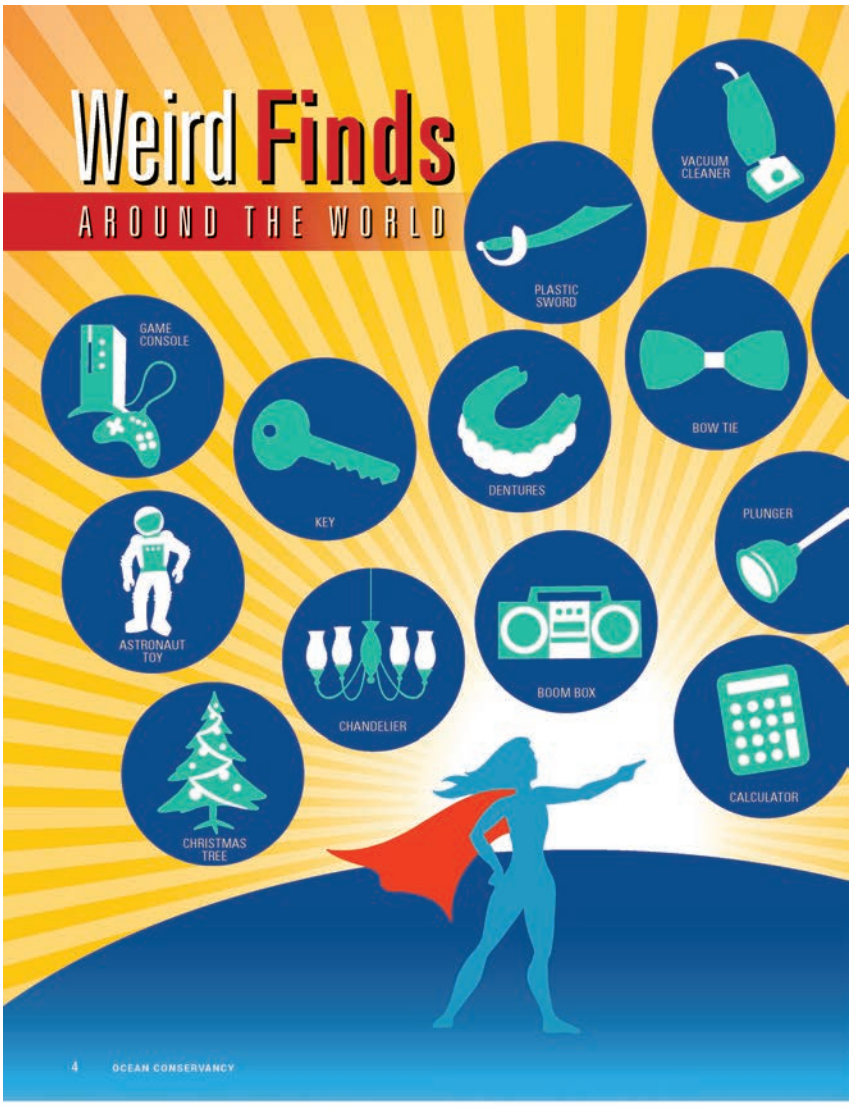
JANIS JONES
Chief Executive Officer, Ocean Conservancy

CONTENTS

1 A Message from Ocean Conservancy's CEO
2 Data Spotlight: Trash Trends
4 Weird Finds Around the World
6 From the Inland Out
10 #SuitUpToCleanUp
12 Show Me the Science
14 Going Beyond the Beach
16 2018 Supporting Partners
18 2018 Ocean Trash Index
24 Our 2018 Ocean Heroes
28 Acknowledgements


TOP 10 ITEMS COLLECTED
1 CIGARETTE BUTTS 5,716,331
2 FOOD WRAPPERS 3,728,712
3 STRAWS, STIRRERS 3,668,871
4 FORKS, KNIVES, SPOONS 1,968,065
5 PLASTIC BEVERAGE BOTTLES 1,754,908
6 PLASTIC BOTTLE CAPS 1,390,232
7 PLASTIC GROCERY BAGS 964,541
8 OTHER PLASTIC BAGS 938,929
9 PLASTIC LIDS 728,892
10 PLASTIC CUPS, PLATES 656,276
THE Plastic Trash TREND
2017 became the first year that all of the top-ten most commonly found items during the International Coastal Cleanup were made of plastic (including cigarette butts, which contain plastic filters). Unfortunately — but not surprisingly — the trend continued in 2018.
Enough beverage cans to make full armor for 308 superheros
Enough plastic bags to make plastic bag capes for 1,056,514 superheros


CONTINUES
Topline STATS
1,080,358 People
23,333,816 Pounds
10,584,041 Kilograms
22,301 Miles
35,890 Kilometers
97,457,984 Items Collected
122 Participating Countries
Enough balloons to make 17.5 superheros fly!
TINY TRASH
Big Impact
Tiny Trash are items measuring less than 2.5cm
45,748,045 PLASTIC PIECES
21,685,143 FOAM PIECES
2,808,975 GLASS PIECES
70,242,163 TOTAL TINY TRASH
Enough trash to fill 1,557 semitrucks!
Enough fishing line and rope to lasso a villain over 143 miles away!
INTERNATIONAL COASTAL CLEANUP 3


Weird Finds
AROUND THE WORLD
VACUUM CLEANER
PLASTIC SWORD
GAME CONSOLE
BOW TIE
KEY
DENTURES
PLUNGER
ASTRONAUT TOY
BOOM BOX
CHANDELIER
CALCULATOR
CHRISTMAS TREE
4 OCEAN CONSERVANCY


DOG SWEATER
TRAFFIC CONE
CAR SEAT
PRINCESS WAND
LIGHT BULB
WATERING CAN
ACTION FIGURE
TOP
25
PARTICIPATING LOCATIONS
1 PHILIPPINES
2 UNITED STATES
3 HONG KONG
4 ECUADOR
5 TANZANIA
6 SOUTH AFRICA
7 DOMINICAN REPUBLIC
8 TAIWAN
9 MEXICO
10 UNITED KINGDOM
11 CANADA
12 CHILE
13 CHINA
14 THAILAND
15 INDONESIA
16 SRI LANKA
17 JAMAICA
18 KENYA
19 PUERTO RICO
20 MALAYSIA
21 PANAMA
22 NORWAY
23 INDIA
24 PERU
25 VENEZUELA

FROM THE *Inland* *Out*





Colorado is about as far from the ocean as you can get among U.S. states, but since 2014 it has been home to a strong and growing International Coastal Cleanup effort thanks to the incredible work of a local community organization there, the Fountain Creek Watershed Flood Control and Greenway District, and their Outreach Coordinator Alli Schuch.

"Even though we're not near a coast, we wanted to create awareness of our local community's impacts on the entire Fountain Creek Watershed and our downstream neighbors – including the ocean," she explains. Beginning near Pike's Peak in the Rocky Mountains, Fountain Creek flows through several Colorado communities before reaching the Arkansas River to the south, eventually flowing into the Gulf of Mexico and out into the Atlantic Ocean. To highlight the larger inland-ocean connection, Alli founded "Creek Week" – nine days of area cleanups where everyone can get involved. In 2018, nearly 100 different teams participated.

"Anyone of any age or ability can participate in one of our cleanups and make a real contribution in just an hour or two," Alli says. "Our slogan here is 'pick a day, pick a location, and pick it up.'"

As is the case with ICC events around the world and in vastly different geographies, Creek Week volunteers tend to find many of the same items over and over again: cigarette butts, fast food wrappers, and other plastics (and the occasional, larger dumped item like a tire or refrigerator).

"I think people are oftentimes surprised by the amount of garbage that's out there," notes Alli. Creek Week has had many "ripple effects," including increased participation in other cleanups throughout the year.

"A cleanup is simple way to connect people to the natural environment and our numerous watershed management issues. We hope people will be inspired to take the next steps to do more." Since first starting Creek Week, volunteer turnout has increased by 350%.

And it's not just on creeks.

"Sometimes people think, 'Well, I don't have a creek in my neighborhood,'" says Alli. "But that's another one of our educational messages: Whatever is on the land will eventually make its way into the water. So cleaning up a sidewalk or a street – where debris can flow into a storm drain – is an easy thing to do to protect our creeks and the ocean."


PRESIDENT OF SRI LANKA
Maithripala Sirisena participates in a monumental cleanup effort at Dadalla Beach.
CHILE
MALAWI
PHILIPPINES
GREECE
Underwater CLEANUPS
134,117 Items Collected
444 Miles of Underwater Habitat
(715 KM)
80,597 Pounds of Trash Collected
(36,558 KG)
7,867 Divers
PROJECT AWARE
IN PARTNERSHIP WITH PROJECT AWARE
To find out more or to get involved under the surface, check out our partner Project AWARE at
www.projectaware.org/diveagainstdebris

FROM THE Inland Out

OCEAN HEROES OVERCOMING DISASTER:

Spotlighting the Northern Mariana Islands and Florida, USA

While some cleanups may involve a walk on the beach, they aren't always a walk in the park. Each year, International Coastal Cleanup events are delayed or cancelled due to natural disasters that often aggravate the ocean trash problem, and 2018 was no different. A number of devastating storms struck communities during the cleanup season and many ICC coordinators and volunteers dealt with much larger cleanups than anticipated.

In the Northern Mariana Islands (NMI), Typhoon Mangkhut approached the island of Rota in September with winds of over 120 miles per hour. William Pendergrass, ICC Coordinator for NMI through the Bureau of Environmental and Coastal Quality, explained, "The eye of the typhoon went directly over the island of Rota, causing significant and extensive damage to power and water infrastructure, residential homes, businesses and the island's natural resources." Still, he noted, "The island of Rota and its people are very resilient and although the island sustained extensive damage as a result of Super Typhoon Mangkhut, Rota residents, government agencies and public schools rallied together and came out to volunteer their services to clean the island of debris on September 28."

In the Gulf of Mexico, communities faced a different ocean issue in September. An especially long-lasting red tide event – a bloom of algae species that is worsened by factors including nutrient run-off – affected multitudes of marine life and was a human health concern, too. "Unfortunately, we had to cancel the 2018 ICC cleanup event in Sarasota due to the lingering effects of the red tide outbreak," said Wendi Crisp, ICC Coordinator in Sarasota, Florida, with Keep Sarasota Beautiful. For people, the bloom can cause coughing and sneezing and irritate the eyes. Luckily, many communities in Florida already conduct year-round cleanups outside of ICC season. Red tide events are natural occurrences but, much like storms, can be magnified by human activities. During cleanup season, we're feeling the impact our actions have on our blue planet, ocean trash and beyond.





2018

GoodMate

WATERCRAFT CLEANUPS

31,366	498	2,220	399,692
Pounds (14,227 KG)	Miles (801 KM)	People	Total Items Collected



Great British Beach Clean ANNIVERSARY

Nothing rubbish about this: 2018's Great British Beach Clean was the biggest beach cleanup that the United Kingdom has ever seen! Just short of 14,000 volunteers took to the shores of the UK, doubling in number from the previous year. After a year when the issue of marine debris made serious waves in British popular culture, it's no wonder that UK citizens were motivated to turn out and make a difference in their own communities. In 2017, BBC's iconic "Blue Planet II" series was the most-watched TV show in the country, and the trend continued with the release of BBC's "Drowning in Plastic" documentary and Sky News channel's Ocean Rescue campaign.

The so-called "Blue Planet" effect was felt across the whole of the United Kingdom as volunteers at nearly 500 beaches collected 8,550 kgs (18,849 lbs) of litter. The UK government even began to take action on marine debris, passing legislation on bans of certain single-use plastics. According to Lauren Eyles, Beachwatch Programme Manager and ICC Coordinator at the Marine Conservation Society, "It feels that we are on the precipice of being able to make positive changes when it comes to our plastic addiction."

"We were blown away by the amount of engagement," said Lauren. "On the event's 25-year anniversary, the UK became the tenth highest participating country worldwide in the ICC."

CONNECTING Ocean Heroes

#SuitUpToCleanUp

Whether it's with a sidekick or alongside an entire league of fellow champions, heroes never work alone. The same can be said of those fighting on the frontlines against ocean plastic pollution. Through Ocean Conservancy's Clean Swell mobile app and #suituptocleanup campaign, connecting with fellow ocean heroes the world over has never been easier.



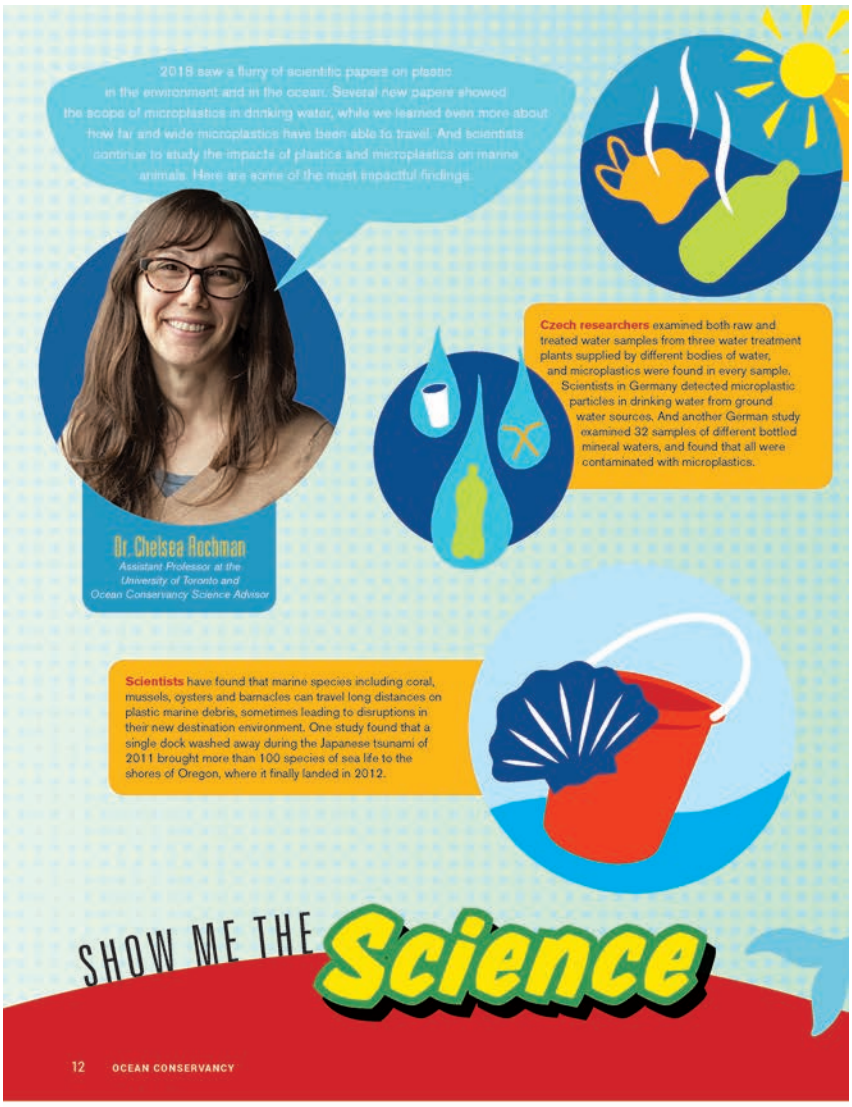


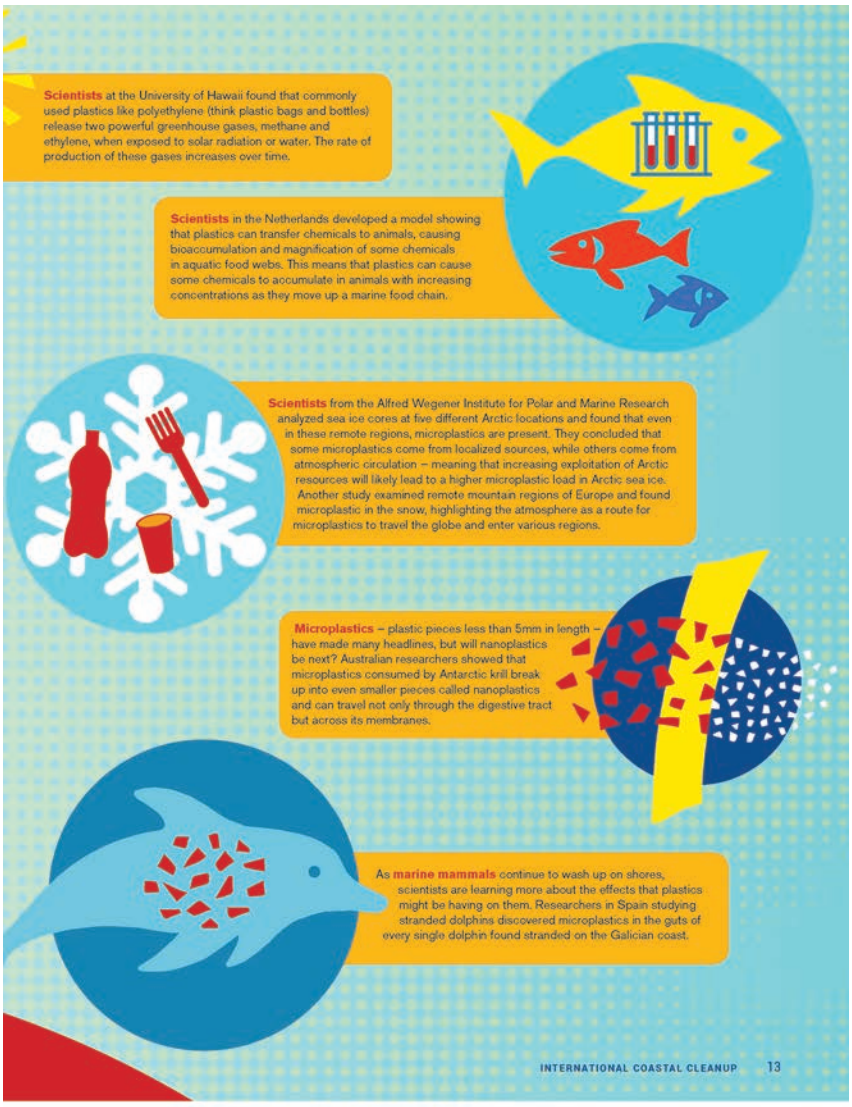







CALIFORNIA, USA
FLORIDA, USA
THAILAND
Numerous amazing partners including @theplanetlovelife, @eckerdlife, @yennareese, @fraflower, and @thetwenty_fifthbaam hosted an incredible cleanup this morning that removed 785lbs of trash from North Skyway Beach! Thank you everyone who attended. You are all awesome!
#keeppinellasbeautiful
#dobeautifulthings
#suitupcleanup
#EstuariesWeek
Tomorrow is the #International Coasta-Cleanup! Will you be joining in to help make out ocean and beaches cleaner and safer for marine life? You can learn more and find an event near you at the link in our profile. Last year's cleanup resulted in more than 10,000 tons of trash collected by over 789,000 volunteers covering almost 18,000 miles!
#SuitUpToCleanUp
(Photo: Ryan Tabata/NOAA)
repteddeutch This weekend I'm going to #suitupcleanup
The Ocean Conservancy International Coastal Cleanup has multiple locations in South Florida. Check out the map and join us on Sept 15! suitupcleanup.org
SUIT UP TO CLEAN UP SEPT 15
BUILD A
Clean Swell
With Clean Swell™, join a global community working to improve our ocean by adding vital data to the world's largest database on marine debris. This database is used by scientists, conservation groups, governments and industry leaders to study ocean trash and take action to ensure trash never reaches our beaches.
App Store
Google Play
INTERNATIONAL COASTAL CLEANUP 11


2018 saw a flurry of scientific papers on plastic in the environment and in the ocean. Several new papers showed the scope of microplastics in drinking water, while we learned even more about how far and wide microplastics have been able to travel. And scientists continue to study the impacts of plastics and microplastics on marine animals. Here are some of the most impactful findings.
Dr. Chelsea Rochman
Assistant Professor at the University of Toronto and Ocean Conservancy Science Advisor
Czech researchers examined both raw and treated water samples from three water treatment plants supplied by different bodies of water, and microplastics were found in every sample. Scientists in Germany detected microplastic particles in drinking water from ground water sources. And another German study examined 32 samples of different bottled mineral waters, and found that all were contaminated with microplastics.
Scientists have found that marine species including coral, mussels, oysters and barnacles can travel long distances on plastic marine debris, sometimes leading to disruptions in their new destination environment. One study found that a single dock washed away during the Japanese tsunami of 2011 brought more than 100 species of sea life to the shores of Oregon, where it finally landed in 2012.
SHOW ME THE Science
12 OCEAN CONSERVANCY



Scientists at the University of Hawaii found that commonly used plastics like polyethylene (think plastic bags and bottles) release two powerful greenhouse gases, methane and ethylene, when exposed to solar radiation or water. The rate of production of these gases increases over time.

Scientists in the Netherlands developed a model showing that plastics can transfer chemicals to animals, causing bioaccumulation and magnification of some chemicals in aquatic food webs. This means that plastics can cause some chemicals to accumulate in animals with increasing concentrations as they move up a marine food chain.

Scientists from the Alfred Wegener Institute for Polar and Marine Research analyzed sea ice cores at five different Arctic locations and found that even in these remote regions, microplastics are present. They concluded that some microplastics come from localized sources, while others come from atmospheric circulation – meaning that increasing exploitation of Arctic resources will likely lead to a higher microplastic load in Arctic sea ice. Another study examined remote mountain regions of Europe and found microplastic in the snow, highlighting the atmosphere as a route for microplastics to travel the globe and enter various regions.

Microplastics – plastic pieces less than 5mm in length – have made many headlines, but will nanoplastics be next? Australian researchers showed that microplastics consumed by Antarctic krill break up into even smaller pieces called nanoplastics and can travel not only through the digestive tract but across its membranes.

As **marine mammals** continue to wash up on shores, scientists are learning more about the effects that plastics might be having on them. Researchers in Spain studying stranded dolphins discovered microplastics in the guts of every single dolphin found stranded on the Galician coast.

GOING BEYOND THE Beach



Any way you cut it, 2018 was a huge year for the International Coastal Cleanup. For the first time ever we had more than 1 MILLION volunteers participate. We are so proud of and grateful for the cleanup coordinators and volunteers who made that possible – and who continue to spread the message of ocean conservation throughout the year.

Our numbers were bolstered by the amazing new partnerships we cemented over the year, too – another cause for celebration. We worked closely with the Indonesian government – host of the 2018 Our Ocean Conference – to mobilize thousands of volunteers to clean up a Bali beach on ICC day, tripling the number of ICC volunteers in Indonesia over the previous year. Brands like Discovery's Shark Week, Swiss watchmaker Breitling and their "Surfers Squad" of world champion surfers, and others helped us raise awareness of the ocean plastic pollution problem and magnified our reach. Pop culture celebrities like Ke$ha, The Red Hot Chili Peppers, Jared Leto, and Julia Roberts encouraged their fans to "Suit Up to Clean Up" and join the movement. Simply put: the 2018 ICC raised the bar.

Of course we need more than cleanups to end the plastic pollution crisis. But Ocean Conservancy raised the bar there, too, continuing to take on the challenge in all places and from all angles.

Emerging research was surfaced by advisors, researchers and scientists at the 6th International Marine Debris Conference, highlighting incredible advancements on this issue, but also emphasizing the extent of the research gaps that remain. Members of our Trash Free Seas® program team met with G7 environment ministers, briefed the G20 group of countries, and laid the groundwork for the 2019 launch of our partnership with APEC (Asia Pacific Economic Cooperation) host economy Chile.

We continued to push for improvements in waste collection and recycling in parts of the world that need it most. Working with the Trash Free Seas Alliance® and our friends at Closed Loop Partners we officially launched Circulate Capital, the world's only investment management firm that focuses on preventing plastic from leaking into the ocean. In October, Circulate Capital announced that it had raised more than $100 million to put toward projects in South and Southeast Asia, where the ocean plastic problem is most dire.

Recognizing that we must also reduce our reliance on disposable single-use plastic, we supported new ICC partner Starbucks in announcing that they would phase out plastic straws thanks to a newly redesigned (and recyclable) strawless lid. It was a shining example of the important role that companies – and innovation – can play in stemming the tide of ocean plastic.

Knowing that we cannot address the ocean plastic crisis without addressing the threat of ghost gear – lost or abandoned fishing gear like nets, traps and other equipment – Ocean Conservancy also became Lead Partner of the Global Ghost Gear Initiative (GGGI).

And in our headquarter city of Washington, D.C., Ocean Conservancy worked with U.S. lawmakers to pass the Save Our Seas (SOS) Act. Signed



AND SPEAKING OF Ghost Gear

During the 2018 International Coastal Cleanup the National Oceanic and Atmospheric Administration (NOAA) suited up against plastic pollution to clear derelict fishing equipment from the remote Northwestern Hawaiian Islands. Home to beautiful coral reefs, endangered Hawaiian monk seals, and threatened green sea turtles, these ecologically and culturally significant islands sit directly in the path of the North Pacific Gyre. The debris that collects on their shores and reefs has created an urgent threat to the health of the islands and reefs as well as to the organisms that call them home.

While regular cleanups take place on the big islands through ICC coordinator Keep the Hawaiian Islands Beautiful, the remote Northwest Hawaiian Islands aren't as easy to access. Working from ships and small boats, the NOAA team removed more than 166,000 pounds of abandoned fishing gear and other plastics from the islands. Their massive undertaking not only freed entangled sea life and corals, it also generated valuable data to help us better understand and fight back against the global ghost gear problem.

into law in October, SOS reauthorized the National Oceanic and Atmospheric Administration's Marine Debris Program while calling on the U.S. State Department to engage allies to address the marine debris problem internationally.

With some 8 million metric tons of plastic entering the ocean every year, there is a lot of work to do. The good news is that everyone has a role to play, whether on the beach or beyond it. Thank you for playing your part!

2018 INTERNATIONAL COASTAL CLEANUP

Supporting Partners

American Express joined the ICC community in 2018 through cleanups on 4 continents, with 500 employee volunteers removing and recording over 17,000 individual ocean trash pieces.



BANGLADESH



MALAYSIA

The **Coca-Cola Foundation** has supported the ICC for more than two decades, with employee cleanups around the world. Coca-Cola Beverages Florida joined forces with Ocean Conservancy to collect trash and recyclables from Tampa and St. Petersburg area beaches. The cleanup mobilized more than 150 volunteers and kicked off a pilot program with The Coca-Cola Company to turn all the recovered beverage bottles into new Coca-Cola 20-ounce bottles.

A supporter of the ICC since its inception, **Dow** amplified its employee cleanup effort in a big way in 2018, with more than 5,600 employees removing over 51,000 pounds of trash at 55 cleanup spots worldwide.

A new partner of the Cleanup, **PACIFIC LIFE** made a splash in the spring with employee cleanup events in Orange County, CA; Omaha, NE; and Lynchburg, VA. These events contributed to a year-long celebration marking the company's 150th anniversary.





Bank of America has partnered with the ICC since 2000. From Asia to Europe to the USA and dozens of other locations across the globe, employees have joined the cleanup in full force ever since. In the last three years alone, they removed 55,147 pounds of trash along 82 miles of waterways and coastlines.

- The Coca-Cola Foundation
- Bank of America
- American Express
- The Panaphil and Uphill Foundations

- Breitling
- The CVS Health Foundation
- The Dow Chemical Company
- The Forrest C. & Frances H. Lattner Foundation
- National Oceanic and Atmospheric Administration
- Pacific Life Foundation
- Brunswick Public Foundation
- Cox Enterprises, Inc.
- The Martin Foundation
- Norwegian Cruise Line Holdings Ltd.
- Amcor Limited
- ITW
- Owens-Illinois Inc.
- The Philip Stephenson Foundation

OUTREACH PARTNERS

- Keep America Beautiful
- Project AWARE
- United Nations Environment
- Waterkeeper Alliance

2018 Ocean Trash Index INTERNATIONAL CLEANUPS

COUNTRY/LOCATION	PEOPLE	POUNDS	KILOGRAMS	MILES	KILOMETERS	TOTAL ITEMS COLLECTED
ALBANIA	1	1	0.5	0.1	0.2	6
ALGERIA	10	98	44	0.3	0.4	-
ARGENTINA	781	9,310	4,223	3.9	6.2	47,652
ARUBA	11	8	3	1.7	2.7	68
AUSTRALIA	1,707	13,794	6,257	147.1	236.7	35,254
AZERBAIJAN	598	10,543	4,782	1.0	1.6	867
BANGLADESH	520	2,648	1,201	3.1	5.0	20,884
BARBADOS	389	1,953	886	3.5	5.6	58
BELGIUM	122	1,161	527	12.0	19.3	309
BELIZE	1,433	13,232	6,002	27.6	44.4	72,570
BERMUDA	725	8,395	3,808	16.5	26.5	35,446
BONAIRE	210	1,313	596	5.5	8.8	4,725
BRAZIL	2,265	25,612	11,617	77.5	124.7	83,204
BRUNEI	935	17,991	8,160	97.6	157.0	15,539
BULGARIA	14	29	13	0.1	0.2	160
CAMBODIA	109	3,092	1,402	1.3	2.1	14,739
CAMEROON	530	403	183	0.3	0.4	39,256
CANADA	14,427	122,847	55,722	972.5	1,565.0	428,716
CAYMAN ISLANDS	2	17	8	3.3	5.3	283
CHILE	14,156	379,087	171,951	18.7	30.1	269,541
CHINA	10,991	279,061	126,580	124.2	199.8	96,533
COLOMBIA	778	7,918	3,592	16.3	26.3	20,226
COSTA RICA	585	3,065	1,390	5.8	9.3	25,621
CROATIA	33	1,101	500	9.2	14.8	9
CURAÇAO	236	1,410	639	11.3	18.2	9,322
CYPRUS	210	326	148	1.9	3.1	4,537
CZECH REPUBLIC	4	8	4	0.3	0.4	1
DENMARK	8	10	5	2.4	3.8	183
DOMINICAN REPUBLIC	17,277	310,372	140,782	62.6	100.7	538,281
ECUADOR	55,032	307,005	139,255	627.7	1,010.1	908,101
EGYPT	57	482	219	1.8	2.9	285
EL SALVADOR	50	1,504	682	0.3	0.4	10
ETHIOPIA	5	31	14	0.3	0.4	-
FIJI	21	258	117	1.0	1.6	145
FINLAND	16	484	220	0.8	1.2	380
FRANCE	34	825	374	2.1	3.4	1,191
GERMANY	1,156	5,252	2,382	62.3	100.3	44,431
GHANA	3,829	186,973	84,809	20.6	33.1	75,449,133
GIBRALTAR	8	330	150	0.4	0.6	366
GREECE	4,082	10,381	4,709	28.1	45.2	121,959
GRENADA	129	1,094	496	2.7	4.4	12,832
GUAM	1,373	9,642	4,373	2.9	4.7	372
GUATEMALA	43	397	180	0.9	1.4	381
GUERNSEY	187	32	14	1.0	1.6	3,889
GUYANA	323	3,302	1,498	2.1	3.4	20,246
HONDURAS	66	1,778	806	6.0	9.6	2,035
HONG KONG	188,922	13,656,714	6,194,581	1,372.5	2,208.9	13,927
ICELAND	13	210	95	0.2	0.3	744
INDIA	7,393	44,643	20,250	240.4	387.0	86,897
INDONESIA	10,081	20,242	9,182	214.9	345.9	139,137
IRELAND	3,707	45,783	20,767	167.5	269.6	7,534
ISRAEL	253	1,968	893	2.8	4.5	9,951
ITALY	236	5,741	2,604	10.0	16.0	11,561
JAMAICA	9,573	104,864	47,566	132.9	213.9	774,077
JAPAN	4,541	32,155	14,585	187.4	301.6	162,164
JERSEY	43	92	42	1.1	1.7	284
KENYA	9,564	53,267	24,162	938.7	1,510.8	291,965
KUWAIT	101	176,001	79,833	0.1	0.2	-
MACAU	100	790	358	0.3	0.5	11,102
MACEDONIA	1	1	0.5	0.1	0.2	8
MALAWI	353	9,757	4,426	6.5	10.5	293,731
MALAYSIA	9,280	38,910	17,649	1,098.7	1,768.2	347,174

TOP 10 ITEMS COLLECTED GLOBALLY

1 CIGARETTE BUTTS	2 FOOD WRAPPERS (CANDY, CHIPS, ETC.)	3 STRAWS, STIRRERS	4 FORKS, KNIVES, SPOONS	5 PLASTIC BEVERAGE BOTTLES	6 PLASTIC BOTTLE CAPS	7 PLASTIC GROCERY BAGS	8 OTHER PLASTIC BAGS	9 PLASTIC LIDS	10 PLASTIC CUPS, PLATES
-	-	1	-	3	-	-	-	1	-
-	-	-	-	-	-	-	-	-	-
4,662	4,925	900	2,094	5,302	3,294	5,715	8,352	1,138	377
1	2	-	2	4	-	1	-	-	3
5,573	1,447	688	194	731	1,189	662	113	417	508
-	124	-	-	104	31	-	-	-	-
8,329	4,251	418	102	587	258	321	418	623	71
-	2	-	2	1	3	-	-	1	4
70	27	8	6	13	26	9	3	2	5
1,330	4,621	3,042	2,131	4,727	7,921	2,134	3,181	1,149	2,335
6,920	1,354	450	358	1,064	1,795	202	510	315	391
1,380	102	74	80	46	125	19	3	11	39
20,032	4,178	5,052	555	2,510	5,172	3,751	276	625	2,726
1,513	1,068	382	416	2,691	1,532	748	195	273	592
28	-	1	1	12	9	9	-	7	-
407	529	983	321	2,674	445	814	2,127	189	817
484	855	323	85	19,389	2,697	411	139	1,585	38
167,811	26,760	9,602	3,183	9,309	22,311	374	10,969	167	4,853
2	8	-	7	34	89	-	-	3	2
73,405	16,881	4,401	2,896	9,776	13,520	7,441	5,360	8,488	3,420
1,026	6,861	510	364	4,964	5,262	3,428	2,748	31	1,015
1,470	770	837	427	1,817	400	242	429	1,561	635
127	638	3,390	238	154	18,772	49	73	14	70
-	1	-	-	1	1	1	-	-	-
3,090	182	885	215	303	106	261	6	136	707
2,770	248	391	54	52	128	13	2	34	32
-	-	-	-	-	-	-	-	-	-
56	46	3	-	-	2	9	-	2	-
15,264	7,837	14,525	19,708	24,878	26,152	16,077	17,294	43,328	33,890
56,428	66,346	17,101	32,409	59,260	41,838	49,129	59,255	34,150	61,093
5	13	2	3	7	4	5	6	1	3
-	-	-	-	10	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	10	3	1	55	3	10	2	1	1
65	-	-	5	43	1	4	-	-	4
11	7	-	3	328	12	42	-	-	3
19,808	3,654	521	813	351	998	842	86	1,203	133
3,561,310	904,335	2,968,041	1,622,199	75,152	153,390	12,488	22,919	32,649	23,420
-	4	-	2	25	3	23	-	1	3
18,302	1,178	5,327	102	3,277	6,249	1,973	174	2,187	2,652
240	1,249	90	117	705	211	638	17	369	392
24	35	11	12	35	23	18	-	5	12
60	20	-	50	40	30	10	15	20	20
657	397	-	35	45	65	30	10	-	3
182	632	731	815	5,521	1,552	425	620	312	1,364
33	86	24	31	779	37	90	39	13	46
271	224	301	205	342	332	363	-	157	202
1	1	2	-	63	44	49	-	-	1
7,993	11,091	1,812	1,448	6,511	3,437	8,522	3,905	1,788	8,354
33,760	10,920	10,704	2,061	8,837	7,867	4,279	6,048	3,789	3,084
853	589	149	102	381	536	215	30	150	67
3,313	262	225	105	182	282	262	234	64	425
3,936	260	338	41	103	485	58	24	67	46
8,611	28,937	11,801	15,510	261,945	91,718	18,488	30,740	8,003	27,985
9,855	8,998	2,576	178	12,046	7,998	4,552	7,708	4,143	778
63	15	-	10	30	11	-	-	-	10
2,938	32,855	5,977	818	40,807	31,639	1,749	75,262	3,207	4,312
-	-	-	-	-	-	-	-	-	-
-	492	708	120	1,500	990	60	192	-	180
3	-	1	1	1	-	-	-	-	-
12,810	11,018	382	5,246	13,451	14,208	61,132	9,936	2,158	28,352
46,746	19,520	18,279	5,816	50,699	16,707	25,958	4,251	4,962	8,159

2018 Ocean Trash Index INTERNATIONAL CLEANUPS

COUNTRY/LOCATION	PEOPLE	POUNDS	KILOGRAMS	MILES	KILOMETERS	TOTAL ITEMS COLLECTED
MALDIVES	103	1,084	492	7.9	12.7	17,176
MALTA	123	3,788	1,718	10.3	16.6	4,106
MAURITIUS	422	14,450	6,554	11.4	18.4	25,041
MEXICO	15,257	151,080	68,415	192.6	310.0	393,450
MONTENEGRO	1	1	0.5	0.1	0.2	6
MOROCCO	34	1,545	701	0.9	1.4	970
MOZAMBIQUE	557	3,114	1,412	23.0	37.0	36,787
NEPAL	3	66	30	0.1	0.2	5
NETHERLANDS	435	789	358	25.3	40.7	4,793
NEW ZEALAND	177	1,255	569	14.5	23.3	6,811
NICARAGUA	304	1,870	848	6.2	10.0	7,340
NIGERIA	269	2,138	970	1.4	2.3	20,392
NORTHERN MARIANA ISLANDS	941	4,504	2,043	93.7	150.8	36,371
NORWAY	7,871	106,143	48,146	161.0	259.2	28,728
OMAN	28	31	14	0.1	0.2	522
PALAU	15	440	200	0.6	1.0	585
PANAMA	9,267	146,727	66,554	28.7	46.2	288,696
PARAGUAY	70	2,703	1,226	3.1	5.0	2
PERU	7,178	291,921	132,413	12.2	19.6	11,595
PHILIPPINES	276,120	798,104	362,014	1,076.2	1,731.9	7,866,415
POLAND	30	140	63	0.4	0.7	672
PORTUGAL	259	1,195	542	9.7	15.6	23,260
PUERTO RICO	9,557	117,739	53,405	273.7	440.4	382,064
QATAR	55	770	349	0.9	1.4	829
RUSSIA	142	493	224	3.7	6.0	558
SABA	29	254	115	0.6	1.0	1,587
SAMOA	34	57	26	0.2	0.3	918
SAUDI ARABIA	29	277	126	0.9	1.5	655
SENEGAL	68	1,478	670	3.5	5.6	2,519
SEYCHELLES	317	401	182	140.3	225.7	5,947
SIERRA LEONE	200	1,323	600	1.0	1.6	-
SINGAPORE	3,580	30,270	13,730	19.9	32.0	171,464
SINT MAARTEN	151	1,762	799	0.5	0.8	812
SLOVENIA	340	4,212	1,911	1.3	2.1	356
SOUTH AFRICA	19,563	30,331	13,758	224.7	361.6	274,868
SOUTH KOREA	4,276	335,217	152,052	51.2	82.4	75,530
SPAIN	2,284	15,069	6,835	31.0	49.8	9,326
SRI LANKA	9,649	71,289	32,336	68.4	110.1	238,455
ST. HELENA	178	3,275	1,485	1.9	3.1	26,032
ST. KITTS & NEVIS	286	1,524	691	4.0	6.4	10,421
ST. LUCIA	223	7,842	3,557	3.8	6.1	15,361
ST. VINCENT AND THE GRENADINES	27	2,260	1,025	0.6	0.9	5,445
SURINAME	96	1,213	550	0.8	1.3	10,849
SWEDEN	2,227	23,526	10,671	157.4	253.3	1,447
SWITZERLAND	525	5,410	2,454	41.0	66.0	3,158
TAIWAN	15,939	60,960	27,651	30.4	48.9	296,575
TANZANIA	31,361	1,028,236	466,400	64.7	104.2	10,784
THAILAND	10,933	33,194	15,057	126.2	203.2	224,377
THE BAHAMAS	902	4,585	2,080	39.1	63.0	31,538
TRINIDAD AND TOBAGO	3,767	38,090	17,277	25.7	41.4	174,109
TURKEY	793	3,076	1,395	13.7	22.1	11,571
U.S. VIRGIN ISLANDS	643	3,554	1,612	17.8	28.6	23,183
UKRAINE	48	2,787	1,264	1.9	3.0	4,292
UNITED ARAB EMIRATES	578	7,600	3,447	21.7	34.9	15,882
UNITED KINGDOM	14,527	22,273	10,103	143.3	230.6	301,916
UNITED STATES	226,889	3,867,269	1,754,164	11,961.9	19,250.8	5,106,515
URUGUAY	2,001	8,819	4,000	67.0	107.8	28,801
VANUATU	223	1,113	505	14.3	23.0	20,749
VENEZUELA	6,230	70,416	31,940	76.8	123.6	331,170
VIETNAM	859	5,286	2,398	6.4	10.3	17,002
LOCATION NOT RECORDED	11,726	51,768	23,482	217.7	350.4	367,190
GRAND TOTAL	1,080,358	23,333,816	10,584,041	22,301.3	35,890.3	97,457,984

TOP 10 ITEMS COLLECTED GLOBALLY

1 CIGARETTE BUTTS	2 FOOD WRAPPERS (CANDY, CHIPS, ETC.)	3 STRAWS, STIRRERS	4 FORKS, KNIVES, SPOONS	5 PLASTIC BEVERAGE BOTTLES	6 PLASTIC BOTTLE CAPS	7 PLASTIC GROCERY BAGS	8 OTHER PLASTIC BAGS	9 PLASTIC LIDS	10 PLASTIC CUPS, PLATES
560	404	25	39	6,106	5,861	193	35	12	19
847	34	104	32	494	95	470	3	32	33
2,844	1,332	93	57	3,902	326	246	1,696	99	245
87,494	12,471	10,493	7,332	31,342	36,166	10,557	10,371	13,472	8,137
-	-	-	-	1	1	-	-	1	-
151	20	5	13	-	20	1	210	-	12
365	207	373	152	1,751	6,710	493	620	1,594	197
-	-	-	-	-	-	-	-	-	-
824	422	67	37	298	160	169	-	83	102
283	209	141	31	172	464	882	55	78	36
273	935	62	38	1,354	844	435	568	308	113
299	3,027	772	1,216	1,660	3,851	87	467	2,395	2,467
7,440	1,862	494	677	2,577	1,872	1,003	1,068	283	446
2,934	7	254	210	2,030	1,220	1,270	53	7	35
20	53	5	-	133	150	12	-	-	6
55	21	68	5	-	12	25	80	4	8
1,774	11,603	4,046	10,582	70,817	10,091	10,141	6,875	4,742	5,297
-	-	-	-	-	-	-	-	-	-
908	961	782	806	1,303	1,427	1,119	5	280	1,494
434,275	2,029,991	283,720	132,574	479,061	335,640	491,970	482,325	399,224	274,938
85	54	11	5	27	58	33	-	23	16
9,577	480	344	40	530	497	148	192	188	294
46,526	10,620	31,639	10,472	25,210	23,480	4,890	6,674	21,354	15,279
10	150	3	12	109	28	50	-	10	19
5	-	68	-	56	10	118	-	-	-
242	57	90	21	70	56	17	11	4	103
82	116	35	14	30	54	105	-	20	26
1	13	16	24	26	195	14	-	70	36
133	143	54	12	998	114	148	32	6	55
32	77	45	8	252	82	-	5	61	1
-	-	-	-	-	-	-	-	-	-
24,687	9,509	11,453	1,692	13,296	6,374	3,302	8,082	1,625	4,670
56	20	27	-	215	20	30	25	15	-
-	27	6	6	16	4	4	4	1	8
38,702	17,766	13,096	2,232	10,803	20,991	5,610	4,741	5,395	1,389
7,906	2,974	2,392	1,280	4,218	2,946	274	6,652	1,449	1,696
1,429	1,238	206	146	789	216	388	120	103	233
6,859	24,865	4,733	1,609	50,271	23,671	16,041	7,570	2,954	4,511
2,026	602	427	263	2,708	773	99	-	774	5
3	56	94	120	1,454	2,409	40	184	263	116
915	704	170	464	3,050	1,735	334	386	148	625
-	45	1	54	1,927	361	15	32	220	163
-	-	-	-	6,650	-	100	-	-	-
162	139	36	11	32	28	99	32	1	39
303	90	9	4	466	51	74	-	8	26
7,136	6,561	37,456	572	37,538	31,784	12,375	1,263	1,354	15,538
1	2	-	-	34	3,822	4,335	4	-	1
11,743	14,470	15,352	6,406	13,459	7,387	22,326	26,998	7,264	11,847
618	1,117	960	877	2,230	2,264	673	1,757	554	1,046
3,708	6,329	1,812	3,770	42,428	11,188	2,557	4,694	1,734	3,542
2,302	177	357	324	1,067	713	657	24	171	372
1,624	1,761	1,109	808	1,803	1,893	282	675	443	670
336	420	36	78	840	321	147	19	13	284
2,595	630	208	323	1,698	1,383	483	482	257	355
23,827	22,402	203	5,395	5,614	16,383	5,265	2,271	322	1,837
809,538	303,586	122,387	39,338	209,803	268,244	89,820	71,816	65,884	46,100
3,959	2,211	448	96	1,664	2,647	1,407	1,211	1,549	409
817	3,054	518	478	1,828	696	1,336	670	-	469
17,100	17,744	9,642	9,143	29,431	26,132	13,586	12,411	24,606	17,141
567	1,342	1,829	258	1,129	846	1,339	620	280	624
45,345	26,737	18,123	6,212	44,461	33,556	22,842	1,170	7,656	9,512
5,716,331	3,728,712	3,668,871	1,968,065	1,754,908	1,390,232	964,541	938,929	728,892	656,276

2018 Ocean Trash Trends UNITED STATES CLEANUPS

COUNTRY/LOCATION	PEOPLE	POUNDS	KILOGRAMS	MILES	KILOMETERS	TOTAL ITEMS COLLECTED
ALABAMA	5,300	25,301	11,476	261.9	421.5	107,957
ALASKA	764	3,383	1,534	167.0	268.8	30,268
ARIZONA	419	53,644	24,333	6.6	10.6	616
ARKANSAS	21	60	27	6.0	9.7	996
CALIFORNIA	74,813	827,946	375,549	2,501.1	4,025.0	725,535
COLORADO	2,888	54,034	24,509	33.8	54.4	1,403
CONNECTICUT	1,923	23,411	10,619	109.2	175.8	196,784
DELAWARE	1,176	5,774	2,619	75.1	120.9	54,192
DISTRICT OF COLUMBIA	528	4,944	2,242	27.0	43.4	3,367
FLORIDA	30,349	495,751	224,869	3,328.0	5,355.8	891,255
GEORGIA	22,223	430,314	195,187	1,130.3	1,819.0	103,920
HAWAII	869	7,380	3,347	152.0	244.6	45,615
IDAHO	1	41	19	0.6	1.0	113
ILLINOIS	2,818	7,099	3,220	70.0	112.6	146,727
INDIANA	636	297	135	19.2	31.0	11,518
KANSAS	7	18	8	1.0	1.6	25
KENTUCKY	1	1	0.5	1.0	1.6	43
LOUISIANA	1,349	20,816	9,442	106.9	172.0	42,533
MAINE	1,688	5,402	2,450	135.6	218.2	56,238
MARYLAND	721	5,357	2,430	31.9	51.4	63,513
MASSACHUSETTS	4,320	81,526	36,979	215.7	347.1	984,915
MICHIGAN	1,642	11,640	5,280	76.3	122.8	83,927
MINNESOTA	74	163	74	2.1	3.3	3,358
MISSISSIPPI	2,649	20,756	9,415	50.0	80.5	199,086
MISSOURI	85	1,328	603	8.9	14.3	1,231
MONTANA	4	9	4	0.3	0.5	81
NEBRASKA	55	1,540	699	13.0	20.9	4,813
NEVADA	80	1,107	502	0.8	1.3	1,675
NEW HAMPSHIRE	1,008	12,627	5,727	41.3	66.5	32,248
NEW JERSEY	5,735	29,150	13,222	138.6	223.1	37,440
NEW YORK	7,587	52,403	23,770	316.3	509.1	295,742
NORTH CAROLINA	4,095	187,005	84,824	553.7	891.0	50,418
OHIO	2,244	38,635	17,524	44.8	72.0	218,777
OREGON	4,319	54,410	24,680	431.2	694.0	16,035
PENNSYLVANIA	13,910	188,731	85,607	40.3	64.8	83,143
RHODE ISLAND	2,311	13,760	6,242	94.0	151.2	160,960
SOUTH CAROLINA	1,700	18,718	8,490	181.8	292.6	29,171
TENNESSEE	90	1,420	644	3.4	5.5	9,753
TEXAS	17,050	1,042,199	472,734	802.6	1,291.6	128,435
UTAH	3	23	10	1.9	3.1	56
VERMONT	271	3,902	1,770	17.3	27.8	16,469
VIRGINIA	5,345	121,656	55,182	351.6	565.8	135,033
WASHINGTON	1,998	9,772	4,433	379.9	611.4	62,051
WISCONSIN	1,755	3,625	1,644	27.1	43.5	64,679
WYOMING	3	33	15	1.0	1.6	32
STATE NOT RECORDED	62	161	73	1.0	1.6	2,334
GRAND TOTAL	226,889	3,867,269	1,754,164	11,962.0	19,250.8	5,106,515

TOP 10 ITEMS COLLECTED IN THE UNITED STATES

1 CIGARETTE BUTTS	2 FOOD WRAPPERS (CANDY, CHIPS, ETC.)	3 PLASTIC BOTTLE CAPS	4 PLASTIC BEVERAGE BOTTLES	5 STRAWS, STIRRERS	6 BEVERAGE CANS	7 PLASTIC GROCERY BAGS	8 GLASS BEVERAGE BOTTLES	9 OTHER PLASTIC/FOAM PACKAGING	10 METAL BOTTLE CAPS
18,169	7,643	6,841	9,933	3,336	6,959	2,569	3,078	2,633	2,502
4,811	1,623	731	428	212	661	261	293	746	377
52	67	55	20	8	27	9	13	104	42
289	77	32	65	15	110	10	45	26	10
152,124	73,263	38,653	18,457	20,758	14,435	17,264	13,000	11,943	12,030
49	162	42	139	48	89	181	54	-	13
16,018	7,418	4,315	5,496	2,062	2,626	1,631	2,966	1,585	2,025
7,893	3,611	7,263	2,535	2,788	1,213	831	719	1,068	741
143	229	150	866	67	97	64	99	32	-
190,759	56,507	71,913	37,394	26,047	21,130	19,150	16,775	12,021	13,264
25,768	99	4,013	12,485	2,080	8,733	5,189	6,742	3,476	1,245
7,710	3,028	1,786	659	633	549	601	740	505	590
10	5	6	4	6	7	1	6	2	4
30,619	11,661	10,252	3,896	5,853	3,266	2,400	1,899	2,517	6,021
2,756	473	723	129	362	108	54	92	493	111
-	-	-	-	-	13	-	3	-	5
14	6	-	1	-	3	5	-	-	-
2,208	2,618	5,404	4,698	1,598	1,745	958	1,005	463	685
18,541	3,748	1,851	1,588	847	935	485	717	2,358	374
1,425	1,469	4,407	8,192	4,395	757	730	776	491	275
36,459	10,544	9,217	7,581	4,086	5,187	2,163	3,375	4,039	2,061
24,830	4,913	4,637	843	2,652	608	494	302	1,169	567
1,078	332	76	52	73	66	33	37	75	34
57,712	12,218	8,776	11,273	3,861	5,752	3,451	4,434	3,890	4,072
123	83	46	95	50	62	45	36	15	10
11	10	6	7	8	5	7	7	-	-
1,500	227	193	335	37	636	165	265	52	135
20	306	65	314	40	108	52	12	8	-
10,305	1,333	811	341	248	654	198	294	923	229
5,928	5,981	3,045	2,487	2,069	1,137	1,047	1,106	229	475
32,189	19,092	23,459	13,508	11,528	7,589	5,934	7,860	6,169	10,152
11,892	4,026	2,766	2,986	1,491	2,042	1,046	1,249	1,408	554
18,175	13,413	7,614	11,544	5,675	5,705	5,141	4,199	2,997	1,291
2,393	1,599	520	298	283	575	254	238	228	182
22,857	12,734	6,159	8,576	2,458	2,371	3,589	2,901	1,352	89
36,522	11,237	10,141	7,196	5,426	4,118	1,907	3,814	3,636	4,641
8,262	2,230	1,588	1,570	699	1,311	550	1,074	498	376
48	21	17	9,212	19	177	10	17	-	-
14,636	5,675	18,902	6,033	4,516	2,997	2,257	1,391	1,776	2,952
1	23	2	1	-	-	11	-	-	-
64	220	45	205	14	427	136	265	75	4
15,745	14,528	5,577	13,993	3,022	5,792	7,823	4,537	3,458	3,559
15,313	5,007	1,873	2,390	931	1,372	511	1,164	906	831
12,684	3,893	3,911	1,807	1,898	1,479	534	616	1,492	553
10	-	-	1	-	5	-	2	-	-
253	133	264	115	139	81	67	66	-	-
809,538	303,586	268,244	209,803	122,387	113,719	89,820	88,283	74,858	73,081

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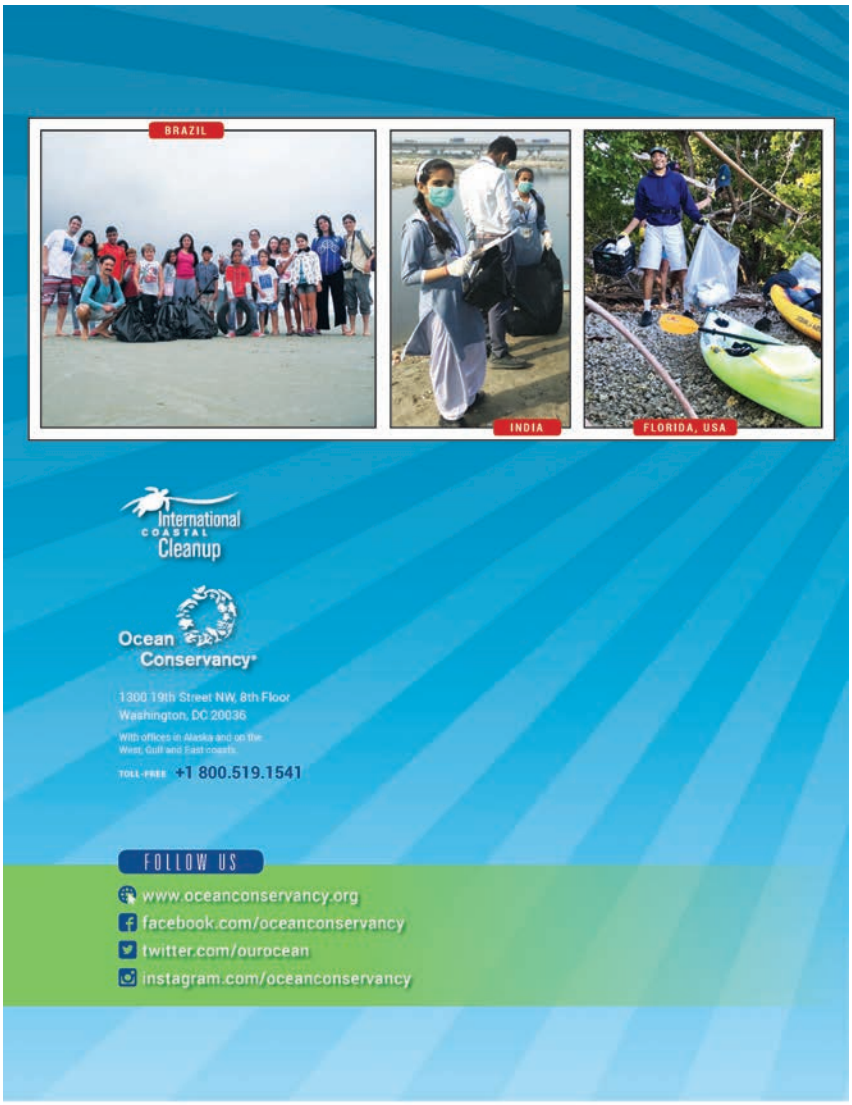
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EXTENDED PRODUCER RESPONSIBILITY FOR PACKAGING & PAPER PRODUCTS

A Step Toward the Circular Economy

What is EPR for PPP?

Extended producer responsibility (EPR) is a policy tool that shifts responsibility for the post-consumer management of products and packaging from local governments to producers. This includes financial responsibility and sometimes day-to-day management of covered material. **EPR is a game-changer for reducing and recycling PPP, and for creating a circular economy.** EPR for PPP is common throughout much of the world, including Canada and Europe, where programs have been in place for decades and many countries have PPP recycling rates above 70% or even 80%.

What Does EPR for PPP Cover?

EPR for PPP programs cover at least all residential (consumer-facing) packaging and printed paper, **including non-recyclable materials** and PPP from online retailers. Some programs also cover residential material collected in public spaces and, less often, commercial and industrial PPP.

Who Pays for EPR for PPP Systems?

Under all EPR for PPP systems, **producers internalize recycling costs**, just like the cost of raw materials, electricity, or other costs of doing business. Producers do not charge a direct fee for recycling services.

How are EPR for PPP Systems Financed?

Producers pay fees on all PPP materials they place on the market. Producers typically submit these fees to a Producer Responsibility Organization (PRO), which is an entity they establish to carry out their responsibilities. Fees are typically assessed by material type, weight, and other criteria, such as the cost to manage a material.

EPR for PPP programs are moving to eco-modulated fees that incentivize producers to take environmental factors into consideration, such as using recycled content or reducing greenhouse gas emissions. For example, under eco-modulated fees, the PRO may charge producers more if they use difficult-to-recycle packaging materials for their products, and charge less if they use widely recyclable materials.

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What are the Benefits of EPR over Current U.S. Recycling Programs?

Under EPR for PPP, recycling programs are funded by producers, whereas current U.S. programs are funded with taxpayer or ratepayer dollars. EPR can harmonize recycling statewide by establishing a uniform set of accepted materials and consistent education across a state. Harmonized recycling reduces contamination. Collected recyclables then have a higher value and are more marketable. In the end, more material gets recycled.

Does EPR Address Fluctuating Recyclables Markets?

EPR systems are more stable than current recycling systems in the U.S. and have more successfully weathered market volatility – especially in full producer responsibility systems, such as British Columbia's (B.C.). The B.C. system has fared better than other Canadian provincial systems since the China Sword policies took effect because producers have fostered local end markets for most materials and have achieved economies of scale to keep the system efficient.

What is the Role of Local Government?

The most successful programs to date place full responsibility on the producers to achieve results while offering local governments the option to **continue collecting recyclable materials** and educating residents. **Local governments should always have flexibility** to choose how they participate in EPR for PPP programs.

How Does EPR Impact Trash and Recycling Services for Residents?

Trash services are not directly impacted. If local governments provided garbage collection and other services (such as organics collection) before EPR, they continue to do so and to charge ratepayers or taxpayers for those services. Contracts with private haulers for trash services are also not impacted. **Residents continue to have access to recycling collection services**, but under full EPR for PPP systems, producers provide these services at no direct charge.

How Does EPR Impact Recycling Haulers and Processors?

Under EPR, haulers provide services under contract to producers or local governments (depending on the EPR system) for the collection of covered PPP materials. In addition, EPR for PPP can expand recycling services to communities that did not previously have them. Thus, under EPR for PPP, **there are often more opportunities for both haulers and processors.**

Who Oversees EPR for PPP Recycling Programs?

EPR programs are financed and typically implemented by producers (through one or more PROs) **with strong government oversight and enforcement**. Legislation enabling PR for PPP programs requires a PRO (on behalf of the producers) to submit a plan to government for review and approval. A plan can include convenience standards, reporting requirements, mandated recycling rates, verifiable downstream markets, environmental criteria, and other factors for which **producers are legally responsible to meet.**

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LEARN MORE

This fact sheet is based on the report *Extended Producer Responsibility for Packaging and Paper Products: Policies, Practices, and Performance.*

For more information, visit https://bit.ly/2QIu5p3

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SWANA
SOLID WASTE ASSOCIATION OF NORTH AMERICA

June 17, 2020

The Honorable John Barrasso
Chairman
Committee on Environment & Public Works
United States Senate
Washington, DC 20510

The Honorable Thomas Carper
Ranking Member
Committee on Environment & Public Works
United States Senate
Washington, DC 20510

Dear Chairman Barrasso and Ranking Member Carper:

The Solid Waste Association of North America (SWANA) appreciates the opportunity to provide this testimony to the Environment and Public Works (EPW) Committee concerning the challenges facing recycling in the United States. SWANA is the largest professional association for the solid waste and recycling industry in the United States, with more than 10,000 members in 47 chapters. We are committed to advancing from solid waste management to resource management. Our members include both local government officials and private sector representatives.

This week marks three years since China announced its National Sword program, which has had a dramatic impact on recycling programs in the United States and elsewhere. Under National Sword, China has imposed significant restrictions on the import of recyclables and scrap. Because the United States about twenty-five percent of these recovered materials to China, nearly 17 million tons per year, local governments, recycling facilities, and scrap processors have been forced to find other markets for much of the paper, metal, and plastic that we recover from the waste stream. A lack of domestic processing facilities, along with other countries following China's lead in reducing imports of recyclables, have made this challenging.

Among the impacts of National Sword was a decrease in the value of recovered materials. With our largest export destination reducing its demand, prices for recovered paper and plastic declined. Prices leveled off in late 2019 and some commodity prices were increasing in early 2020, but the COVID-19 pandemic has had a very significant impact on the recycling supply chain, including pricing. The emergency orders issued by numerous states closing industrial and commercial facilities such as schools, offices, and stores meant that recovered paper generated at these locations was no longer available. This affects manufacturers who rely on recovered paper in their operations. For example, recovered office paper is a substantial source of feedstock for the manufacturing of toilet paper. If you're wondering why so many stores were out of toilet paper in the early weeks of the COVID-19 pandemic, the disruption of the recycling supply chain was a major contributor.

At the same time, with many more Americans working from home, we have seen an increase in the volume of waste and recyclables generated from the residential side of the industry. Unfortunately, residential recyclables typically have a higher contamination rate than commercial recyclables. Contamination refers to non-recyclable material that is placed in a recycling bin, such as plastic bags, diapers, holiday lights, or bowling balls. One of the serious challenges that U.S. recycling programs and facilities face is the high level of contamination in the residential recycling stream, which increases costs and disrupts operations.

Because residential waste and recyclable volumes spiked upwards in March and April, some local governments temporarily suspended their curbside recycling collection programs to make sure that all of the trash was collected and managed properly. SWANA estimates that in late April, residential waste volumes peaked nationally at about twenty percent higher than normal, with some communities experiencing increases of more than thirty percent. This stressed many residential solid waste collection systems, although as businesses have started to reopen over the past month, we've seen a decline in volume on the residential side from the peak. As a result, most communities that suspended curbside recycling programs have reinstated them.

A second COVID impact was operational changes at recycling facilities. A typical modern recycling facility often includes workers working on either side of a conveyor belt picking materials off the belt. These workers are usually very close to each other. Our members have had to change processes, including installing plexiglass separators between employees or mandating social distancing, and providing additional personal protective equipment, which has increased costs. A handful of recycling facilities temporarily closed to make these changes, although most have reopened.

A third impact has been increased concerns by front-line recycling collection and processing workers about exposure to the COVID-19 from the materials they were collecting or processing. According to one report, the virus can live on cardboard for up to twenty-four hours and on certain plastic and metal for up to three days. Recycling collection workers touch cardboard every day on their routes, as they place boxes from e-commerce and stores placed at the curb into the truck. SWANA has provided guidance to employers, employees, and the general public about steps they can take to reduce the potential for exposure, and although employers in the industry have provided gloves, facial coverings, and other personal protective equipment (PPE) to protect against exposure, these concerns continue.

A fourth and final impact of COVID-19 has been a delay in Congress' consideration of legislation that would support American recycling programs and systems. This delay is entirely understandable, as the House and Senate have focused appropriately on responding both to the pandemic and the resulting adverse economic impact. In the months before COVID-19, several bills were introduced that would support recycling, including the Save Our Seas 2.0 Act, the RECOVER Act, the RECYCLE Act, and the Break Free from Plastic Pollution Act. In January 2020, Save Our Seas 2.0 was approved unanimously by the Senate, and awaits consideration in the House. SWANA strongly supports this bill, which in addition to addressing marine litter and

pollution, provides money to local governments and others for recycling education. SWANA also supports the RECOVER and RECYCLE Acts. With local governments under unprecedented budgetary pressure, federal support for municipal recycling programs is more important than ever. Just like roads and bridges, recycling is part of America's essential infrastructure, providing hundreds of thousands of jobs and billions in tax revenue, as well as protecting the environment and reducing greenhouse gas emissions.

SWANA's work to help the industry overcome the current challenges facing recycling programs has continued despite the impact of COVID-19. For example, next week, SWANA is holding a major technical conference (virtually), and we have many sessions on recycling, including a session featuring EPA and industry leaders discussing both the challenges and opportunities our industry is facing. EPA will be providing an update on its America Recycles initiatives, including its work towards announcing new national recycling goals later this year. In November 2019, at its America Recycles Day Summit, EPA Administrator Wheeler announced that the agency would propose such goals in Fall 2020. We urge this Committee, Congress, and other stakeholders to hold the Agency to that commitment. National recycling goals will galvanize private investment in our recycling infrastructure and focus public attention on this important topic.

Finally, SWANA notes this is National Waste and Recycling Workers week. This is a week in which the waste and recycling industry and local governments recognize the great work that these hard-working men and women do, every day, collecting and processing our trash and recyclables. SWANA urges all Americans to be thankful to waste and recycling workers for the amazing job they are doing keeping our communities and neighborhoods safe and clean, especially during the COVID-19 pandemic. In a recent letter to SWANA, Maryland Governor Larry Hogan, who chairs the National Governors Association, thanked both SWANA and "waste collectors, recyclers, drivers, engineers, technicians" and others who have provided the essential service of waste and recycling during the pandemic. We couldn't agree more. This Committee can support the remarkable work that these employees are doing by: (1) providing financial support to local recycling programs; (2) urging EPA to issue national recycling goals; and (3) making sure that America's recycling workers receive appropriate personal protective equipment and COVID-19 testing to they can safely continue to turn our discarded materials into new useful products.

SWANA appreciates the opportunity to provide this testimony, and looks forward to working with the Committee, EPA, and others to strengthen recycling in the United States. If you have any questions about recycling or the contents of this written testimony, please contact David Biderman, SWANA's Executive Director and CEO, at dbiderman@swana.org

Sincerely,

David Biderman
Executive Director & CEO
Solid Waste Association of North America

THE RECYCLING PARTNERSHIP

Hearing on "Responding to the Challenges Facing Recycling in the United States"

Statement for the Record

Senate Committee on Environment and Public Works

June 17, 2020

Elizabeth Biser
Vice President, Policy & Public Affairs
The Recycling Partnership

Thank you for the opportunity to submit a statement into the official hearing record for the Senate Committee on Environment and Public Works' hearing "Responding to the Challenges Facing Recycling in the United States."

The Recycling Partnership is a national nonprofit that works with companies, communities, and policymakers across the nation to strengthen public recycling programs. Our organization puts private dollars to work in communities because we know that when we invest in a system that creates jobs, feeds manufacturing, protects resources, empowers sustainable action, and unlocks opportunity, everyone wins.

We applaud the Committee for holding a hearing that focuses on the important issues relating to recycling in the United States. Americans realize how critical recycling is to our economy and our environment; 85% of Americans strongly believe in recycling according to a recent survey commissioned by The Recycling Partnership. Citizens across the country depend on community recycling programs to be able to exercise this strong desire to recycle. Unfortunately, high costs and difficult markets for some materials pose significant challenges to community recycling programs. This statement provides a snapshot of the economic value of recycling, describes the current challenges we see facing communities, and then provides recommendations of actions that Congress can take to help.

Recycling is an economic driver. According to the EPA, recycling and reuse activities contribute to 757,000 U.S. jobs. When we recycle, materials are sorted and processed back into raw materials that can be made into new products. There are jobs created at each point of this process, along with economic investment made by recycling and processing companies.

Community recycling programs deliver this essential feedstock to U.S. manufacturers, many of whom could not make their products without this critical supply. Toilet paper, cardboard

delivery boxes, packaging for food and medical supplies, and many other items critical to the response to the COVID-19 pandemic are made from recycled materials. In short, large sectors in our economy and the environment depend on community recycling programs and associated infrastructure to make and deliver those goods to market and keep them out of landfills.

However, the ability of community recycling programs to sustain and grow the supply of recyclable materials is facing significant challenges. In many areas of the U.S., communities are paying substantially more to send curbside-collected recyclables to a sortation facility than to a landfill for disposal — sometimes more than twice as much. Communities are also experiencing impacts to their local budgets from the pandemic, presenting challenges around the financing of key services, including recycling. Nevertheless, many cities are persevering through these challenges because citizens so strongly support recycling programs.

As we work hand-in-hand with communities across America, The Recycling Partnership has demonstrated proven solutions that help communities provide more, effective recycling programs in light of these challenges. These solutions include ensuring citizens have automatic access to recycling, that citizens are using the most efficient means of material collection and making sure that citizens are educated on what and how to properly recycle.

We maintain robust data on our work and know that these strategies improve the quantity and quality of materials collected. For example, The Recycling Partnership's anti-contamination campaign in Atlanta saw a 57% decrease in unwanted materials in recycling carts when education was paired with engagement methods such as cart-tagging. Using cart-based collection increases the amount of materials by more than 100 pounds per household. Decreasing contamination improves the quality and increases the value of the material collected, better helping offset the costs of recycling programs.

Congress can act to bolster the recycling system by action in some key areas: supporting better data collection, enhancing education, and facilitating infrastructure investment.

Data: 2020 Recycling Data Efforts

Strong data is the foundation of all smart policy solutions. For too long, recycling in the United States has been characterized by its lack of reliable, comprehensive data. There is not enough data on how many community recycling programs currently operate in the U.S., much less the amount of recyclable material that is collected and processed from residential homes. The Recycling Partnership urges Congress to appropriate $5 million to the EPA to conduct a comprehensive data collection effort that we have termed the "2020 Recycling Census." That effort outlines the metrics needed to have informed conversations about the state of recycling in the United States, to craft effective solutions for increasing the efficient collection and processing of recyclable materials, to strengthen recycling markets, and to measure the effectiveness and progress of efforts moving forward against a meaningful benchmark.

Education: RECYCLE Act (S. 2491)
Federal support for recycling education and outreach is critical. Education and optimization efforts increase the quality and quantity of materials collected, helping ensure the flow of essential feedstocks to U.S. manufacturers. Supporting legislation such as the recently introduced Senate measure, the RECYCLE Act (S. 2491) would go a long way towards addressing this critical need.

Infrastructure: RECOVER Act (H.R. 5115)
The speed of packaging innovation has outpaced the capabilities of our recovery infrastructure. Important innovations are occurring in the U.S. regarding circular packaging design, including the sortation and processing of recyclables, but we need these technologies to accelerate and be adopted on a broad scale. This includes homegrown, high-tech solutions such as artificial intelligence and robotics from companies like AMP Robotics from Denver or BHS from Eugene, Oregon. Incentives and grants, such as what is offered in the RECOVER Act (H.R. 5115), will drive broad-scale adoption of the necessary infrastructure investments for improved collection, sortation, and processing of recyclables.

COVID-19 Recycling Resiliency Proposal
In response to the COVID-19 pandemic, The Recycling Partnership has proposed that $100 million be appropriated to EPA to allocate to states through competitive grants for recycling-related infrastructure to address immediate needs related to the resilience of the collection, sortation, and separation of recyclable materials. This funding would ensure continuity of operations and the delivery of high-quality recycled feedstock for use in domestic manufacturing.

We are facing a challenge that requires public, private, and nonprofit partners to work together and transition from simply fixing problems to looking at the possibilities of a circular economy future. It's a future where we no longer bury valuable materials, but instead put these materials to work for our economy, creating new jobs and protecting our environment. Congress can be a consequential actor on these issues, and we urge attention to the opportunities we have suggested.

Thank you for allowing us to submit this statement to the hearing record. We look forward to working with you on solutions that create jobs and protect our planet and its people.

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June 17, 2020

The Honorable John Barrasso
Chairman, Committee on Environment and Public Works
307 Dirksen Senate Office Building
Washington, DC 20510

The Honorable Tom Carper
Ranking Member, Committee on Environment and Public Works
513 Hart Senate Office Building
Washington, DC 20510

Dear Senator Barrasso and Senator Carper:

On behalf of WWF's 1 million plus members and nearly 11 million activists around the country, I want to thank you for convening today's hearing "Responding to the Challenges Facing Recycling in the United States." Whether we are talking about the impacts of virgin materials production, the shortfalls in recyclability, recycling infrastructure, and consumer access, or the impacts of mismanaged disposal, material use and recycling are issues whose time has come. In fact recently, almost 700,000 WWF supporters called for government action to address these problems. Thank you for your leadership in furthering this much needed dialogue and the momentum toward passage of a meaningful solution.

We have all seen the alarming statistics around virgin plastics production, the disarray of recycling and solid waste management systems, and the impacts of leakage of natural resource value into the environment. Here are just some of the relevant data points. Mass production of plastics began just six decades ago. In that time, 8.3 billion metric tons of plastic materials have been generated, with 6.3 billion metric tons resulting in plastic waste. Global plastic production is expected to more than triple by 2050, accounting for a full 20 percent of all oil consumption. Only 34% of municipal solid waste is recycled annually in the United States and only 9% of plastic waste. Only 52% of homes have access to curbside recycling and the cost of disposal at a landfill remains a fraction of the cost at a recycling center. Every year, 8 million tons of plastic enter the ocean. That is equivalent to one garbage truck full of plastic every minute. By 2050, if we continue to pollute the ocean at the current rate, the total waste in the oceans will weigh more than all of the fish, and 99% of seabirds will have ingested plastic.

Across all of those numbers, one thing is clear – we have a systems problem. We are extracting virgin natural resources for the production of plastic, paper, and glass products. In each of those production streams, significant environmental impacts result, whether the lens is transformation of fossil fuels to plastic products, deforestation for paper products, or other key production challenges. The natural resource value in those products are then all too often lost from the system at the end of their lives, as new products are again made from virgin materials over recycled content. Worse yet, materials at the end of a product's life often leak into nature, further contributing to environmental harm. It's a broken system that could be realigned with smart policies and incentives for the benefit of industry, consumers, and key conservation objectives.

WWF hopes that today's conversation will set the stage for refinement and passage of those smart policies and incentives – to repair the system and set the stage for a circular economy. Any such legislative package should include a phase out of truly unnecessary materials, standards for recyclability and use of recycled content, mechanisms to bring private investments to the table to create that recycled content, provisions to address consumer access, education, and labeling, and language to promote US leadership globally and ensure our waste is not exported to nations least able to manage it. These are the types of provisions that are included in the Break Free From Plastic Pollution Act and the reason why we support that bill as a major step toward creating a manageable, equitable, and financially smart circular economy. We are glad that Senator Udall will be testifying today and thank him and his staff for his incredible leadership on this issue.

WWF business partners and key industry voices have made major commitments to measuring and reducing their plastic footprint and using recycled content. Government, industry, and the public must work together to make that vision a reality across the board – to bring private dollars to the table to deliver high value, recycled content in a manner that will reduce production impacts and improve consumer access. Thank you for your leadership in moving this conversation forward. We are happy to assist in any way that we can as that dialogue continues.

Sincerely:
Roberta Elias
Director, Policy and Government Affairs
WWF US

Senator BARRASSO. I want to thank all the members of the Senate who were here to participate in this.

I thank our witnesses, Ms. Croke, Ms. Stasz, and Ms. Butler for all of your help. Very thoughtful, very productive time.

Some of the members who were not able to join us may want to submit follow up questions for the record. I know Senator Whitehouse had a question that he is going to ask several of you to respond to as well. So the hearing record will be open for 2 additional weeks.

I want to thank all of you for your time and your testimony for being with us today.

The hearing is adjourned.

[Whereupon, at 11:58 a.m., the hearing was adjourned.]

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